Enclosure 3 Combined RAI Responses Part 1 of 2

Item Number 1 **ER Section 1.1**

Request:

Section 9.2.3.3.1 states that CCNPP Unit 3 will operate as a baseload, merchant independent power producer. Do CCNPP Units 1 and 2 operate in a similar manner?

Response:

CCNPP Units 1 and 2 operate as baseload, merchant plants, the same as proposed for CCNPP Unit 3.

ER Impact:

No changes to the ER are required.

Item Number 2 **ER Section 1.2.3**

Request:

Section 1.2.3 of the ER states that the net electrical output of proposed Unit 3 would be 1562 MWe. Section 9.2.2 of the ER refers to an installed capacity of 1600 MWe for Unit 3. State the net electrical output of proposed Unit 3. Explain the difference between the two values.?

Response:

1562 MWe is an approximate net capacity. As stated in Section 3.1 and Section 3.2.1, CCNPP Unit 3 has a design and gross rating of 1710 MWe. Assuming 130 MWe for house (auxiliary) loads and 18 MWe for cooling tower fans, an approximate1562 MWe net rating results. Chapter 9 refers to 1600 MWe installed capacity as a nominal rating for comparison purposes with alternatives.

ER Impact:

No changes to the ER are required.

Item Number 3 **ER Section 2.2.1**

Request:

Identify the closest Tribal lands to the CCNPP site.

Response:

There are no known claims by Native Americans on lands within the site boundary, within the 8 mi (13 km) radius of the CCNPP site, or within the State of Maryland. According to the National Park Service, the closest native lands to the site are the Pamunkey and Mattaponi reservations in King William County, Virginia. These reservations encompass 1,200 and 150 acres, respectively, and were granted an act of the Commonwealth of Virginia legislature.

ER Impact:

No changes to the ER are required.

Item Number 4 **ER Section 2.3.1**

Request:

Provide information on circulation patterns and velocity vectors in the vicinity of the proposed discharge outfall. Thermal discharge and spatial extent are discussed in Section 5.3.2 pages 5.3-(8-10), Tables 5.3.2-(1-4), Fig 5.3.2-1.

Response:

ER Section 5.3.2 discusses circulation patterns and velocity vectors. In the vicinity of the CCNPP site, the length of tidal excursion, which is the range of water particle movement over a tidal cycle, is estimated to be approximately 1.75 mi (2.82 km). Average rise and fall of the semidiurnal tides is approximately 1 ft (0.3 m) as determined from the NOAA Cove Point gauging station just south of the CCNPP site (NOAA, 2007). Ebb and flow velocities can vary based on tide stage and have been measured as high as 0.78 ft/sec (0.24 m/sec) in previous thermal plume studies (Lacy, 1979).

Tidal currents in the Chesapeake Bay follow a distribution similar to that of mean tidal ranges. The spring tidal current, as predicted by NOAA at the entrance of the Chesapeake Bay, is about 1.7 knots (3.1 km/hr). At the entrance of Baltimore Harbor, the current magnitude reduces to approximately 1.1 knots (2.0 km/hr) (NOAA, 2006a). The current velocity in the vicinity of the discharge point can be expected to be with in the range of these two estimates. The tides and tidal currents in the Chesapeake Bay can be significantly affected by local meteorological conditions, including wind storms and barometric pressure changes. The tidal current information in the Chesapeake Bay is supplemented by computer simulations and tidal velocity measurements as described below.

Computer simulations of tide in the Chesapeake Bay by the Chesapeake Community Modeling Program (CCMP) 3D model C3PO (CCMP, 2008) indicate that between tides the flow circulation near the site follows a clockwise direction. As the flood tide moves towards the upper reach of the Chesapeake Bay, surface flow vectors near the site start to deflect westwards. During flood tide, the tidal current is directed towards north. The flow reverses with ebb tide. The northward flow vector near the site starts to deflect eastward (clockwise). CCMP model results (CCMP, 2008) also indicate that large tidal circulation patterns may attach to the west bank of the Chesapeake Bay near the site. The maximum simulated tidal velocity near the site for May 22, 2008 from such a circulation remains below 3.3 fps (1.0 mps) or about 2 knots (3.7 km/hr).

Tidal velocity measurement data are available at the Cove Point gage station from the National Oceanic and Atmospheric Administration (NOAA) website (NOAA, 2008). A maximum tidal velocity of about 2 knots (3.7 km/hr) or 3.3 fps (1.0 mps) was measured between January and May 2008 (NOAA, 2008).

References:

CCMP, 2008. Current Plots of the Chesapeake Bay, Chesapeake Community Modeling Program (CCMP) 3D model C3PO, website: http://ccmp.chesapeake.org/C3POANIM/MAPlink.html, accessed May 22, 2008

Lacy, 1979. Thermal Plume Studies in the Vicinity of Calvert Cliffs Nuclear Power Plant, 1977-1978. Academy of Natural Sciences of Philadelphia, Lacy, 1979.

NOAA, 2008. Tides and Currents, Cove Point Station, National Oceanic and Atmospheric Administration, website: http://co-ops.nos.noaa.gov/data_menu.shtml?stn=cb1001+CovePoint&type=Physical+Oceanographic+Real-Time+System&port=cn, accessed May 22, 2008.

NOAA, 2007. Tides and Currents, Tidal Station Locations and Ranges, National Oceanographic and Atmospheric Administration, Website: www.co-ops.nos.noaa.gov/tides06/tab2ec2c, accessed: March 26, 2007.

NOAA, 2006a. Tidal Currents (information extracted from the National Oceanic and Atmospheric Administration for tidal range at various locations along the Chesapeake Bay), National Oceanic and Atmospheric Administration, Website: http://tidesandcurrents.noaa.gov, accessed: November 29, 2006.

ER Impact:

No changes to the ER are required.

Item Number 5 **ER Section 2.3.1**

Request:

Soil textural classification (%sand, %silt, %clay) and bulk density are missing. Please provide them. In Table 2.3.1-19, define the meaning of "Natural Moisture" (total porosity, moisture content, field capacity, or wilting point by volume or weight, etc.) and "Moisture Unit Weight" (e.g., moisture content per unit dry weight of soil, moisture content per unit wet weight of soil, etc.). Define PCF with actual units (e.g., lbs/ft3). Finally, where did the 0.8 come from when defining the effective porosity?

Response:

The necessary information on soil textural classification, bulk density, natural moisture, and moisture unit weight is found in the geotechnical data report included as Appendix 2.5-A and Appendix 2.5-B of the ER. [Reference: Geotechnical Subsurface Investigation Data Report (Revision No. 1), CGG Combined Operating License Application (COLA) Project, Calvert Cliffs Nuclear Power Plant (CCNPP), Calvert County, Maryland, Report by Schnabel Engineering North, LLC, April 2007.(NRC Accession Numbers ML080990186 to ML080990193, ML080990195 to ML080990198, ML080990200 to ML080990260)]. The ER will be revised to include references to these appendices.

Natural Moisture, as represented in ER Table 2.3.1-19, represents moisture content in percent. "Moisture Unit Weight" in ER Table 2.3.1-19 should read "Moist Unit Weight" and is defined as Dry Unit Weight x Moisture Content. The correct terminology will be added in the revised ER. PCF will be replaced with lbs/ft^3 in the revised ER Table 2.3.1-19. The determination of effective porosity and the reference for using (total porosity x 0.8) to determine effective porosity is provided in ER Section 2.3.1.2.3.3.

ER Impact:

The cited changes will be made in a future revision to the ER.

Item Number 6 **ER Sections 2.3.2, 3.3.1**

Request:

Provide a water use diagram during pre-construction and construction periods. (Cross reference with HS-7 HS-7[a]).

Response:

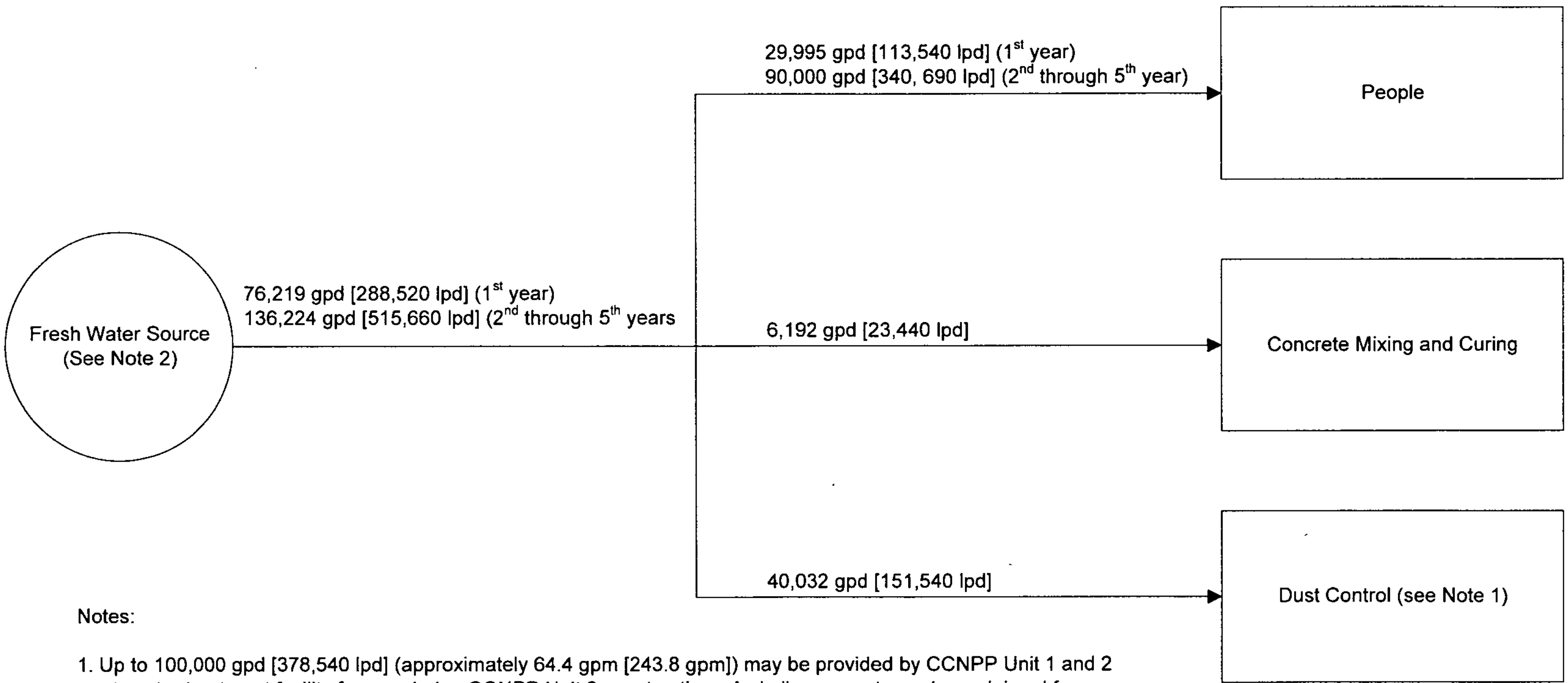
A construction water use diagram has been prepared and is attached. Pre-construction water use will be similar to construction water use, but somewhat reduced, based on the prescribed level of pre-construction effort. A pre-construction schedule has not been finalized. As a result, it is not possible to provide a quantitative analysis of pre-construction water use at this time.

It is, however, possible to qualitatively evaluate pre-construction waster use. For example, given the limited scope of activities defined for the pre-construction period it would be expected that significantly fewer people will be on site during this period than during the construction period. Similarly, since pre-construction concrete work will be essentially limited to non-safety related structures, it would be expected that the rate at which concrete work will be performed during the pre-construction period will be less than during the construction period. Both of these factors will reduce the amount of water required for the pre-construction period accordingly. The amount of water required for pre-construction dust control will be primarily dependent on the extent of land clearing activities that are defined for this phase, but will likely be similar to the value identified for the construction phase.

ER Impact:

The construction water use diagram and a discussion of pre-construction water use will be incorporated into the ER Section 3.3 in a future revision.

CCNPP Unit 3 Construction Water Use Diagram



Notes:

1. Up to 100,000 gpd [378,540 lpd] (approximately 64.4 gpm [243.8 gpm]) may be provided by CCNPP Unit 1 and 2 wastewater treatment facility for use during CCNPP Unit 3 construction. A similar amount may be reclaimed from CCNPP Unit 3 excavation work. This water is suitable for dust control.

2. Up to 85,000 gpd [321,760 lpd] (approximately 59 gpm [223.4 lpm]) may be provided by CCNPP Unit 1 and 2 under existing appropriations permit.

3. Use to be approximately 285 days per year.

Item Number 7 **ER Sections 2.3.2, 3.3.1**

Request:

The following items were noted:

a) Maximum Chesapeake Bay withdrawal is 43,480 gpm (97 cfs) (Table 3.3-1). Confirm that there is an error in Fig. 3.3-1, which reports 37,778 gpm.

b) Maximum effluent discharge to Chesapeake Bay is 23,228 gpm (51.8 cfs) (Figure 3.3-1). Confirm that there is an error in Section 3.4.2.2 page 3.4-6, which conflicts with Fig 3.3-1 and Table 3.3-1. 19,437 should be 19,426; 17,366 should be 17,355, and 23,204 should be 23,228. Is 17,633 the correct value in Section 3.5.2.2 page 3.5-8?

c) Table 3.3-1. Confirm the error in Fig 3.3-1, which reports 37,778 gpm, or provide an explanation.

d) Page 3.3-1 notes 4.1E7 gal/mo, which equals 935 gpm, not 3040 gpm. Confirm the error, or provide an explanation.

Provide correct values where errors are confirmed.

(Cross reference with HS-23, 24, 25[(a)]).

Response:

1) The value of 37,778 gpm shown on Figure 3.3-1 (Revision 0) should have been 37,788 gpm. The average withdrawal is shown in parentheses and the maximum flow of 43,480 gpm is shown below the average flow in brackets. Refer to the figure key. Both values are also listed accordingly in Table 3.3-1 (Revision 0). Note that the average and maximum flow rates for Chesapeake Bay withdrawal previously provided in the ER have been subsequently revised to 41,095 gpm and 47,383 gpm, respectively, as shown on the attached update to ER Table 3.3-1.

2) The values provided in Section 3.4.2.2 (page 3.4-6) for average and maximum effluent discharge and average cooling tower blowdown will be revised to agree with revisions to ER Table 3.3-1 and Figure 3.3-1.

   The discharge flow of 17,633 gpm noted in Section 3.5.2.2 (page 3.5-8) which was used in determining the concentration of radioactivity released through the liquid pathway, is conservative. Referring to Table 3.3-1 (Revision 0), the anticipated average and maximum effluent discharge into the Chesapeake Bay was indicated to be 19,426 gpm and 23,228gpm, respectively. Note that the average and maximum flow rate for effluent discharge to the Chesapeake Bay has subsequently been revised to 21,019 gpm and 24,363 gpm, respectively. Hence, the concentration of tritium and any other radionuclides will be less using a larger discharge flow rate.

3) The value of 37,778 gpm as shown on Figure 3.3-1 (Revision 0) as the anticipated average flow for bay water, should have been shown as 37,788 gpm. The average and maximum flow rates for Chesapeake Bay withdrawal previously provided in the ER have been subsequently revised to 41,095 gpm and 47,383 gpm, respectively, as shown on the attached update to ER Table 3.3-1.

4) In Revision 0 of the Environmental Report, the value of 4.1E7 gal/month equates to 942 gpm (i.e., 940 gpm for ESWS cooling tower evaporation plus 2 gpm for drift – see Table 3.3-1, Revision 0). This only represents a portion of the desalinated water to be used. The 3,040 gpm of desalinated water is used as follows: 276 gpm (membrane filtration) + 2,764 gpm (reverse osmosis). The value of 2,764 gpm of desalinated water is distributed as follows: 779 gpm (reverse osmosis reject) + 1,882 gpm (ESWS makeup: 940 gpm drift + 2 gpm evaporation + 940 gpm blowdown) + 103 (power plant makeup). Note that the average desalinated water consumption for the ESWS cooling towers has subsequently been revised from 4.1 E7 gal/month to 2.5 E7 gal/month, as shown on the attached update to ER Table 3.3-1. Also note that the Chesapeake Bay water demand for desalinization has been revised from 3,040 gpm to 3,063 gpm.

A preliminary water use diagram is attached that will be used to update ER Figure 3.1-1. This diagram is considered preliminary and is marked "draft" because it has not been released for construction.

ER Impact:

1, 3) The average and maximum flow rates from Chesapeake Bay withdrawal will be revised to 41,095 gpm and 47,383 gpm throughout the section. Table 3.3-1 and Figure 3.3-1 will also be updated.

2) Flows indicated in ER Section 3.4.2.2 (page 3.4-6) for the average and maximum effluent discharge to Chesapeake Bay and the average cooling tower blowdown will be revised to agree with those in the revised Table 3.3-1 and Figure 3.3-1.

Pursuant to the different discharge flow given in ER Section 3.5.2.2, a statement will be added to that section stating that the concentrations of tritium and any other radionuclides released through the liquid pathway were based on a conservative discharge flow rate of 17,633 gpm. Referring to Table 3.3-1, the anticipated discharge flow rate for effluents into the Chesapeake Bay is greater.

4) Table 3.3-1 and Figure 3.3-1 will be updated.

Table 3.3-1: Anticipated Water Use

Water Streams	Average Flow [a] gpm (lpm)	Maximum Flow [b] gpm (lpm)
Chesapeake Bay Water Demand for Desalinization[c,d]	**3,063 (11,595)**	**3,063 (11,595)**
Membrane Filtration (Backwash)	306 (1,158)	306 (1,158)
Reverse Osmosis	2,757 (10,437)	2,757 (10,437)
Reverse Osmosis Reject [e]	*1,532 (5,799)*	*1,532 (5,799)*
Essential Service Water System (ESWS)/Ultimate Heat Sink (UHS) System Makeup [e,f]	*629* (2,381)	*1,490 (5,640)*
'ESWS' Cooling Tower Evaporation' [l]	*'566' ('2,142')*	*'1,364' ('5,163')*
'ESWS' Cooling Tower Drift'	*'2' ('8')*	*'4' ('16')*
'ESWS' Cooling Tower Blowdown'	*'61' ('231')*	*'122' ('461 ')*
Power Plant Makeup	*183* (693)	926 (3,505)
'Demineralized Water Distribution System'	*'80' ('303')*	*'80' ('303')*
'Potable and Sanitary Water Distribution System' [k]	*'93' ('352')*	*'216' ('818')*
"Plant Users" [k]	*"93" ("352")*	*"216" ("818")*
"Non-Plant Users" [g]	*"0" ("0")*	*"0" ("0")*
'Fire Water Distribution System' [h]	*'5' ('19')*	*'625' ('2,365')*
'Floor Wash Drains'	*'5' ('19')*	*'5' ('19')*
Additional Capacity	*413 (1,563)*	*413 (1,563)*
Chesapeake Bay Water Demand	**41,095 (155,563)**	**47,383 (179,365)**
Desalinization Plant	3,063 (11,595)	3,063 (11,595)
Circulating Water System (CWS)	38,032 (143,968)	44,320 (167,770)
CWS Cooling Tower Evaporation	*19,016 (71,984)*	*22,160 (83,885)*
CWS Cooling Tower Drift [i]	*39 (148)*	*39 (148)*
CWS Cooling Tower Blowdown	*18,977 (71,836)*	*22,121 (83,737)*
Effluent Discharge to Chesapeake Bay from Seal Well[m]	**21,019 (79,566)**	**24,363 (92,224)**
Seal Well	21,019 (79,566)	24,363 (92,224)
Waste Water Retention Basin Discharge	20,915 (79,172)	24,136 (91,364)
Miscellaneous Low Volume Waste	*39 (148)*	*55 (209)*
ESWS Cooling Tower Blowdown	*61 (231)*	*122 (461)*
CWS Cooling Tower Blowdown	*18,977 (71,836)*	*22,121 (83,737)*
Desalinization Plant Waste	*1,838 (6,957)*	*1,838 (6,957)*
'Membrane Filtration'	*'306' ('1,158')*	*'306' ('1,158')*
'Reverse Osmosis Reject' [e]	*'1,532' ('5,799')*	*'1,532' ('5,799')*
Start-up Temporary Storage Discharge [j]	---	---
Trash Screen Cleaning Water Discharge [j]	---	---
Treated Sanitary Waste	93 (352)	216 (818)
Treated Liquid Radwaste	11 (42)	11 (42)

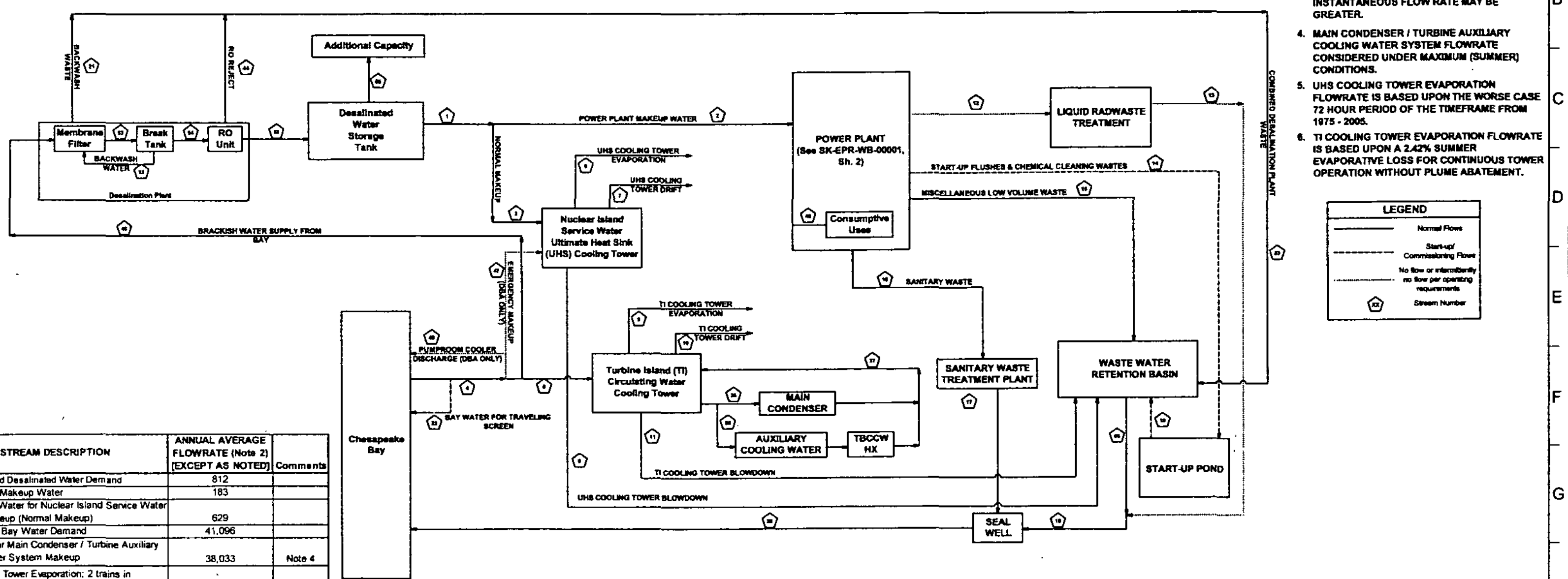
Key:

gpm – gallons per minute

lpm – liters per minute

Notes:

a. Average flow represents the expected water consumptive rates and returns for normal plant operating conditions.
b. Maximum flow represents water consumptive rates and returns during normal shutdown/cooldown.
c. The source for fresh water is desalinated Chesapeake Bay water.
d. Maximum flow of 3,063 gpm (11,595 lpm) will be provided to the Desalinization Plant, which produces 1,225 gpm (4,637 lpm) of fresh water. Maximum fresh water demand will be met with Desalinization Plant makeup of 1,225 gpm (4,637 lpm) plus water stored in the desalinated water storage tank.
e. The desalinated water demand of 3,063 gpm (11,595 lpm) is based on 40% recovery for the preliminary design of the Desalinization Plant. Influent flow to the reverse osmosis (RO) process equipment is 3,063 gpm (11,595 lpm). Backwash of the membrane filtration results in 306 gpm (1,158 lpm) of membrane filter reject flow. Assuming 40% recovery from the Desalinization Plant, the corresponding production rate for the RO process would be approximately 1,225 gpm (4,637 lpm). RO reject would be approximately 1,532 gpm (5,799 lpm). Referring to the above table, note that a production rate of 1,225 gpm (4,637 lpm) would be less than the makeup demand for the UHS cooling towers. However, the makeup and evaporation demands for the UHS cooling towers in the above table are bounding values that occur under design ambient conditions; actual demands are anticipated to be significantly less. Therefore, the flows will likely change during the detailed design phase. Also, the difference between actual demand and flow anticipated by RO equipment will be accommodated by the desalinated water storage tank.
f. Two trains will be operating under normal conditions and four trains during shutdown/cooldown.
g. The average flow for potable water demand is based on projected staffing during normal plant operation. Non-plant water users include potable and sanitary needs for administrative buildings and warehouses, and water required for landscaping maintenance. Non-plant water users have not been included in the estimated demand. However, water stored in the raw water storage tank(s) is expected to accommodate other station water users since it will be designed for peak load provisions.
h. During normal operating conditions, water consumed by the Fire Water Distribution System is attributed to system leakage and periodic testing. The maximum consumptive rate is based on meeting the National Fire Protection Association's requirement for replenishing fire protection water storage.
i. The average and maximum cooling tower drift losses are considered equivalent and are less than 0.005% of the CWS flow rate of 785,802 gpm (2,974,584 lpm).
j. Startup effluents occur during plant start-up; the effluents will be stored within tanks or bladders, which will be removed once startup is complete. Makeup flows associated with startup and trash screen cleaning are anticipated to be minimal. Similarly, discharges associated with startup effluents and trash screen cleaning effluents, are also anticipated to be minimal.
k. The maximum potable and sanitary water usage is estimated based on the maximum continuous flow in the Nuclear Island and Conventional Island, and one maximum intermittent flow in either area.
l. The average evaporative rate during normal operation with two trains operating is 283 gpm (1,071 lpm) per train. The maximum evaporation rate during shutdown/cooldown with four trains operating is 341gpm (1,291 lpm) per train. The blowdown rate is based on 10 cycles of concentration.
m. Consumptive loss in the power plant is 40 gpm (151 lpm). This is derived as follows: [183 gpm – (11 gpm liquid radwaste + 93 gpm sanitary waste + 39 gpm misc. low volume waste)] = 40 gpm. Total water consumed is: (566 gpm + 2 gpm) ESWS cooling tower evaporation and drift + (19,016 gpm + 39 gpm) CWS cooling tower evaporation and drift + (413 gpm) additional capacity + (40 gpm) power plant consumption = 20,076 gpm (75,996 lpm). Note that this also equates to 41,095 gpm – 21,019 gpm (i.e., bay water flow demand minus effluent discharged into the Chesapeake Bay).



NOTES:

1. ADDITIONAL CAPACITY ALLOTTED FOR LATER USAGE.
2. *WATER FLOW RATES ARE BASED ON THE* SPECIFIED PROCESS CONDITIONS FOR THE PLANT CONFIGURATION AND ARE SHOWN IN GPM (GALLONS PER MINUTE) UNLESS OTHERWISE SPECIFIED.
3. NORMAL FLOW RATE IS SHOWN. MAXIMUM INSTANTANEOUS FLOW RATE MAY BE GREATER.
4. MAIN CONDENSER / TURBINE AUXILIARY COOLING WATER SYSTEM FLOWRATE CONSIDERED UNDER MAXIMUM (SUMMER) CONDITIONS.
5. UHS COOLING TOWER EVAPORATION FLOWRATE IS BASED UPON THE WORSE CASE 72 HOUR PERIOD OF THE TIMEFRAME FROM 1975 - 2005.
6. TI COOLING TOWER EVAPORATION FLOWRATE IS BASED UPON A 2.42% SUMMER EVAPORATIVE LOSS FOR CONTINUOUS TOWER OPERATION WITHOUT PLUME ABATEMENT.

STREAM NO.	STREAM DESCRIPTION	ANNUAL AVERAGE FLOWRATE (Note 2) [EXCEPT AS NOTED]	Comments
1	Total Required Desalinated Water Demand	812	
2	Power Plant Makeup Water	183	
3	Desalinated Water for Nuclear Island Service Water System Makeup (Normal Makeup)	629	
4	Chesapeake Bay Water Demand	41,096	
5	Bay Water for Main Condenser / Turbine Auxiliary Cooling Water System Makeup	38,033	Note 4
6	UHS Cooling Tower Evaporation; 2 trains in operation	566	Note 5
7	UHS Cooling Tower Drift	2	
8	UHS Cooling Tower Blowdown	61	
9	TI Cooling Tower Evaporation	19,016	Note 6
10	TI Cooling Tower Drift	39	
11	TI Cooling Tower Blowdown	18,977	
12	Liquid Radwaste	11	
13	Treated Liquid Radwaste	11	
14	Startup Flushes & Chemical Cleaning Wastes	0	Note 3
15	Miscellaneous Low Volume Waste	39	
16	Sanitary Waste	93	
17	Treated Sanitary Waste	93	
18	WWRB & Liquid Radwaste Discharge to Seal Well	20,925	
19	Startup Pond Discharge	0	Note 3
20	Seal Well Discharge	21,019	
21	Desal Membrane Filter Backwash Waste	306	
22	Water Required to Clean Trash Screens	0	Note 3
32	Desal Membrane Filter Backwash	306	
33	Combined Desalination Plant Waste	1,838	
35	Auxiliary Cooling Water Flow	21,720	
36	Main Condenser flow	764,082	
37	Combined flow back to TI cooling tower	785,802	
44	RO Reject from Desalination Plant	1,531	
46	Consumptive Losses	40	
47	Emergency Makeup Water (Design Basis Accident (DBA) Only)	0	Note 3
48	Brackish Water Influent to Desalination Plant	3,063	
49	Emergency Makeup Pumproom Cooler (DBA Only)	0	Note 3
52	Desalinated Water Effluent	1,225	
53	Influent to RO Break Tank	3,063	
54	Influent to RO membrane	2,756	
55	Additional Capacity Usage	413	
56	WW Retention Basin to Discharge	20,914	

DRAFT

REV 00B SIGNOFF

Brian T. Pick 3/25/08
Earnestine Johnson 3/27/08 — EARNESTINE JOHNSON
Joseph M. Mate 3/27/08
N/A
N/A
SHANKAR RAO 3/27/08
E.A. Sherow 3/28/08
N/A
N/A

DESIGN VERIFICATION REPORT: N/A

U.S. EVOLUTIONARY POWER REACTOR (EPR)

CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 3

AREVA

N/A

NS

CONTRACT NO. 300065 | JOB NO. 25237

WATER BALANCE DIAGRAM

REVISION DESCRIPTION: ISSUED FOR OWNER'S ACCEPTANCE

AREVA SERIAL NO.	N/A	N/A
BECHTEL DOCUMENT NO.	25237-209-M5-YA-00001	00B
UNISTAR DOCUMENT NO.	CCNP3-002-YA-MG00-00001	00B
SIZE: D	SCALE: NTS	PAGE 1 OF 1

22" x 34" D SIZE

Item Number 8 **ER Section 2.4.1**

Request:

Provide citable references/data for all field studies conducted in support of Unit 3 construction and operation.

Response:

The references and data for ER Section 2.4.1 Terrestrial Ecology are:

- Final Flora Survey Report for Proposed UniStar Nuclear Project Area, Calvert Cliffs Nuclear Power Plant Site, Calvert County, Maryland, TetraTech NUS, May 2007
- Final Rare Plant Survey Report for Proposed UniStar Nuclear Project Area, Calvert Cliffs Nuclear Power Plant Site, Calvert County, Maryland TetraTech NUS, May 2007
- Final Faunal Survey Report for Proposed UniStar Nuclear Project Area, Calvert Cliffs Nuclear Power Plant Site, Calvert County, Maryland TetraTech NUS, May 2007
- Current Status of Two Federally Threatened Tiger Beetles At Calvert Cliffs Nuclear Power Plant, 2006 Knisley, C. Barry (October 26, 2006)

Copies of these documents are included as an attachment to this submittal.

ER Impact:

No changes to the ER are required.

Item Number 9 **ER Section 2.4.2**

Request:

Citable references need to support facts presented. Provide full citations.

Response:

The references to ER Section 2.4.2, Aquatic Ecology are:

- Aquatic Field Studies for UniStar Calvert Cliffs Expansion Project, EA Engineering, Science, and Technology, Inc., May 2007
- Submerged Aquatic Vegetation Surveys for UniStar Calvert Cliffs Expansion Project, EA Engineering, Science, and Technology, June 2007
- Final Wetland Delineation Report for Proposed UniStar Nuclear Project Area, Calvert Cliffs Nuclear Power Plant Site, Calvert County, Maryland, TetraTech NUS, May 2007

Copies of these documents are included as an attachment to this submittal.

ER Impact:

No changes to the ER are required.

Item Number 10 **ER Sections 2.4, 3.2**

Request:

Cannot read legends. Provide legend information for the following figures: Figs 2.4-1, Fig 3.2.1-(26, 27, 37, 40, 42-45, 47-50, 52-55); Fig 3.2.2-(1-3, 12, 13)

Response:

Legend readability will be improved to the extent practicable for the listed figures. Updated figures will be provided in a future revision to the ER.

ER Impact:

Identified figures will be updated in a future ER revision

Item Number 11 **ER Section 2.4**

Request:

The key appears to be mislabeled as Assessment Area Xi, as opposed to IX. Identify the correct label.

Response:

Figure 4.3-2 is mislabeled and will be revised to correct this error.

ER Impact:

The key in Figure 4.3-2 will be corrected in a future ER revision.

Item Number 12 **ER Section 2.4.2**

Request:

An Essential Fish Habitat (EFH) analysis will be conducted by NRC. To support this analysis, please provide information on the Federally managed fish and shellfish species with designated EFH in the Chesapeake Bay in the vicinity of Calvert Cliffs. This information should consist of life histories, habitat requirements, prey species, and impacts of construction and operation on the Federally managed species as well as their prey species.

Response:

Essential Fish Habitat (EFH) is defined under the Magnuson-Stevens Fishery Conservation Management Act (16 USC §§ 1801 to 1883), as amended by the Sustainable Fisheries Act (SFA) of 1996, as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA, 2008). "Waters" include aquatic areas and their physical, chemical and biological properties that are used by fish (NOAA, 2008). "Substrate" includes sediment, hard bottom, structures, and associated biological communities that are under the water column (NOAA, 2008). Waters and substrates necessary for fish spawning, breeding, feeding or growth to maturity, covering all stages within the life cycle of a particular species, refers to those habitats required to support a sustainable fishery and a particular species' contribution to a healthy ecosystem (50 Code of Federal Regulations (CFR) 600.10).

Section 303(a)(7) of the Magnuson-Stevens Act requires that the eight Regional Fishery Management Councils (RFMC) describe and identify EFH for each federally managed species and minimize adverse impacts from fishing activities on EFH.
Section 305(b)(2)-(4) of the Magnuson-Stevens Act outlines the process for providing the National Marine Fisheries Service (NMFS) within the National Oceanic and Atmospheric Administration (NOAA) and the RFMC with the opportunity to comment on activities proposed by federal agencies that have the potential to adversely impact EFH areas. Federal agencies are required to consult with NMFS (using existing consultation processes for NEPA, the Endangered Species Act, or the Fish and Wildlife Coordination Act) on any action that they authorize, fund, or undertake that may adversely impact EFH. This requirement is therefore applicable to the NRC in connection with issuing a COL for a new nuclear plant.

Adverse effects to EFH, as defined in 50 CFR 600.910(A), include any impact that reduces the quality and/or quantity of EFH. Adverse effects may include:

- Direct impacts such as physical disruption or the release of contaminants;
- Indirect impacts such as the loss of prey or reduction in the fecundity (number of offspring produced) of a managed species; and
- Site-specific or habitat-wide impacts that may include individual, cumulative or synergetic consequences of a federal action.

- An EFH assessment of a federal action that may adversely affect EFH must contain:
- A description of the proposed project;
- An analysis of the effects, including cumulative, on EFH, the managed species and associated species such as major prey species, and the life history stages that may be affected;
- The agency's conclusions regarding the effects of the action on EFH; and
- Proposed mitigation if applicable (50 CFR 600.920(g)).

The Mid-Atlantic RMC, which is responsible for EFH in Maryland, has established EFH for various life stages of nine species of fish in the northern Chesapeake Bay, where CCNPP is located:

Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
Prepilus triacanthus (butterfish)	X	X	X	X
Rachycentron canadum (cobia)	X	X	X	X
Scomberomorus cavalla (king mackerel)	X	X	X	X
Scomberomorus maculatus (Spanish mackerel)	X	X	X	X
Sciaenops ocellatus (red drum)	X	X	X	X
Pomatomus saltatrix (bluefish)			X	X
Centropristis striata (black sea bass)			X	X
Scophthalmus aquosus (windowpane flounder)			X	X
Paralichthys denatus (summer flounder)		X	X	X

Source: NOAA, 2008.

The EFH for these species includes the entire northern Chesapeake Bay and are depicted on ER Figure 2.4-3 in relation to the area proposed to be impacted during additional CWIS, discharge, and barge facility construction. However, NMFS indicated that the EFH designations for cobia, king mackerel, and Spanish mackerel are overly broad and should not be considered for this evaluation (NMFS, 2008); therefore, these fish species are not included in further EFH discussions. Potential impacts to the remaining species and EFH within the construction area are presented in the following subsections.

Habitat Areas of Particular Concern (HAPC) are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation (NMFS, 2008a). RFMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons:

- Importance of the ecological function provided by the habitat

- Extent to which the habitat is sensitive to human-induced environmental degradation
- Whether, and to what extent, development activities are, or will be, stressing the habitat type
  - Rarity of the habitat type

The HAPC designation does not confer additional protection or restrictions on an area, but can help prioritize conservation efforts. Healthy populations of fish require not only the relatively small habitats identified as HAPCs, but also other areas that provide suitable habitat functions.

Butterfish

EFH has been designated in the vicinity of the proposed CWIS, discharge, and barge facility construction area for eggs, larvae, juvenile and adult butterfish. Butterfish are a pelagic species, and they spawn offshore from May to July in the Chesapeake Bay region (Murdy, 1997). Eggs do not drift to nearshore areas, so it is unlikely that impacts to EFH for eggs will occur as a result of the proposed CWIS, discharge, and barge facility construction activities. In addition, butterfish eggs were not collected during entrainment sampling conducted at CCNPP from March 2006 to March 2007 (EA, 2007b); therefore, impacts to butterfish eggs from proposed construction are also not expected.

Butterfish larvae are often associated with jellyfish, living in their tentacles for protection but also sometimes falling victim to their hosts (USFWS, 1953). This association is not essential, however, as butterfish larvae have been observed swimming at the surface without the company of jellyfish (USFWS, 1953) and may also shelter in floating seaweed mats (Murdy, 1997). Butterfish are pelagic species throughout their life cycle, and at the larval stage, would not be expected to occur in nearshore environments, except in association with jellyfish or seaweed mats that are driven inshore by winds and currents. As a result, impacts to butterfish larval EFH are expected to be minimal. In addition, butterfish larvae were not collected during entrainment sampling conducted from March 2006 to March 2007 at CCNPP (EA, 2007b); therefore, impacts to butterfish recruitment are not expected from CWIS, discharge, and barge construction activities.

Butterfish juveniles usually end their association with jellyfish/seaweed and start exhibiting adult schooling behavior around 60 mm Standard Length (SL) (USFWS, 1953). Butterfish juveniles may occur in the vicinity of CCNPP from May to November, and if so, may experience direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely effect the recruitment of butterfish juveniles in the Chesapeake Bay. In addition, butterfish juveniles were not collected during entrainment sampling conducted from March 2006 to March 2007 at CCNPP (EA, 2007b); therefore, impacts to butterfish recruitment are not expected from CWIS, discharge, and barge construction activities.

Butterfish adults occur in the Chesapeake Bay from March to November and occur occasionally in the upper bay in the vicinity of CCNPP (Murdy, 1997). They form large schools in both inshore and offshore waters, usually over sand bottoms (NOAA, 1999). As a result, because substrates in the vicinity of the proposed construction activities are 93 percent sand (EA, 2007a), impacts to butterfish adult EFH may occur from direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Indirect impacts from loss of prey or reduction of fecundity are not expected. In addition, butterfish were collected in impingement samples collected at CCNPP Units 1 and 2 in 15 out of the 21 years sampled from 1975 to 1995 (Ringger, 2000), and impingement has and will likely continue. Trawl studies confirm that impingement is a non-selective cropping mechanism – species are impinged at a rate proportional to their abundance in the vicinity of a CWIS (Ringger, 2000). MDNR has concluded that impingement losses are small compared to mortality from other causes, and impingement does not adversely affect regional populations (Ringger, 2000). Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely affect adult butterfish in the Chesapeake Bay.

Red Drum

EFH has been designated in the vicinity of the proposed CWIS, discharge, and barge facility construction area for eggs, larvae, juvenile and adult red drum. Red drum is a euryhaline fish species that supports a healthy recreational sportfishery throughout most of its range (FAO, 2008c). Red drum spawn in nearshore coastal waters from late summer through fall, and the eggs drift until they hatch (Murdy, 1997). Information regarding spawning of red drum near CCNPP is not available; however, since red drum eggs generally hatch within 24 hours, depending on water temperature, and sciaenid eggs (potentially red drum) were collected in entrainment samples collected at the CCNPP CWIS (EA, 2007b), it is possible that red drum spawn near CCNPP. While impacts to red drum egg EFH may occur as a result of dredging in the vicinity of the existing CWIS and barge facility and during installation of the discharge pipe, these activities will be occurring in areas that have been previously disturbed. Direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction may be possible. Direct impacts from contaminant releases from construction equipment are unlikely. Compared with the expanse of EFH in the Chesapeake Bay, the proposed area of impact is not expected to adversely effect the reproduction of red drum in the Chesapeake Bay.

Sciaenid eggs were collected in entrainment samples from the CWIS at CCNPP during May through September 2006, with an average density ranging from 0.44 eggs/100 m^3 to 173.65 eggs/100 m^3 (EA, 2007b). The peak number of eggs entrained occurred in July, and the total annual estimate for entrainment of sciaenid eggs at maximum flow for CCNPP was 1,538,748,100 eggs (80 percent confidence interval ± 502,300,000) (EA, 2007b). Red drum exhibit high fecundity, and large female red drum will spawn greater than one million eggs (FAO, 2008c), so a significant impact on red drum reproduction from the proposed construction activities is not expected.

Red drum larvae (approximately 6-8 mm SL) are transported via currents into estuaries, where they utilize seagrass beds and SAV as nursery habitats (FAO, 2008c). An SAV survey was conducted in Fall 2006 within waters adjacent to the CCNPP (EA, 2007a). SAV or critical habitat for any SAV species was not observed during this survey. In addition, a review of SAV observation data (1994-2006) available through the Virginia Institute of Marine Science (VIMS) reveals that SAV has not been observed along the shoreline in the vicinity of the study area during the period from 1994-2004. Based on a lack of SAV presence during the September 2006 survey, and a lack of observations of SAV as part of the VIMS annual surveys, it is unlikely that SAV occurs within the study area (EA, 2007a). As a result, impacts to red drum larval EFH are not expected due to construction activities. In addition, red drum larvae were not collected in entrainment samples collected at CCNPP from March 2006 to March 2007 (EA, 2007b); therefore, impacts to red drum recruitment are not expected from the proposed construction activities.

Red drum juveniles are generally found in shallow estuarine areas with little tidal influence and grassy or muddy bottoms (USFWS, 1984). Because the 2006 SAV survey did not find SAV in the vicinity of CCNPP and 93 percent of the substrate in the vicinity of CCNPP is sand (EA, 2007a), impacts to red drum juvenile EFH are not expected due to construction activities. In addition, red drum juveniles were not collected in entrainment samples collected at CCNPP from March 2006 to March 2007 (EA, 2007b); therefore, impacts to red drum recruitment are not expected from the proposed construction activities.

Adult red drum occur in the Chesapeake Bay from May to November and are most abundant in the spring and fall near the Chesapeake Bay mouth in salinities above 15 parts per thousand (Murdy, 1997). The species ranges as far north as the Patuxent River (Murdy, 1997). As a result, red drum may be uncommon near CCNPP; however, impacts to red drum adult EFH may occur. Impacts to red drum adult EFH may occur from direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Indirect impacts from loss of prey or reduction of fecundity are not expected. While impacts to red drum adult EFH may occur as a result of dredging in the vicinity of the existing CWIS and barge facility and during installation of the discharge pipe, these activities will be occurring in areas that have been previously disturbed. Red drum were only collected in one year (1983) during the impingement sampling conducted at CCNPP Units 1 and 2 from 1975 to 1995 (Ringger, 2000). Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely affect adult red drum in the Chesapeake Bay.

Bluefish

EFH has been designated in the vicinity of the proposed CWIS, discharge, and barge facility construction area for juvenile and adult bluefish. The bluefish is a highly migratory, pelagic schooling fish species that is considered a voracious predator of other fish, is known to kill fish that it does not eat, and supports important recreational and commercial fisheries (Murdy, 1997). After offshore spring spawning, bluefish move shoreward, and smaller fish may enter the Chesapeake Bay (Murdy, 1997). Early juveniles enter the lower bay and its tributaries in late summer and early fall (May through October) but may migrate out of the Chesapeake Bay and move south along the coast later in the fall (Murdy, 1997). All major estuaries between Penobscot Bay, Maine and St. Johns River, Florida are EFH for bluefish juveniles, and they generally occur in the "mixing" and "seawater" zones. While the area in the vicinity of the proposed construction activities is EFH for bluefish juveniles, salinities may be less than ideal in this area (EA, 2007b). As a result, impacts to bluefish juvenile EFH are not expected due to the proposed construction activities. In addition, bluefish juveniles were not collected in entrainment samples collected at CCNPP from March 2006 to March 2007 (EA, 2007b); therefore, impacts to red drum recruitment are not expected from the proposed construction activities.

Adult bluefish occur in the Chesapeake Bay from spring to fall and are abundant in the lower bay and is common most years in the upper bay, although they are rare north of Baltimore (Murdy, 1997). The adults form large schools, generally comprised of like-sized fish, which can cover tens of square miles (Murdy, 1997). Bluefish begin to migrate out of the Chesapeake Bay in early autumn (Murdy, 1997). As a result, the proposed construction activities may affect the EFH for adult bluefish. Impacts to bluefish adult EFH may occur from direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Indirect impacts from loss of prey or reduction of fecundity are not expected. In addition, bluefish were collected in impingement samples collected at CCNPP Units 1 and 2 in 9 out of the 21 years sampled from 1975 to 1995 (Ringger, 2000). While impacts to adult bluefish EFH may occur as a result of dredging in the vicinity of the existing CWIS and barge facility and during installation of the discharge pipe, these activities will be occurring in areas that have been previously disturbed. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely affect bluefish adults in the Chesapeake Bay.

Black Sea Bass

EFH has been designated in the vicinity of the proposed CWIS, discharge, and barge facility construction area for juvenile and adult black sea bass. The black sea bass is a warm temperate species that is usually associated with structured habitats (shipwrecks, reefs) on the continental shelf. Spawning occurs over the continental shelf. Most juvenile settlement occurs in coastal areas, and the juveniles migrate into estuaries, usually from July to September (NOAA, 1999b). Juvenile black sea bass are generally found in deep vegetated flats (Murdy, 1997). Because the 2006 SAV survey did not find

SAV in the vicinity of CCNPP and 93 percent of the substrate in the vicinity of CCNPP is sand (EA, 2007a), impacts to black sea bass juvenile EFH are not expected due to the proposed construction activities. In addition, black sea bass juveniles were not collected in entrainment samples collected at CCNPP from March 2006 to March 2007 (EA, 2007b); therefore, impacts to black sea bass recruitment are not expected from the proposed construction activities.

Black sea bass adults are most often found on rocky bottoms near pilings, wrecks, and jetties (Murdy, 1997) and may also occur around oyster bars (NOAA, 1999a). Large adults are also more common offshore than in the Chesapeake Bay (Murdy, 1997). A survey of the oyster community near CCNPP was conducted in fall 2006 (EA, 2007a). Surveys of oyster communities within the Chesapeake Bay found that oyster densities were very low (0.015 oysters/ m^2). Based on GIS analysis of the oysters recovered from the survey, the site has an estimated population of 2,387 oysters, or approximately 9.6 bushels. The total area covered by the survey was approximately 160,000 m^2 or 40 acres (EA, 2007a). Black sea bass adults may associate with these oyster bars and may also associate with the existing barge facility. In addition, black sea bass were collected in impingement samples collected at CCNPP Units 1 and 2 in 6 out of the 21 years sampled from 1975 to 1995 (Ringger, 2000). As a result, the proposed construction activities may affect the EFH for adult black sea bass. Impacts to black sea bass adult EFH may occur from direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Indirect impacts from loss of prey or reduction of fecundity are not expected. While impacts to black sea bass adult EFH may occur as a result of dredging in the vicinity of the existing CWIS and barge facility and during installation of the discharge pipe, these activities will be occurring in areas that have been previously disturbed. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely affect black sea bass adults in the Chesapeake Bay.

Windowpane Flounder

EFH has been designated in the vicinity of the proposed CWIS, discharge, and barge facility construction area for juvenile and adult windowpane flounder. Juvenile windowpane flounders are found generally in waters less than 30 meters deep when water temperatures are generally greater than 9°C (NOAA, 1999a). As a result, the proposed construction activities may affect the EFH for windowpane flounder juveniles. Juveniles may experience direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. While impacts to windowpane flounder juvenile EFH may occur as a result of dredging in the vicinity of the existing CWIS and barge facility and during installation of the discharge pipe, these activities will be occurring in areas that have been previously disturbed. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely effect the recruitment of windowpane flounder in the Chesapeake Bay. In addition, windowpane flounder larvae were not collected during entrainment sampling conducted from March 2006 to March 2007 at CCNPP (EA, 2007b); therefore, impacts to summer flounder recruitment are not expected from CWIS, discharge, and barge construction activities.

Adult windowpane flounders are year-round residents in the Chesapeake Bay that are occasional to common in the upper bay, extending as far north as the Choptank River (Murdy, 1997). Temperature seems to be the one environmental factor controlling adult distribution (NOAA, 1999a). Based on the temperatures observed in the Chesapeake Bay near CCNPP in various studies (EA, 2007a) (EA, 2007b), adult windowpane flounder most likely occur in vicinity of the proposed construction activities. As a result, the proposed construction activities may affect the EFH for adult windowpane flounder. In addition, windowpane flounder were collected in impingement samples collected at CCNPP Units 1 and 2 in 5 out of the 21 years sampled from 1975 to 1995 (Ringger, 2000). Impacts to windowpane flounder adult EFH may occur from direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Indirect impacts from loss of prey or reduction of fecundity are not expected. While impacts to adult windowpane EFH may occur as a result of dredging in the vicinity of the existing CWIS and barge facility and during installation of the discharge pipe, these activities will be occurring in areas that have been previously disturbed. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely affect windowpane flounder adults in the Chesapeake Bay.

Summer Flounder

EFH has been designated in the vicinity of the proposed CWIS, discharge, and barge facility construction area for larval, juvenile, and adult summer flounder. Summer flounder spawn offshore, and larvae enter the Chesapeake Bay from October to May (Murdy, 1997), entering inshore coastal and estuarine areas to complete transformation. After metamorphosis, the larvae settle from the water column to the substrate, where they may start to exhibit burial behavior (NOAA, 1999c). Summer flounder bury themselves in sandy substrates, which comprise approximately 93 percent of the substrate in the vicinity of the proposed construction activities (EA, 2007a). As a result, the proposed construction activities may affect the EFH for transforming summer flounder larvae. Juveniles may experience direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely effect the recruitment of summer flounder in the Chesapeake Bay. In addition, summer flounder larvae were not collected during entrainment sampling conducted from March 2006 to March 2007 at CCNPP (EA, 2007b); therefore, impacts to summer flounder recruitment are not expected from CWIS, discharge, and barge construction activities.

Juvenile summer flounder utilize eelgrass beds as nursery habitats in the Chesapeake Bay (Murdy, 1997). Because the 2006 SAV survey did not find SAV in the vicinity of CCNPP and 93 percent of the substrate in the vicinity of CCNPP is sand (EA, 2007a), impacts to summer flounder juvenile EFH are not expected due to construction activities. In addition, summer flounder juveniles were not collected in entrainment samples collected at CCNPP from March 2006 to March 2007 (EA, 2007b); therefore, impacts to summer flounder recruitment are not expected from construction activities.

Most adult summer flounder migrate into the Chesapeake Bay from spring to autumn and then migrate offshore during the winter months; however, some are year-round residents (Murdy, 1997). The summer flounder is more common in the lower bay than in the upper bay, extending as far north as the Gunpowder River (Murdy, 1997). Adult summer flounder typically occur in deep channels, ridges, or sandbars. Summer flounder greater than 3 years in age primarily inhabit coastal waters (Murdy, 1997). Adults have often been reported as preferring sandy habitats (NOAA, 1999c), and because the substrate in the vicinity of the proposed construction activities is 93 percent sand (EA, 2007a), proposed construction activities may affect the EFH for adult summer flounder. In addition, summer flounder were collected in impingement samples collected at CCNPP Units 1 and 2 in 18 out of the 21 years sampled from 1975 to 1995 (Ringger, 2000). In 1984, summer flounder was the fifth most abundant fish species impinged at CCNPP (Ringger, 2000). Impacts to summer flounder adult EFH may occur from direct impacts from physical disruption due to dredging, discharge pipe installation, and barge facility construction. Direct impacts from contaminant releases from construction equipment are unlikely. Indirect impacts from loss of prey or reduction of fecundity are not expected. Compared with the expanse of EFH in the Chesapeake Bay, however, the proposed area of impact is not expected to adversely affect summer flounder adults in the Chesapeake Bay.

The only known HAPC designated for this region of the Chesapeake Bay determined from the present review is for summer flounder larvae and juveniles. The HAPC is SAV and macroalgae beds in nursery habitats (NOAA, 2001). As mentioned earlier in this section, the 2006 SAV survey did not find SAV in the vicinity of CCNPP (EA, 2007a); therefore, it does not appear that HAPC for the summer flounder exists near CCNPP.

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ER Impact:

No changes to the ER are required.

Item Number 13 **ER Section 2.4.2**

Request:

Increased runoff and sediment loading to existing waterways (e.g., wetlands and creeks) during maximum precipitation events during construction may have impacts to natural resources, although this should be regulated by the permitting process. Provide an analysis to describe the impacts. (Cross reference with HS-1[(a)]).

Response:

Construction activities inclusive of clearing and grading will typically promote increased runoff effects. The characteristics (quantity and timing of flow) of the runoff associated with the Probable Maximum Precipitation (PMP) event, in this case approximately 28", 38", and 44" for the 6-, 24- and 72-hour events respectively (NWS, 1980), will exhibit: 1) a higher peak discharge, 2) a steeper flood hydrograph (reduced time to peak discharge), and 3) a greater total volume of flow.

In order to develop a quantitative understanding of the impacts to the local hydrology and the associated erosion and sediment transport, the existing and proposed conditions must be modeled in some manner. Among the various acceptable hydrologic models that perform hydrograph generation, channel routing, and storage routing, TR-55, which was developed by the Natural Resources Conservation Service, serves as the standard (USDA, 1986). For estimating rates of erosion under differing watershed conditions, the Revised Universal Soil Loss Equation (RUSLE) provides acceptable estimates for use in comparing existing and proposed conditions (USDA, 1996). Although originally created for use in selected cropping and management systems, RUSLE has been extended to apply to non-agricultural conditions including construction.

While the existing and final site conditions are known at this time, the "intermediate" conditions resulting from temporary disturbances during construction are not. These temporary disturbances will largely be a function of the staging, access and sequence of construction activities. These elements of construction planning for CCNPP Unit 3 will not be available until the detailed construction plan is finalized. As it stands, the current Calvert Cliffs Nuclear Power Plant (CCNPP) site design includes modifications to contributing watershed areas and land use, and potential refinements to the current design that will likely result in additional modifications to catchment areas.

The Maryland Department of the Environment (MDE) is responsible for implementation and supervision of the erosion and sediment control program established by the Sediment Control Subtitle. Included among the MDE responsibilities is the confirmation that erosion and sediment control methods and practices are implemented and maintained in accordance with the manual, *1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control* (MDE, 1994). This guidance specifies acceptable temporary measures and methods to be applied during construction that will effectively minimize the likelihood of sediment pollution by:

1) minimizing the opportunity for erosion to occur, 2) implementing discharge and sediment control measures before, during and after disturbance, and 3) immediately stabilizing disturbed areas as soon as work is completed.

It should be noted that the procedures and structures utilized for management of construction related runoff are not designed based on hydrological and hydraulic parameters *per se*, but rather are to be specified based on the size of disturbed areas, degree of slope and other physical factors including soil type. In general, the sizing of control measures will be conservative so there will be sufficient volume or capacity to control/contain sediment as determined for the site size and soil characteristics. Successful performance of these measures for the control and mitigation of sediment pollution is, therefore, assumed as long as the site construction manger adheres to the manual guidelines.

Similarly, the MDE, under the authority the Annotated Code of Maryland, Environment Article, §4-203 regulations is responsible for storm water management in the counties and municipalities to "maintain after development, as nearly as possible the predevelopment characteristics." This requires the implementation of permanent discharge and sediment control measures (best management practices, [BMPs]) for which guidance is provided in the *2000 Maryland Stormwater Design Manual: Volumes I & II* (MDE, 2000). Unlike the temporary measures set forth in the Maryland manual for erosion and sediment control, the measures for permanent control of sediment pollution are based on engineering design criteria that include detailed analysis of the hydraulic and hydrologic characteristics of the site. Recommended procedures for engineering analysis and design are set forth in this manual, which includes the requirement that water quality with respect to sedimentation be maintained at pre-construction levels (i.e., no impacts to receiving waters) by properly managing the precipitation in the area.

The result of any storm water event, and especially one of any significant size, will result in increased turbidity and suspended solids in the receiving water, and even under the best of circumstances, no storm water BMP is going to achieve 100 percent efficiency, especially during a PMP. Turbidity can result in increased water temperature, decreased dissolved oxygen, and other changes in water chemistry. Fine silt represents a somewhat larger problem for the receiving streams as it settles into the interstices of the stream bottom and embeds the substrate. This impact suffocates aquatic macroinvertebrates and reduces the available habitat. Streams that are heavily impacted by silt have a lower *EPT taxa* percentage (lower stream-water quality) and increased levels of tolerant *taxa*. Impacts of fine sediment to fish include gill irritation, loss of spawning habitat, decreased food supplies, and the exhibition of avoidance behavior. These impacts are typically temporary and are reversed once the event is over.

Performing a detailed analysis of the effects of increased runoff and sediment loading to existing waterways due to maximum precipitation events during construction is not considered to be beneficial at this time since the expected modifications to the construction and site plans will result in the need to correspondingly modify the predictive models and the resulting measures to control erosion and sedimentation.

However, if the site construction erosion and sediment control systems are in place and managed properly and the final storm water BMPs are properly sized, then downstream erosion and sediment impacts to receiving waters will be kept to a minimum during any PMP event.

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NWS, 1980. Hydrometeorological Report No. 53: Seasonal Variation of 10-square-mile Probable Maximum Precipitation Estimates, United States East of the 105th Meridian. National Weather Service (Ho, Francis P. and Riedel, John T.), 1980.

USDA, 1986. Urban Hydrology for Small Watersheds TR-55, USDA Natural Resources Conservation Service, Technical Release 55, June 1986.

USDA, 1996. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation RUSLE, Publication ARS, U.S. Department of Agriculture, Washington, DC, Agriculture Handbook No. 703, July 1986.

ER Impact:

No changes to the ER are required.

Item Number 14 **ER Section 2.4.2.1**

Request:

Provide complete survey [field] data of aquatic habitats, not just major category summaries; include seasonal data. Provide all aquatic survey data (e.g., water and sediment chemistry, sediment particle size, water and habitat quality, biota) in electronic format, such as Excel spreadsheets, so that verification calculations can be performed.

Response:

The majority of aquatic field data supported the development of the Aquatic Field Studies report (EA, 2007). This report is also provided as an attachment to this letter in response to RAI Item Number 8. Copies of data files for this report are provided as an attachment to this letter.

Additional macroinvertibrate field studies were conducted for use in the U.S. Corps of Engineers Section 404 permit application and mitigation plan. The data files for this work are also provided as an attachment to this letter.

Reference

EA, 2007. Aquatic Field Studies for UniStar Calvert Cliffs Expansion Project, EA Engineering, Science, and Technology, Inc., May 2007

ER Impact:

No changes to the ER are required.

Item Number 15 **ER Section 2.4.2.1**

Request:

Describe freshwater tributaries on site that will (Branches 1 & 2) or may (Woodland Branch) be affected. Characterize the habitat and fauna within Branches 1 and 2 that would be impacted by the construction of Unit 3. Provide similar information about Woodland Branch, which may be affected by construction of the new unit. Also, characterize the flora and fauna within the tributaries of Johns Creek (Branch 3, two small unnamed small tributaries that do not show on all maps, and the main tributary near cooling tower site) that would be impacted by the construction of Unit 3. Provide data and other information that supports these characterizations.

Response:

Branch 1 (Canoy Creek)

Branch 1 consists of the Camp Canoy Fishing Pond, constructed by excavation and stream channel impoundment, and associated wetlands and stream channels. It includes 1) three stream channels, seepages, and bordering wetlands that originate up-gradient (west and southwest) of the pond; 2) two small, isolated wetlands on forested slopes up-gradient (west and southwest) of the pond; 3) the pond basin and wetland fringe; and 4) the outlet stream channel (with two small impoundments), and bordering wetlands that carry the outflow from the pond northeast to the Chesapeake Bay. The cliffs block tidal influence from the upstream wetlands complex.

The pond is a man-made impoundment with an earthen dam on the northeast side. The associated wetlands are poorly drained bottomland deciduous forest. The wetlands support forest vegetation dominated by sweet gum (*Liquidambar styraciflua*) undergrown by sweet gum and red maple (*Acer rubrum*) saplings and highbush blueberry (*Vaccinium corymbosum*) shrubs. Groundcover in the drier fringes of the wetlands consists predominantly of ferns such as New York fern (*Thelypteris noveboracensis*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), and royal fern (*Osmunda regalis*). Groundcover in the wetter part of the vegetated wetlands consists predominantly of lizard tail (*Saururus cernuus*) and some ferns. Vegetation fringing the Camp Canoy Fishing Pond and in the two smaller down-gradient impoundments is herbaceous marsh vegetation, including sedges, rushes, grasses, and forbs. Hydrology is typical of the upper part of a dendritic stream system. The streams flowing into the Camp Canoy Fishing Pond are fed by groundwater discharges, and flow increases downstream, with ultimate discharge to Chesapeake Bay.

Fauna along Branch 1 includes generalist species of mammal, birds, and herptofauna. The most ubiquitous mammalian species is the white-tailed deer (*Odocoileus virginianus*).

Branch 2 (Lone Creek)

Branch 2 consists of a small, forested, wetland area and a system of streams (referred to as Lone Creek) draining lands north of Camp Canoy and south of the existing CCNPP Units 1 and 2. One stream with ephemeral (upstream) and intermittent (downstream) segments originates in a swale close to the northwest corner of Camp Canoy and flows to the north and east. A second stream (perennial) originates as the outflow from an existing man-made stormwater basin south of the existing reactors. The two streams join in a forested valley north of Camp Canoy and flow east into the Chesapeake Bay just south of the existing CCNPP Barge Dock. The downstream reach carries perennial flow. A third stream originates north of the central part of Camp Canoy and flows north to the main stream. Its flow regime is ephemeral.

The perennial and intermittent stream channels are deeply incised and lack adjacent vegetated wetlands at most points. The hydrology is typical of the upper part of a dendritic stream system. The streams are fed by groundwater discharges and flow increases downstream. A second man-made stormwater basin occurs at the downstream end of Branch 2, near the CCNPP Barge Dock. Unlike the dry basin southwest of CCNPP Units 1 and 2, the basin near the barge dock appears to consist of permanent open water surrounded by a narrow fringe of emergent wetland vegetation. The Chesapeake Bay shoreline contains riprap in this area.

The stream channels are shaded by deciduous trees, primarily tulip poplar (*Liriodendron tulipifera*), growing near the tops of the banks in uplands (mixed deciduous forest). Vegetation in the channels is therefore sparse to absent at most locations. Very narrow patches of sedges and rushes, less than 1 – 2 ft in width, border the running water within the stream banks in a few places. A small, forested, wetland area occurs north of the central part of Camp Canoy, in the vicinity of the aforementioned third stream feature. The vegetation in the wetland consists of sweet gum with scattered highbush blueberry, pawpaw (*Asimina trilobata*), and shadbush (*Amalanchier canadensis*) shrubs (poorly drained bottomland deciduous forest). The groundcover consists predominantly of deertongue grass (*Dichanthelium clandestinum*), tussock sedge (*Carex stricta*), soft rush (*Juncus effusus*), fimbristylis (*Fimbristylis* sp.), poison ivy (*Toxicodendron radicans*), and common greenbrier (*Smilax rotundifolia*). The hydrology of this small, forested, wetland area appears to be influenced by discharge from a swimming pool occurring landward of the wetland area.

Fauna along Branch 2 includes generalist species of mammal, birds, and herptofauna. The most ubiquitous mammalian species is the white-tailed deer. A field survey for benthic macro-invertebrates was conducted in April 2008. Benthic macro-invertebrates were collected using techniques developed for low gradient, non-tidal streams (USEPA, 1999). At each sampling station, habitat quality was also assessed using the survey sampling guidance in the Maryland Biological Stream Survey (MBSS) Sampling Manual from the Maryland Department of Natural Resources (MDNR) (MDNR, 2001).

One location on Lone Creek (Sample Location LC-I-01[see attached figure]) within the proposed impact area was surveyed for benthic macro-invertebrates. Under the USEPA Rapid Bioassessment Method Protocols (RBP), the habitat quality score for this location was 129, i.e., in the sub-optimal habitat range. This reach was also sampled for benthic macro-invertebrates. Benthic macro-invertebrate scores rated "Fair" under the MBSS guidelines (MDNR 2001). Macro-invertebrates found consisted primarily of midges and fly larva. This reach also included the presence of stoneflies, mayflies and caddis flies.

Woodland Branch

Woodland Branch includes three unnamed tributaries which occur northwest of the existing CCNPP Units 1 and 2 facilities. The tributaries are similar to the stream features discussed above for Branch 1 and Branch 2. The hydrology is typical of the upper part of a dendritic stream system. The streams are fed by groundwater discharges and flow increases downstream (northwest). The associated wetlands are poorly drained bottomland deciduous forest. Fauna along Woodland Branch includes generalist species of mammal, birds, and herptofauna. Note: Under the proposed development plan for the CCNPP Unit 3 facility, no impacts to stream features will occur.

John's Creek Tributaries

The Johns's Creek system within the proposed CCNPP Unit 3 footprint encompasses headwater streams and bordering wetlands which form the upper part of Johns Creek. One headwater stream subsystem (Branch 3) and associated wetlands originates at a cluster of seepages to the north, near existing CCNPP plant facilities. It flows generally to the southwest. The other headwater stream subsystem (i.e., near the proposed cooling tower location) and associated wetlands originates at seepages south on privately owned forested land south of the CCNPP site. It flows generally to the northwest. The two stream subsystems merge at a point approximately 1,800 ft west of Camp Canoy.

The upper reaches of channels in both stream subsystems are incised and shaded by deciduous trees, primarily tulip poplar and upland oaks (mixed deciduous forest), growing on the tops of the banks and in the adjoining uplands. A level floodplain area adjoins the channels down-gradient, becoming progressively wider and reaching a width of approximately 100 ft at the point where the two subsystems merge. Drier lands at the outer edge of the floodplain support well-drained bottomland deciduous forest dominated by American beech (*Fagus grandifolia*), tulip poplar, black gum (*Nyssa sylvatica*), and sweet gum. Wetter floodplain lands support poorly drained bottomland deciduous forest dominated by red maple, black gum, and sweet gum.

Dense patches of New York fern occur in both the well-drained and poorly drained forest lands. Patches of other ferns such as sensitive fern, cinnamon fern, and royal fern occur only in the poorly drained forest lands. Small areas along both channels lack closed tree canopy and support herbaceous marsh vegetation consisting of dense stands of phragmites (*Phragmites australis*). The transition between forest cover and phragmites cover is generally gradual and irregular. Generally, the phragmites infestations extend to areas where beavers (*Castor canadensis*) have killed bottomland trees or where water backed up by beaver dams has killed trees.

The headwaters of John's Creek displays hydrology typical of the upper part of a dendritic stream system in a humid climate. The headwater streams in both subsystems are fed by groundwater discharges at distinct seepage areas and flow increases downstream. Channels become progressively less distinct downstream from the seepages, with flow spreading out into the adjacent floodplain wetlands. Most uplands in the watersheds contributing surface runoff to both stream subsystems support natural forest cover and thus generate minor quantities of runoff in association with rainfall events.

Fauna within the headwaters of John's Creek includes generalist species of mammal, birds, and herptofauna. The most ubiquitous mammalian species is the white-tailed deer. A field survey for benthic macro-invertebrates was conducted in April 2008. Benthic macro-invertebrates were collected using techniques developed for low gradient, non-tidal streams (USEPA, 1999). At each sampling station, habitat quality was also assessed using the survey sampling guidance in the MBSS Sampling Manual from the MDNR (MDNR, 2001). Field sampling events were also conducted in September 2006 and March 2007 to assess stream habitat conditions.

Two locations in John's Creek were sampled in September 2006 and March 2007; i.e., one location upstream and one location downstream of a dewatered reach that was filled in with phragmites along the mainstem of John's Creek (EA, 2007). This portion of John's Creek is located downstream of the proposed impact zone. Water quality at both locations indicated a healthy stream. Benthic macro-invertebrate and fish assemblages at the downstream location were excellent, and the overall habitat assessment produced an optimal score. The upstream location, however, supported only one species of fish, the eastern mudminnow (*Umbra pygmaea*), which is a common stream species that is extremely tolerant of poor water quality.

Differences in the benthic community of the two reaches were also apparent. The upstream location was numerically dominated by oligochaetes and chironomids; the downstream location by amphipods. However, both locations supported at least two of the three groups of aquatic insects that are considered indicators of nondegraded streams (Ephemeroptera, Plecoptera, and Trichoptera). Although both locations scored in the "optimal" category on the habitat assessment, an evaluation of the subscores reveals that the upstream site has poor pool variability, marginal epifaunal substrate and cover, and suboptimal pool substrate, sediment deposition, and channel sinuosity. The difference in the overall scores of the two reaches is attributable to substrate, cover, and pool variability.

Six locations in John's Creek were sampled in April 2008 further upstream in unnamed tributaries to John's Creek (see attached figure). USEPA RBP habitat scores for these locations were similar; i.e., sub-optimal habitat. Three of these streams were sampled for benthic macro-invertebrates; i.e., UT-JC-101, UT-JC-102, and UT-JC-103. The benthic macro-invertebrate scores rated "Fair" under the MBSS guidelines. The data for each of the aforementioned three streams are presented below.

Under the RBP, the habitat quality score of the stream reach denoted as UT-JC-I01 was 105; i.e., in the sub-optimal habitat range. This stream reach just barely met the minimum requirements for benthic macro-invertebrate sample-ability under the guidelines of the MBSS. Macro-invertebrates in this reach scored an index rating of "Fair". Macro-invertebrates found included an abundance of stoneflies and the presence of both Mayflies and Caddisflies.

The habitat quality score of the stream reach denoted as UTJC-I02 was 138 (sub-optimal habitat range). This stream reach also barely met the minimum requirements for benthic macro-invertebrate sample-ability under the guidelines of the MBSS. Macro-invertebrates in this reach scored an index rating of "Fair". Macro-invertebrates found included an abundance of stoneflies and the common presence of both Mayflies and Caddisflies.

The habitat quality score of the stream reach denoted as UTJC-I03 was 129 (sub-optimal habitat range). This stream reach was sampled for benthic macro-invertebrates with the intent of being representative of the upstream watershed and stream characteristics of three smaller reaches occurring upstream. Macro-invertebrates in this reach scored an index rating of "Fair". Macro-invertebrates found included an abundance of stoneflies and Caddisflies with the presence of mayflies.

References

EA, 2007. Aquatic Field Studies for Unistar Calvert Cliffs Expansion Project, EA Engineering, Science, and Technology, Inc, May 2007.

MDNR, 2001. Maryland Biological Stream Survey Sampling Manual, Maryland Department of Natural Resources, 2001.

USEPA, 1999. Assessment Framework for Mid-Atlantic Coastal Plain Streams Using Benthic Macroinvertebrates (MACS Report), prepared for the Mid-Atlantic Integrated Assessment Program, NHEERL-NAR-X-255, U.S. Environmental Protection Agency, Region 3. J. J. Maxted, M.T. Barbour, J. Gerritsen, V. Poretti, N. Primrose, A. Silvia, D. Penrose, and R. Renfrow,1999.

ER Impact:

No changes to the ER are required.

Item Number 16 **ER Sections 2.4.2.1, 2.4.2.2**

Request:

Provide the following:

a) Complete life-history/abundance/distribution information for important freshwater species, including "ecologically important" species, such as the North American beaver. Also is Humped Bladderwort in area?

b) Complete life-history/abundance/distribution information for "important" estuarine species. In addition to those species included in the ER, provide information for summer flounder, red drum, weakfish, spotfin killifish, alewife, blueback herring, green turtle, leatherback turtle, and soft-shelled clam.

c) For the spotfin killifish (Fundulus luciae), which is a state-listed species occurring in Calvert County, include information that allows a determination of the likelihood that the species could be affected by the proposed new unit.

d) Sandy beach habitat was not included in the Rare Plant Survey conducted for the site. Confirm that the state-listed endangered sea purslane (Sesuvium maritimum), which inhabits sandy shore and beach habitats and is listed for Calvert County (MDDNR 2007), is not found on site.

Response:

<u>Information on Important Freshwater Species</u>

NUREG-1555 defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12, by the USFWS or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; 5) species that could serve as biological indicators of effects on local terrestrial ecosystems or 6) species that could pose a potential nuisance to plant operation. A single species may meet more than one of the five criteria.

Important freshwater species in the context of the project area include the North American beaver, American eel, spotfin killifish, nutria, and phragmites. The beaver is a keystone species potentially critical to the structure and function of local terrestrial ecosystems. The American eel has commercial and recreational value. It is found in both fresh and salt water habitats and discussed in the following section, "Important Estuarine Species". The spotfin killifish is a state-listed species occurring in Calvert County. Although it may inhabit fresh water, it is primarily considered a species of salt-to-brackish environments and is discussed in the following section "Description of Additional Species". Phragmites and nutria are species that could pose a potential nuisance to plant operation or critically disrupt the structure and function of local terrestrial ecosystems. They are listed by the Chesapeake Bay Program among the top five species which are causing significant negative impacts to the Bay's aquatic ecosystem and are discussed in "Response to NRC Data Requests, Item Number 17."

Information on North American Beaver

Beavers are primarily aquatic animals, and the largest rodents in North America. They have a waterproof, rich, glossy, reddish brown or blackish brown coat. The underhairs are much finer than the outer, protective, guard-hairs. The ears are short, round, and dark brown in coloration. A beaver's hind legs are longer than its front legs, thus making the rear end to be higher than the front end while walking.

Population Abundance and Distribution: Beavers are found throughout all of North America except for the northern regions of Canada and the deserts of the southern United States and Mexico.

Habitat Requirements: Beavers are essentially aquatic and require water in the form of a pond, stream, lake, or river for their well-being. Because of their skills in regulating water level and stream flow with dams, beavers are able to convert an otherwise unfavorable area into one that is habitable. Their ponds tend to fill up with sediment washed off the slopes above and in time become meadows, forcing the beavers to move to new sites. Large rivers and lakes offer suitable habitat in places where natural food and den or house sites are available, but the largest populations are on small bodies of water.

Beavers build dams to slow down the flow of water in streams and rivers and then build stable lodges for shelter. The dams are engineered according to the speed of the water; in slow water the dam is built straight, but in fast water the dam is built with a curve in it. This provides stability so that the dam will not be washed away.

Beavers travel good distances from their homes to find food. If they find a good source, they build canals to the food source as a way to float the food back to their lodges. Logs and twigs are often stored underwater for winter feeding.

Beavers cache and consume the inner bark of both deciduous and evergreen shrubs and trees, as well as terrestrial and aquatic plants.

Beavers maintain wetlands that can slow the flow of floodwaters. They prevent erosion, and they raise the water table, which acts as a purifying system for the water. This happens because silt occurs upstream from dams, and toxins are then broken down. As ponds grow from water backed up by the damn, pond weeds and lilies take over. After beavers leave their homes, the dams decay, and meadows appear.

Life History: Beavers usually live in family groups of up to 8 related individuals called colonies. The younger siblings stay with their parents for up to 2 years, helping with infant care, food collection, and dam building. Beaver families are territorial and defend against other families. One method is territory marking. This is done by making mud piles around the edges of a territory, and then by depositing anal and castoral secretions on these piles. Beavers will also warn others of danger by slapping their tails against the water, creating a powerful noise. This, however, is not always effective, as older beavers will often ignore the warning slaps of younger members of the colony.

Male and female beavers are sexually mature at about 3 years of age. They mate between January and March in colder climates, and in late November or December in the south. Beavers give birth to one litter of kits per year, usually between April and June. The gestation period is about 3 months, or 105-107 days. During this time, the young develop inside the female's body. When they are born they are fully furred, have open eyes, and can swim within 24 hours. After several days they are also able to dive out of the lodge with their parents to explore the surrounding area.

Beavers are incredibly beneficial to the environment. They are instrumental in creating habitats for many aquatic organisms, maintaining the water table at an appropriate level and controlling flooding and erosion, all by building dams.

Population Dynamics: The conservation status differs with respect to source, but there have been significant threats to the survival of the beaver. Beavers have been hunted and trapped extensively in the past and by about 1900, the animals were almost gone in many of their original habitats. Pollution and habitat loss have also affected the survival of the beaver. In the last century, however, beavers have been successfully reintroduced to many of their former habitats.

The Beaver is now common and widespread, even in areas it did not inhabit during pre-colonial times (SI, 2008).

Global Status: G5, US status N5, Maryland S5: Large range in North America; common; expanding populations

Global Protection Needs: In situations where beaver protection is desired, it is necessary to protect both aquatic and riparian habitats. Generally beavers will modify the aquatic system to make it most suitable for themselves. Protection of an adequate amount of riparian habitat to meet the food and building needs of the beavers is critical; ideally the riparian habitat to be protected should extend at least 50 m from the water and should support young deciduous woody vegetation. Along streams, about 1 km of stream channel generally is sufficient to support one beaver family.

Threats: Other than intensive, unregulated trapping, or extensive removal of deciduous woody plants near permanent water sources (except in circumstances where old growth is replaced by young growth), there are few threats to beaver populations. In fact, once established in an area (e.g., a watershed or drainage system), beavers often are difficult to eliminate.

Information on Humped Bladderwort

The Humped bladderwort (*Utricularia gibba)* could be expected to occur in the pond or marsh wetland habitats described for the project area. However, it is not identified in the Flora Survey report.

Humped bladderwort does not appear to be particularly uncommon; the only listed status within North America is "Special Concern, Rhode Island" (USDA, NRCS, 2008).

Additional information: An annual or perennial aquatic herb of shallow waters. Identifiable as a Bladderwort by its aquatic habitat and distinctive bladders (Rook, 2002a).

Distribution: Quebec to Wisconsin and Minnesota, south to Florida and Louisiana, the Pacific states, Central America, and the West Indies (Rook, 2002a).

Habitat: Exposed shores, lakes, ponds, marshes, and fens (Rook, 2002a).

Aquatic Associates: Coontail (*Ceratophyllum demersum*) (Rook, 2002b), Duckweeds (*Lemna minor* (Rook, 2002c), *Lemna trisulca* (Rook, 2002d), *Spirodela polyrhiza* (Rook, 2002e)) (Rook, 2002a).

Important Estuarine Species

NUREG-1555 defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12, by the USFWS or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems. A single species may meet more than one of the five criteria. A sixth criterion, status as a potential nuisance to plant operation, is not discussed, as no nuisance aquatic species are expected to occur in the vicinity of the project area.

A list of species considered important in the project area was compiled based on these criteria and summarized in Table 16-1. Following the table, a brief summary of habitat requirements, life history, and population dynamics is provided for these species as well as for the following: summer flounder, red drum, weakfish, spotfin killifish, alewife, blueback herring, green turtle, leatherback turtle, and soft-shelled clam.

Table 16-1
Important Estuarine Species in the Chesapeake Bay near the CCNPP Site

Species (*Scientific Name*)	Commercially Harvested	Recreational Target	Keystone Species	Indicator Species
Threatened and Endangered Species				
Shortnose sturgeon * *Acipenser brevirostrum*				
Atlantic sturgeon *Acipenser oxyrhynchus oxyrhynchus*	X (Moratorium since 1997)			
Atlantic loggerhead turtle * *Caretta caretta*				
Kemps ridley turtle * *Lepidochelys kempii*				
Harvested Fish				
American shad *Alosa sapidissima*	X			
Bay anchovy *Anchoa mitchilli*	X		X	
Atlantic menhaden *Brevoortia tyrannus*	X		X	X
Atlantic croaker *Micropogonias undulatus*	X	X		
Striped bass *Morone saxitilis*	X	X		
Spot *Leiostomus xanthurus*	X	X		
White perch *Morone americana*	X	X		
Bluefish *Pomatomus saltatrix*	X	X		
American eel *Anguilla rostrata*	X	X		
Harvested Invertebrates				
Blue crab *Callinectes sapidus*	X	X		
American oyster *Crassostrea virginica*	X			X
Other Important Resources				
Submerged Aquatic Vegetation (SAV)			X	X
Plankton			X	X

Note: *Threatened and Endangered Species are not allowed to be taken in the Chesapeake Bay.

The Chesapeake Bay is considered important estuarine habitat to most, if not all, of the estuarine species identified in the area. However, none of the important species in the vicinity of the project are endemic to the Chesapeake Bay. They range widely throughout the mid-Atlantic coast, and most occur in the Gulf of Mexico, as well.

Each important species is described in terms of the following parameters, which provide a context within which site-related effects may be measured and interpreted:

- Critical life support (natural history) requirements, including spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes (including maps)
- Temporal and three-dimensional spatial distribution and abundance, especially in the discharge area and receiving water body (including maps)
- Seasonal catch data (location, volume, and value) for commercially and recreationally important species
- Existing stressors and adverse effects not related to the proposed project

Description of Threatened or Endangered Species

Two fish and two sea turtle species in the project area are afforded special protection under the Endangered Species Act: the shortnose and Atlantic sturgeons, and the loggerhead and Kemp's ridley sea turtles.

Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) is an anadromous bony fish that was listed as federally endangered in 1967 and is considered extremely rare under Commonwealth of Maryland law.

Population Abundance and Distribution: The ancestral range of this species is believed to extend from the St. John River in New Brunswick, Canada to the St. Johns River in Florida. In 1979, Baltimore Gas and Electric researchers captured a shortnose sturgeon during trawl studies in the vicinity of the CCNPP site. Other isolated individuals may use the area intermittently; however, no shortnose sturgeon is known to have spawned in the Chesapeake in decades. In August, 2006, a female with eggs was captured as she swam up the Potomac River, supposedly to spawn. It is not known whether she spawned, but biologists consider it doubtful, since males are exceedingly rare in the area. Intensive efforts by biologists to document the presence of this species in the Chesapeake Bay are ongoing.

Habitat Requirements: Shortnose sturgeons inhabit river mouths, lakes, estuaries, and bays (Froese, 2007a). They prefer deep pools with soft substrates and vegetated bottoms. Shortnose sturgeons move up river channels to spawn in fresh water. Generally, they spawn in sand to boulder-sized substrate with low to medium water flow. (NatureServe, 2008b)

Life History: The shortnose sturgeon spawns in April in Maryland, generally at intervals of a few to several years. Females sexually mature at 6 to 7 years while males sexually mature at 3 to 5 years. The first spawning may occur from 1 to 16 years after maturity. The lifespan of the shortnose sturgeon may reach 50 years in the northern part of its range. (NatureServe, 2008b)

Population Dynamics: The shortnose sturgeon historically inhabited sluggish tidal rivers and near-shore marine waters of the western Atlantic coast, including Chesapeake Bay. Although this fish once supported an enormous international export business, the stock plummeted during the 1900s due to overharvesting. Deteriorating water quality (especially low dissolved oxygen) and placement of dams that restrict its access to historical spawning grounds have likely inhibited the strong comeback that could have been expected once legal protections were put in place.

Atlantic Sturgeon

A larger, longer-lived relative of the shortnose sturgeon, the Atlantic Sturgeon (*Acipenser oxyrhynchus*) is currently on the candidate species list maintained by NOAA Fisheries because it is undergoing a status review under the Endangered Species Act.

Population Abundance and Distribution: The Atlantic sturgeon was formerly known to occur along the Atlantic coast and major estuarine drainages from Labrador to northeastern Florida (NatureServe, 2008c). The MDNR conducted a trial stocking experiment in 1996 to investigate the viability of juvenile hatchery fish that were released on the Eastern Shore. During the subsequent 5 years, 14 percent of the juveniles were recaptured, suggesting that habitat conditions were adequate to support growth and survival. Recent changes to the water quality goals in the Chesapeake Bay are expected to result in habitat improvements for both sturgeon species.

Habitat Requirements: Atlantic sturgeon is primarily a marine species and stays close to the shore when not breeding. They migrate to rivers for spawning and move downstream afterward. Juveniles spend winter and spring mainly in river mouths. Some juveniles spend several years continuously in freshwater, while others move downstream to brackish water when temperatures drop in the fall. Spawning habitat is fresh water, although sometimes tidal or brackish water, over substrates of hard clay, rubble, gravel, or shell. (NatureServe, 2008c)

Life History: Adults migrate between fresh water spawning areas and salt water non-spawning areas. Atlantic sturgeons spawn from April to May in Chesapeake Bay tributaries at intervals of a few to several years Their eggs hatch in approximately one week. The lifespan of the Atlantic sturgeon may be several decades long. (NatureServe, 2008c).

Population Dynamics: The Atlantic sturgeon once supported a robust fishery in the Chesapeake Bay. Prior to 1890, there were an estimated 20,000 in Chesapeake Bay. The decline of the Atlantic sturgeon was not as sudden or steep as that of the shortnose sturgeon, but its populations are currently depleted. The sturgeon's dependence on both estuarine and freshwater habitat make it susceptible to harm from habitat degradation due to pollution, physical barriers to spawning areas, channelization or elimination of backwater habitats, de-watering of streams, and physical destruction of spawning grounds. In Chesapeake Bay and elsewhere in the range, hypoxic events have increased and may degrade nursery habitat for Atlantic sturgeon. In late 1997, a moratorium on the harvest of wild Atlantic sturgeon was implemented and remains in effect until there are at least 20 protected year classes in each spawning stock, which may take up to 40 or more years. (NatureServe, 2008c)

Atlantic Loggerhead Turtle

Loggerheads (*Caretta caretta*) are large reddish-brown sea turtles that have disproportionately large heads.

Population Abundance and Distribution: Loggerheads occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The loggerhead is the most abundant species of sea turtle found in U.S. coastal waters, including the Chesapeake Bay. Approximately 2,000 to 10,000 young loggerheads forage in the bay each summer for horseshoe crabs, jellyfish, and mollusks. In addition to the well-known juveniles, it has been reported that up to 5 percent of the loggerheads in Chesapeake Bay are adult females who are taking time off between nesting efforts.

Habitat Requirements: Loggerheads are most often seen near the mouths of rivers, in water greater than 13 ft (4 m) deep and are known to occur in open sea, mostly over the continental shelf, and in bays, estuaries, lagoons, and creeks in mainly warm temperate and subtropical regions not far from shorelines. Adults occupy various habitats, from turbid bays to clear waters of reefs. Subadults occur mainly in nearshore and estuarine waters. Hatchlings move directly to sea after hatching, and often float in masses of sea plants (*Sargassum*). These hatchlings may remain associated with the sargassum rafts for 3 to 5 years. In the Chesapeake Bay, loggerheads occur mainly in deeper channels, usually at river mouths or in the open bay. Most sightings are in the Virginia portion of the bay, where salinity is higher. (NatureServe, 2008d)

Nesting occurs usually on open sandy beaches above the high-tide mark and seaward of well-developed dunes. Loggerheads nest primarily on high-energy beaches on barrier strands adjacent to continental land masses. They prefer steeply sloped beaches with gradually sloped offshore approaches for nesting sites and will generally return to the same area in subsequent years if the habitat remains suitable (NatureServe, 2008d).

Life History: Loggerheads mate every 2 to 3 years from late March through early June. Nesting occurs mainly at night in late April through early September, and often at high tide. Eggs hatch in about 7 to 11 weeks. The sex of hatchlings is affected by incubation temperature, with warmer temperatures resulting in a preponderance of females and cooler temperatures producing mainly or only males. Hatchlings emerge from the nest a few days after hatching, typically during darkness. Females are sexually mature at an average age of about 15 to 30 years and are reproductively active over a period of about 30 years. (NatureServe, 2008d)

Population Dynamics: The stock structure of the U.S. population of loggerheads is poorly understood. Some evidence suggests that individuals nesting in Georgia represent a population distinct from the Florida nesters. If so, the northern population may be more severely threatened. NOAA Fisheries suggests that it may become necessary to consider listing them as endangered. Adult loggerheads are known to make extensive migrations between foraging areas and nesting beaches. The Virginia Institute of Marine Science Sea Turtle Program actively tracks individuals that nest on Virginia beaches in an effort to determine the migration routes of these turtles. At present, the place of origin of an individual turtle cannot be determined. Turtles feeding in the Chesapeake Bay may represent a number of nesting populations worldwide. At the global level, the primary threat to loggerhead turtle populations is incidental capture in fishing gear, especially in longlines and gillnets, but also in trawls, traps and pots, and dredges. NOAA Fisheries is currently implementing a program to evaluate the incidence of bycatch of sea turtles in various types of gear, including pound nets in the Chesapeake Bay. Egg mortality may result from predation, beach erosion, invasion of clutches by plant roots, crushing by off-road vehicles, or flooding by sea water overwash or excessive rainfall. (NatureServe, 2008d)

Kemp's Ridley Turtle

The Kemp's ridley turtle (*Lepidochelys kempii*) is one of the smallest of the sea turtles, with adults reaching about 2 ft (0.6 m) in length and weighing up to 100 lbs. The Kemp's ridley turtle has been on the endangered species list since 1970.

Population Abundance and Distribution: Adult Kemp's ridley turtles are restricted to the Gulf of Mexico. Juvenile Kemp's ridley turtles inhabit the Gulf of Mexico and the U.S. Atlantic coast north to Nova Scotia. A sizeable group of the Kemp's ridley turtle spends summers in the Chesapeake Bay, although most remain in the higher salinity waters of the Virginia portion of the bay. (NatureServe, 2008e)

Habitat Requirements: This turtle is a shallow water benthic feeder with a diet consisting primarily of crabs. Its preferred habitat is shallow, coastal, and estuarine waters, usually over sand or mud bottoms, where crabs are numerous. Nesting occurs on well-defined, elevated dune areas, especially on beaches backed up by large swamps or bodies of open water having seasonal, narrow, ocean connections. (NatureServe, 2008e)

Life History: Females begin nesting at the age of 8 to 13 years. Nesting occurs on Mexican beaches from April to July. Females lay one to four clutches of about 100 eggs at intervals of 10 to 28 days. The eggs hatch in 50 to 55 days. After leaving the nesting beach, hatchlings are believed to become entrained in eddies within the Gulf of Mexico, where they are dispersed within the Gulf and Atlantic by oceanic surface currents. At two years of age, they enter coastal shallow water habitats. Individual adult females lay 1-4 clutches averaging about 100 eggs at intervals of 10-28 days, during daylight from April to July. Individuals often nest in successive years. Large numbers of females may nest simultaneously on one beach. (NatureServe, 2008e)

Eggs hatch in average of 50-55 days (CSTC 1990). Females begin nesting at an estimated age of 8-13 years (Schmid, 1997).Individual adult females lay 1-4 clutches averaging about 100 eggs at intervals of 10-28 days, during daylight from April to July. Individuals often nest in successive years. Large numbers of females may nest simultaneously on one beach. Eggs hatch in average of 50-55 days (CSTC 1990). Females begin nesting at an estimated age of 8-13 years.Individual adult females lay 1-4 clutches averaging about 100 eggs at intervals of 10-28 days, during daylight from April to July. Individuals often nest in successive years. Large numbers of females may nest simultaneously on one beach.

Population Dynamics: The principal threats to this species occur on the nesting beaches, where both deliberate and accidental disturbances interfere with nesting success and in accidental take by fisheries vessels. Has incurred high mortality due to predation on eggs (especially by coyote), hatchlings, and nesting adults. Restoration of the species requires protecting sub-adult and adult animals by the use of turtle excluder devices on shrimp trawls wherever turtles occur.

Harvested Fish

Nine species of fish that are harvested commercially or recreationally in the Chesapeake Bay are considered important in the project area.

American Shad

The American shad (*Alosa sapidissima*) is one of six shad and herring species to occur in the Chesapeake Bay.

Population Abundance and Distribution: The American shad ranges along the Atlantic Coast from Labrador to the St. John's River in Florida. In addition, the American shad was introduced to the Sacramento River in California, from which it has spread north to eastern Asia and Alaska, and south to Mexico (NatureServe, 2008f). American shad stocks in the Chesapeake Bay are low compared to historic levels (CBP, 2008a).

Habitat Requirements: American shad is an anadromous, pelagic-schooling migratory species. They are found in nearshore marine waters except during the breeding season (NatureServe, 2008f). Spawning takes place in freshwater over shallow flats or in riffles and often in birthplace rivers and streams (Burkhead, 1993).

Life History: From January to June, shad older than approximately four years enter the Chesapeake Bay to spawn in fresh or near-fresh tributaries as far north as the Susquehanna River. Shad usually complete the spawning run without feeding and move far enough upstream for the eggs to drift downstream and hatch before reaching saltwater. After spawning, the adult either dies or resumes its long pelagic migration. Within a month, young fish begin feeding on zooplankton in the Chesapeake Bay. More than 70 percent of the young fish die before leaving the estuary.

Population Dynamics: Historically, it is likely that American shad spawned in suitable waters across the Atlantic coast. Current spawning runs are limited by physical barriers as well as degraded water quality. These impediments to spawning, added to overharvesting, spurred Maryland to implement a fishing moratorium on American shad in 1980. Virginia concurred in 1994, making it illegal to harvest American shad anywhere in the Chesapeake Bay. Stocks are being enhanced in three ways: (1) restoring native spawning habitat by removing dams or building fishways; (2) supplementing wild stocks with hatchery fish; and (3) improving water quality.

A low of several hundred American shad per year was reported in the early 1980s. The most recent data available show an average of 101,140 per year between 2003 and 2005. The increased abundance falls short of the long term restoration goal of two million fish per year. The Atlantic States Marine Fisheries Commission has identified habitat areas of particular concern for the American shad, including spawning sites; nursery areas; inlets that provide access to coastal bays, estuaries and riverine habitat upstream to spawning grounds; and sub-adult and adult nearshore ocean habitat.

The abundance of the closely related hickory shad (*Alosa mediocris*) dropped so low in the Chesapeake Bay in the late 1970s that a moratorium on commercial and recreational capture in Maryland's portion of the Chesapeake Bay was implemented in 1981. Although the population is increasing, the moratorium remains in place. Ocean landings of hickory shad are still allowed and Maryland recorded landings less than 4000 lb (1800 kg) in 2004.

Bay Anchovy

The bay anchovy (*Anchoa mitchilli*) is a small, schooling fish that is a key species in the food web of the Chesapeake Bay (CBEF, 2008).

Population Abundance and Distribution: The bay anchovy ranges along the western Atlantic and Gulf of Mexico coasts, from Maine to Yucatan (NatureServe, 2008g). It is the most abundant fish in the Chesapeake Bay.

Habitat Requirements: The bay anchovy prefers the lower freshwater and estuarine reaches of coastal rivers, bays, sounds, and high salinity near-shore marine waters (NatureServe, 2008g). The bay anchovy is commonly found in shallow tidal areas with muddy bottoms and brackish waters and tolerates a wide range of salinities (Froese, 2007b). Bay anchovies spawn in estuarine waters where temperatures are above 12°C and salinity is greater than 10 percent (Morton, 1989). The bay anchovy spawns throughout the Chesapeake Bay.

Life History: Bay anchovies spawn from May to September in the Chesapeake Bay. Their eggs hatch in approximately 24 hours (Morton, 1989). Those that hatch early in the season become sexually mature during their first summer (Morton, 1989). The life span of the bay anchovy is approximately three years (CBEF, 2008).

Population Dynamics: Through predator-prey relationships, the bay anchovy forms a link between zooplankton and top game fish. Striped bass (CBP, 2008b), bluefish (CBP, 2008c), and other sport fish, as well as some birds (CBP, 2008d) and mammals (CBP, 2008e), depend on the abundance of bay anchovy to sustain them. In one study, bay anchovy accounted for up to 65 percent of the biomass consumed by striped bass in the Bay.

In summer months from 1995 to 2000, bay anchovy eggs comprised more than 94 percent of the fish eggs in the plankton of the Middle Bay portion of the Chesapeake Bay. More than 75 percent of all larval fish collected in ichthyoplankton tows were bay anchovy.

The bay anchovy is not commercially harvested. However, bay anchovy populations in the Chesapeake Bay fluctuate annually. Since 1994, the bay anchovy population in the Chesapeake Bay has been on a long term decline, the first ever recorded for the species. In recent years, recruitment of bay anchovy has been lower than expected, based on the various trawl surveys. Although the specific causes of the decline are not well understood, it is known that oxygen levels below 3.0 mg/L can be lethal to eggs and larvae. Dissolved oxygen greater than 2.0 mg/L is critical for adult survival.

Atlantic Menhaden

Like the bay anchovy, the Atlantic menhaden (*Brevoortia tyrannus*) is a key component of the estuarine food web, consuming plankton and small fish while being consumed by larger predatory fish.

Population Abundance and Distribution: The Atlantic menhaden occurs along the western Atlantic from Nova Scotia south to the Indian River in Florida (Froese, 2007c). Adults are present in near proximity to the CCNPP site year round. In the Middle Bay, spring egg collections were comprised of more than 80 percent menhaden.

Habitat Requirements: The Atlantic menhaden is found inshore in summer, but some move into deeper water in winter. Adults are found in near-surface waters, usually in shallow areas overlying continental shelf. The Atlantic menhaden is found in greatest abundance immediately adjacent to major estuaries. Juveniles are generally pelagic, with the smallest size groups occurring farthest up river. Estuaries are the preferred nursery habitat. (Froese, 2007c).

Life History: Atlantic menhaden spawn throughout the entire year in inshore waters over most of the continental shelf. Their eggs are buoyant and hatch within 2 to 3 days depending on water temperature. Larvae are pelagic and probably spend between one and three months in waters over the continental shelf. In Maryland, larval fish enter the Chesapeake Bay in late winter and early summer and move into lower salinity waters in estuarine tributaries where they are found in great numbers. These juveniles remain in the Bay until the fall when most migrate to the ocean. The following spring they migrate northward as adults to the Chesapeake Bay area and into New England waters. (MDNR, 2007a).

Population Dynamics: Unlike the bay anchovy, the Atlantic menhaden is directly targeted by commercial harvesters. In 2004, more than 3 million lb (1.4 million kg) were landed in Maryland. Atlantic menhaden stocks across the Atlantic coast are stable. However, reduced abundance in the Chesapeake Bay, a key nursery area, has been reported. Due to the concern over the steady decline in recruitment in the Chesapeake Bay, fisheries managers have recently (starting in 2006) capped the commercial harvest of Atlantic menhaden for 5 years. The limits on harvest of Atlantic menhaden are based on the importance of Atlantic menhaden to predatory fish, including the striped bass and bluefish.

Atlantic Croaker

The Atlantic croaker (*Micropogonias undulatus*) is one of the top ten recreational finfish in the Chesapeake Bay.

Population Abundance and Distribution: The Atlantic croaker ranges along the Atlantic coast from Massachusetts to Florida, and from the northern Gulf of Mexico to Mexico (NatureServe, 2007h). Adults are abundant in the Chesapeake Bay from March to October. They move offshore and south along the Atlantic coast in the fall. Juveniles are present in the Bay year round.

Habitat Requirements: The Atlantic croaker is a bottom-feeding generalist, consuming benthic invertebrates and some fish. It prefers coastal waters and estuaries (Froese, 2007d) and is associated with muddy substrates in depths less than 400 ft (120 m), in a wide range of salinity and temperature conditions. Spawning occurs offshore over the continental shelf (SCDNR, 2006). Nurseries and feeding grounds are typically located in estuaries (Froese, 2007d).

Life History: The Atlantic croaker spawns offshore in August. Their eggs are pelagic. Larvae are carried into the coastal inlets by tidal currents (SCDNR, 2006). Young-of-the-year move into the Chesapeake Bay and into low salinity and freshwater creeks during autumn (CBP, 2008b). They overwinter farther upstream and then leave the Bay the following autumn with the adults (CBP, 2008b). Juveniles become sexually mature in two years. (NatureServe 2007g).

Population Dynamics: All of the major predatory fish in the Chesapeake Bay, including striped bass, flounder, shark, spotted seatrout, other species of croaker, bluefish and weakfish, include Atlantic croaker in their diet. The Atlantic croaker is a perennial favorite of the human population, as well, ranking within the top 10 species caught by anglers. Historically, the Chesapeake Bay region accounted for the majority of Atlantic Coast croaker landings. Recreational landings in the region have been declining since 1986. After a sharp decline in commercial landings during the 1970s and 1980s, Atlantic croaker landings in Maryland increased to close to 1 million lb (454,000 kg) per year for most of the 1990s. In fact, commercial landings in 2001 were higher than at any time since 1956, indicating a rebound of the Atlantic croaker fishery in the Chesapeake Bay.

Striped Bass

The striped bass (*Morone saxatilis*) is the dominant predator in the Chesapeake Bay.

Population Abundance and Distribution: The striped bass is native to the Atlantic slope drainages from the St. Lawrence River in Canada to the St. John's River in Florida and in Gulf slope drainages from western Florida to Lake Ponchartrain in Louisiana. It was introduced widely in inland areas of the U.S. and the Pacific coast and has spread north to British Columbia and south to Baja California. Juveniles and adults occur in the Chesapeake Bay year round. The abundance and distribution of the striped bass affect countless other species, including the Atlantic menhaden. (NatureServe, 2007i)

Habitat Requirements: The striped bass is a marine and estuarine coastal species that moves far upstream in channels of medium to large rivers during spawning migrations. Rivers, tidally influenced freshwaters, and estuaries are used for spawning and nurseries. (NatureServe, 2007i)

Life History: Upriver migration and spawning of the Chesapeake populations occur between April and early June (Burkhead, 1993). The striped bass spawns in aggregations. Eggs hatch in 2 to 3 days and larvae become free swimming in 4 to 10 days (Burkhead, 1993). Males become sexually mature in 1 to 3 years, females in 4 to 6 years. In the Chesapeake basin, both sexes stay in nurseries for at least two years either in the Bay or in their birthplace rivers, and first leave the Bay at age 3 to 4 (Burkhead, 1993). The life span of the striped bass is approximately ten years. (Burkhead, 1993)(NatureServe, 2007i)

Population Dynamics: Juvenile striped bass feed on zooplankton and benthic invertebrates. Adults eat a variety of other important fish, including bay anchovy, Atlantic menhaden, spot, Atlantic croaker, and white perch.

This large anadromous species has a complex life history that centers on the Chesapeake Bay, where historically, about 90 percent of the Atlantic population spawned. Distribution patterns are influenced by the age, sex, degree of maturity and the river in which they were born. Successful completion of the striped bass life cycle requires a variety of habitats including spawning sites, nursery areas, passages between inland spawning and estuarine nursery habitats, and offshore wintering grounds.

Commercial and recreational landings in the Chesapeake Bay generally increased from the 1930s through the mid-1970s then declined sharply through the mid-1980s. Aside from direct overfishing, it is thought that low dissolved oxygen increased stress on the fish, making them susceptible to disease. A moratorium on all striped bass fishing in Maryland in 1985, and in Virginia in 1989, allowed the population to rebound. According to the Maryland Department of Natural Resources (MDNR), 602,506 lb (273,292 kg) of striped bass were harvested from the south central area of the Chesapeake Bay near the CCNPP site in 2004. This was one of the top 10 years of greatest harvest since data collection began in 1944. Concerns about the future of this fishery remain. A large percentage of striped bass appear to be malnourished and up to 70 percent of the population is infected with mycobacteriosis, a type of wasting disease. The impact of this disease of sustainability of the stock is not well understood at this time.

Spot

Spot (*Leiostomus xanthurus*), like the Atlantic croaker, occupies a middle position in the Chesapeake Bay food web, as a consumer of benthic invertebrates and as prey for striped bass, bluefish, weakfish, shark and flounder.

Population Abundance and Distribution: Spot can be found in estuarine and coastal waters from Cape Cod to the Bay of Campeche in Mexico (NatureServe, 2007j). Spot ranges throughout the Chesapeake Bay from April through October.

Habitat Requirements: Spot is a generalized omnivorous bottom feeder that prefers shallow coastal waters and estuaries with mud or sand bottoms. It is broadly tolerant of temperature and salinity fluctuations. Spawning takes place offshore over the outer continental shelf. (NatureServe, 2007j).

Life History: Spawning occurs offshore in the months of September through November in the Chesapeake Bay, then the young move into the estuary for rearing. They become sexually mature in two years and have a typical lifespan of three years (NatureServe, 2007j).

Population Dynamics: In addition to their central role in the food web, spot are important to both commercial harvesters and recreational anglers. Inter-annual variability in spawning conditions leads to unpredictable landings. No long term declines, however, have been noted. Commercial landings are highest during the fall migration out of the Chesapeake Bay, when they are taken as by-catch from the pound net fishery in the lower Bay. According to MDNR, commercial catches in Maryland have exceeded 100,000 lb (45,000 kg) annually since 1998.

White Perch

White perch (*Morone americana*) are semi-anadromous predaceous fishes that spend their entire lives in the Chesapeake Bay (MDNR, 2007b).

Population Abundance and Distribution: The range of the white perch encompasses Atlantic slope drainages from the St. Lawrence – Lake Ontario drainage in Quebec to the Pee Dee River in South Carolina (NatureServe, 2007k). The white perch is abundant in the Chesapeake Bay (MDNR, 2007b).

Habitat Requirements: White perch migrate from the open Chesapeake Bay into the tidal-fresh portions of the bay to spawn over the sandy bottoms of brackish or tidal-fresh rivers. They never move into the open ocean and are common in quiet water (NatureServe, 2007k).

Life History: Spawning occurs from April to June, and eggs hatch in about 4 days (NatureServe, 2007k). Young white perch remain near shore downstream from their hatching areas for several months, foraging for insect larvae and crustaceans. Adult white perch overwinter in the deeper channels of the Chesapeake Bay. The lifespan of the white perch is approximately 10 years. (MDNR, 2007b)

Population Dynamics: White perch are heavy consumers of fish eggs, including those of striped bass. The white perch is considered a delicious table fish, and supports an important recreational fishery in the Chesapeake Bay. It is also commonly taken as by-catch by commercial harvesters. Large schools of white perch are vulnerable to capture when they aggregate in large schools to feed on herring. According to MDNR, commercial catches in Maryland have exceeded 1 million lb (453,000 kg) annually since 1995.

Bluefish

The bluefish (*Pomatomus saltatrix*) is a migratory pelagic species that primarily travels in schools.

Population Abundance and Distribution: In the western Atlantic, the bluefish ranges from Nova Scotia to Brazil but is rare in the Caribbean Sea. The migratory bluefish visits the Chesapeake Bay area from spring to fall. It is abundant in the lower bay and common in the upper bay. (Murdy, 1997)

Habitat Requirements: Bluefish occur in oceanic and coastal waters and are most common along surf beaches and rock headlands in clean, high energy waters (Froese, 2007e). Bluefish spawn offshore over outer continental shelf (Murdy, 1997) in the Chesapeake region. Larger juveniles and adult bluefish have broad habitat tolerances and range throughout the Chesapeake Bay in search of forage fish. The bluefish diet is varied, consisting of fish species from all depths, including Atlantic menhaden, weakfish, and croaker. As a large, mobile predator, it competes with the striped bass for food.

Life History: Bluefish spawn offshore in the Chesapeake region in July. Eggs are pelagic and hatching is temperature dependent. Transformation from larva to juvenile occurs after approximately 18 to 25 days. Juvenile bluefish move into the bay during late summer. Most bluefish mature by age 2 (MDNR, 2007c). Their lifespan is approximately 12 years. (NMFS, 2008a)

Population Dynamics: About 20 percent of the bluefish caught commercially in the U.S. are landed in the Chesapeake Bay, making bluefish a significant fishery in the area. The majority of the catch is in the Virginia portion of the Chesapeake Bay. Historic highs and lows in the harvest have occurred during the last 70 years. Until about 1992, commercial landings of bluefish in Maryland routinely exceeded 200,000 lb (90,000 kg) annually. Although overall stocks of bluefish in the Atlantic are increasing, landings in the Chesapeake Bay are on the decline, possibly due to over harvesting. According to MDNR, about 52,000 lbs (23,000 kg) of bluefish were landed by commercial fishermen in 2004.

The bluefish ranked first in number and weight among sportfish in the Chesapeake Bay for nearly 20 years, until the current decline began in 1990. Recreational landings outnumber commercial landings by at least 5 times. MDNR implemented a management plan in 1990 in response to concerns about declining regional bluefish stocks.

American Eel

The American, or common, eel (*Anguilla rostrata*) is a widely distributed catadromous species.

Population Abundance and Distribution: American eels range along the Atlantic coast of North America, throughout the Gulf of Mexico and the Caribbean, and along the east coast of Central America to Venezuela (Murdy, 1997). The American eel is abundant year-round in all tributaries to the Chesapeake Bay.

Habitat Requirements: American eels live predominately in rivers, lakes and estuaries, but migrate into the center of the Atlantic Ocean to spawn. They are most commonly found in permanent streams with continuous flow, hiding during the day in undercut banks and in deep pools near logs and boulders (Froese, 2007f). During the 5 to 20 years the American eel spends in the Chesapeake Bay, it feeds at night on insects, mollusks, crustaceans, worms, and other fish.

Life History: American eels spawn in winter and early spring. Larvae drift in ocean currents before entering coastal waters where they metamorphose. American eels go through phases of pigmentation beginning with the transparent glass eel stage as they migrate upstream. Most of their life is spent in the yellow phase, in which they are nocturnally active omnivores. In the Chesapeake Bay, American eels reach maturity in 8 to 24 years and populations are dominated by females. Sexual maturity is delayed until just prior to the reproductive migration in which eels migrate to the ocean to spawn. Adults die after spawning. (NatureServe, 2007l)(Murdy, 1997)

Population Dynamics: In all its life stages, the American eel is an important prey species, as it is consumed by a variety of fish, aquatic mammals, and birds. The American eel is caught in commercial eelpots. Most eels landed in the Chesapeake Bay area are juveniles, or "glass eels," which are exported to Europe and Asia. Recreational anglers do not typically target the eel for consumption, although they are often bought for use as bait for striped bass and other sport fish.

In 2005, the Atlantic States Marine Fisheries Commission determined that eel abundance had fallen since the late 1970s to mid-1980s and was at or near historic lows along the entire Atlantic coast. The decline was not attributed to any particular cause although several possible factors such as harvest, habitat loss, predation, hydroturbine mortality, disease, parasitism, and reduced fecundity resulting from pollution were noted. The commercial catch in 1981 was more than 700,000 lb (317,000 kg) in both Maryland and Virginia but has been declining ever since.

The American eel is currently being considered for special protection under the Endangered Species Act, which may affect the way the species is managed by the Atlantic States Marine Fisheries Commission. The American eels mature slowly (reproducing at age 8 to 24 years) and are vulnerable to targeted harvest during seasonal migrations, which occur before the first spawning of new adults.

Harvested Invertebrates

Two species of invertebrates have been historically important to commercial and recreational harvesters near the CCNPP site, and throughout the Chesapeake Bay: the Blue Crab and the American Oyster. Both species are now severely depleted, and under strict management provisions.

Blue Crab

The blue crab (*Callinectes sapidus*) plays a vital role in the Chesapeake Bay region as both predator and prey.

Population Abundance and Distribution: Blue crabs are known to occur in the western Atlantic from Nova Scotia to northern Argentina and were introduced in the eastern Atlantic, the northern and eastern Mediterranean, and in Japan (FAO, 2008a). Blue crabs range from the upper Chesapeake Bay near freshwater tributaries down to the mouth of the Chesapeake Bay. Although mating occurs in the areas near the CCNPP site, the females typically migrate down-bay to a spawning and hatching area approximately 70 mi (110 km) south of the CCNPP site, where an appropriate salinity of approximately 23 to 28 parts per thousand occurs.

Habitat Requirements: Blue crabs use all the available habitats within the Chesapeake Bay, preferring shallower areas during warm weather and deeper areas during winter (CBP, 2008c). While males move up into the Bay and tributaries, females tend to congregate in saltier waters (CBP, 2008c). Blue crabs are bottom-dwellers and utilize bay grass beds for mating, shelter, and nurseries (CBP, 2008c).

Life History: Blue crab mating takes place from May to October. Females migrate to the saltier lower bay to spawn where they release larvae, called zoea, after two weeks. The zoea are transported to the ocean by currents and back to the Bay by winds. The larvae molt several times before reaching a post larval form called megalops. Megalops travel farther up into the Bay and metamorphose into the first crab stage. They molt several more times before becoming adults at 12 to 18 months). The lifespan of the blue crab is 3 years (Van Den Avyle, 1984). (CBP, 2008c)

Population Dynamics: The Chesapeake Bay is the largest producer of crabs in the country, supporting major commercial and recreational fisheries. In most years, at least 30 percent of the nation's blue crabs come from Chesapeake Bay waters. According to the CBP, annual commercial harvests can approach 100 million lb (45.4 million kg) of crab.

The number of mature female Chesapeake Bay blue crabs, or spawning stock, remains below the long term average. The 2006 winter survey conducted by MDNR showed that the total number of crabs in the Chesapeake Bay was low compared with historical averages but stable. In 2006, the Chesapeake Bay Foundation issued a Chesapeake Bay score of 38 percent, or grade C for the blue crab. Reasons for the observed reduction in harvest are complex but may include over-harvesting, loss of habitat, and degradation of water quality. Juvenile crabs are closely tied to submerged aquatic vegetation and may suffer a decline when submerged aquatic vegetation is unavailable for use as habitat and nursery grounds. Crabs are bottom feeders, and can be sensitive to low dissolved oxygen near the substrate.

American Oyster

The American oyster (*Crassostrea virginica*) is a filter feeding bivalve mollusk (CBP, 2008d).

Population Abundance and Distribution: The American oyster ranges from Canada's Gulf of St. Lawrence to the Gulf of Mexico, the Caribbean Sea, and the coasts of Brazil and Argentina. It has been introduced to British Columbia, the west coast of the United States, Hawaii, Australia, Japan, and the United Kingdom (FAO, 2008b). Oyster breeding and nursery areas occur near the CCNPP site. New beds were created during construction of CCNPP Units 1 and 2 to mitigate habitat loss. However, oysters have not occurred in sufficient numbers for commercial fishery near the CCNPP site since at least 1971.

Habitat Requirements: The American oyster thrives in estuaries, but also lives in marine coastal environments (FAO, 2008b). American oysters are often found concentrated in areas with shell, hard sand or firm mud bottoms (CBP, 2008h).

Life History: The American oyster discharges gametes into the water column in response to a variety of stimuli, including warmer temperatures, pheromones, and the presence of appropriate phytoplankton. Fertilized eggs develop into larvae after about 24 hours (CBP, 2008h). After 2 to 3 weeks in the plankton, larval oysters attach to the Chesapeake Bay substrate in a place where they will become permanently attached as adults. Upon being stimulated to settle, the oyster cements its left valve to the substrate and metamorphoses into a juvenile oyster, or spat, by discarding its velum, reabsorbing its foot, and enlarging its gills. (FAO, 2008b)

Population Dynamics: The American oyster is highly valued in the Chesapeake Bay but has been declining since the late 1800s due to over-harvesting, parasites, and poor water quality. A healthy oyster provides many services to the Chesapeake Bay ecosystem, including filtering the water, producing planktonic larvae that feed a variety of larval fish, and creating a physical structure with its shell that many other animals use for shelter and foraging.

Efforts to restore the oyster fishery include expanding the amount of clean, hard surfaces for oyster spat to settle, increasing the number of breeding adult oysters, and developing methods for controlling oyster diseases.

Description of Additional Species

ASMFC Stock Status Overview

The Atlantic States Marine Fisheries Commission (ASMFC) collects and publishes stock status data for 22 managed species or species groups. From the "important" species addressed above, these include Atlantic striped bass, Atlantic menhaden, Atlantic croaker, Atlantic sturgeon, American shad, American eel, Bluefish and Spot. From the additional list addressed below, Summer flounder, Red drum and Weakfish are included in the stack status assessments.

Essential Fish Habitat: NMFS Mid-Atlantic RMC, which is responsible for EFH in Maryland, has established EFH for various life stages of nine species of fish in the northern Chesapeake Bay, where CCNPP is located. These fish species are butterfish, cobia, king mackerel, Spanish mackerel, red drum, bluefish, black sea bass, windowpane flounder, and summer flounder. The EFH for these species includes the entire northern Chesapeake Bay and are depicted on Figure 11.1-1 in relation to the area proposed to be impacted during additional CWIS, discharge, and barge facility construction.

Summer Flounder

NMFS Mid-Atlantic RMC has established Essential Fish Habitat (EFH) for various life stages of nine species of fish in the northern Chesapeake Bay. EFH has been designated in the vicinity of the project area for larval, juvenile, and adult summer flounder (*Paralichthys denatus)*.

Population Abundance and Distribution: Summer flounder are found in estuarine and coastal waters from Nova Scotia to Florida. They are most abundant from Cape Cod, Massachusetts to Cape Fear, North Carolina. Within Chesapeake Bay, summer flounder are largely restricted to waters south of Annapolis, but they can be found occasionally in the upper Bay (MDNR, 2007d).

Habitat Requirements: Summer flounder (*Paralichthys denatus)* spawn offshore, and larvae enter the Chesapeake Bay from October to May, entering inshore coastal and estuarine areas to complete transformation. After metamorphosis, the larvae settle from the water column to the substrate, where they may start to exhibit burial behavior (NOAA, 1999). Juvenile summer flounder utilize eelgrass beds as nursery habitats in the Chesapeake Bay. Summer flounder bury themselves in sandy substrates, which comprise approximately 93 percent of the substrate in the vicinity of the proposed construction activities (EA, 2007a). Most adult summer flounder migrate into the Chesapeake Bay from spring to autumn and then migrate offshore during the winter months; however, some are year-round residents. The summer flounder is more common in the lower bay than in the upper bay, extending as far north as the Gunpowder River. Adult summer flounder typically occur in deep channels, ridges, or sandbars. Summer flounder greater than 3 years in age primarily inhabit coastal waters. Adults have often been reported as preferring sandy habitats (NOAA, 1999). (Murdy, 1997)

Life History: Winter spawning migrations in Chesapeake Bay begin in October, moving offshore to depths of 100 to 600 feet during the winter. Their migration is presumably brought on by decreasing water temperatures and declining photoperiods in the fall. Spawning begins at about age 2 and generally occurs in the fall and winter during offshore migrations and/or at the wintering grounds. Fish spawning north of

Chesapeake Bay continues through December, while fish spawning south of Chesapeake Bay begins in November and ends in February (MDNR, 2007d).

Population Dynamics: Maryland Department of Natural Resources (MDNR) provides the following: Summer Flounder are managed as one stock extending from North Carolina to Maine. Since 1980, 70% of the commercial landings have come from the Exclusive Economic Zone (EEZ: greater than 3 miles from shore). Large variability in landings have occurred within and among the states and over time. Summer Flounder exist in Maryland in all waters where the salinity is above 10 parts per thousand. This includes the Maryland Coastal Bays, near shore Atlantic Ocean, and the Chesapeake Bay up to the Bay Bridge.

The coastal stocks underwent a collapse in 1989 and 1990, but since then strict regulation has allowed a slow recovery in spawning stock biomass, age structure, and overall stock abundance. The council Plan Amendment 12 total biomass target (B MSY) required to produce maximum sustainable yield for the stock is B MSY =106,400 mt, and the threshold for a recovered fishery is one-half B MSY =53,200 mt. The peak biomass from 1982 to 1998 was 48,500 mt. 1983, and the low was 16,000 mt. in 1989. The 1998 estimate of biomass was 38,600 mt. The 1999 biomass was estimated at 41,400 mt, or 23% below the threshold target.

Spawning stock biomass has increased (age 0 and older) since 1989 (5,247 mt) to 17,400 mt. in 1996, to 25,000 mt in 1998. There is an 80% chance that the 1998 spawning stock biomass was between 22,500 mt. and 28,500 mt. which is a medium level of historical abundance. The age structure of the SSB has expanded recently. In 1995 only 12% of the SSB was ages 2 and older. In 1998, 70% of the SSB was ages 2 and older. Under equilibrium conditions at FMAX, at least 88% of the spawning stock biomass would be expected to be age 2 and older.

The fishing mortality rate on summer flounder is high, peaking at 2.1 (82% exploitation) in 1992, and was estimated to be 1.5 (72% exploitation) in 1995. The estimated mortality for 1995 was above the target mortality rate [FTGT = 0.53 (38% exploitation)]. The fishing mortality rate for 1996 was estimated to be 1.0 (58% exploitation), still above the management target rate of FTGT 0.41 in 1996. The fishing mortality rate in 1998 was estimated at 0.52. There is an 80% chance the 1998 F was between 0.46 and 0.58. Projections made at the 2000 SARC estimated that by January 1, 2001 F would be 0.26, if quotas were not exceeded in 2000. The overfishing definition is (FMAX = 0.24). While the fishing mortality rate is declining, it is still above the overfishing definition (Doctor, 2000).

Stock status reports from ASMFC showed continuous growth of Summer flounder stocks from 2000 through 2005, with achievement of the Spawning Stock Biomass Threshold target of 100 million pounds as of 2003. However, SSB fell below the threshold to 93.3 million pounds in 2006. ASMFC currently describes Summer flounder stocks as “depleted, overfished and overfishing is occurring.” Fishing mortality is currently F=0.35 (FMAX=0.24).

Red Drum

Red drum (*Sciaenops ocellatus)* is one of nine species for which the Chesapeake Bay has been designated as Essential Fish Habitat (EFH) for eggs, larvae, juvenile, and adult red drum. Red drum is a euryhaline fish species that supports a healthy recreational sportfishery throughout most of its range (FAO, 2008c).

Population Abundance and Distribution: The historic distribution of red drum on the Atlantic coast is from the Gulf of Maine to northern Mexico. This species has become uncommon north of New Jersey.

Red drum are more abundant in the Gulf of Mexico than along the Atlantic coast (MDNR, 2007e). Adult red drum occur in the Chesapeake Bay from May to November and are most abundant in the spring and fall near the bay mouth in salinities above 15 parts per thousand. The species ranges as far north as the Patuxent River. (Murdy, 1997)

Habitat Requirements: Adults occupy coastal and estuarine waters; are most common over sandy bottoms and are often captured in the surf zone. Some individuals may enter fresh water (e.g., St. Johns River, Florida). Juveniles use estuaries as nursery areas for 6-8 months. Red drum juveniles are generally found in shallow estuarine areas with little tidal influence and grassy or muddy bottoms (Buckley, 1984). Juveniles are most abundant in estuarine waters and inlets, while fish older than age-5 primarily inhabit coastal and offshore waters, often in large schools (MDNR, 2007e). Spawning occurs in coastal waters near passes, inlets, and bays. (Manooch 1984)

Life History: Red drum spawn in nearshore coastal waters from late summer through fall, and the eggs drift until they hatch (Murdy, 1997). Red drum larvae (approximately 6-8 mm SL) are transported via currents into estuaries, where they utilize seagrass beds and SAV as nursery habitats (FAO, 2008c).

Red drum are benthic feeders. Juveniles eat mostly copepods, amphipods, and tiny shrimps; adults eat fishes, crabs, shrimps, and sand dollars (Manooch 1984)

Prey items selected by adult red drum vary by season but include moderate-sized crustaceans (e.g., blue crab and white shrimp [*Penaeus* spp.]) and fishes (e.g., clupeids) (Murdy, 1997).

Population Dynamics: Red drum, *Sciaenops ocellatus*, are one of the most recreationally sought-after fish throughout the South Atlantic. Since the 1980s recreational fishing has accounted for about 90 percent of all red drum landings. Over the past decade, anglers have generally harvested between 250,000 and 500,000 fish per year. Red drum are landed commercially in only a few states. Small trip limits (generally the same as each state's recreational creel limit) have kept the commercial harvest between 50,000 and 300,000 pounds in most years of the last two decades.

Through successful joint management by the Atlantic States Marine Fisheries Commission and the South Atlantic Fishery Management Council, red drum populations have shown significant increases. Spawning potential ratio (SPR), a measure of the fecundity of the population, is used to assess the stock. The last red drum assessment in 2000 demonstrated increases in SPR along the coast from 0.5-1.3 percent in 1987-1991 to 15-18 percent in 1992-1998. The next assessment for red drum will be in 2009, and will look to see if SPR has reached the current target of 40 percent.

The Commission approved Amendment 2 to the Red Drum Fishery Management Plan in 2002. The Amendment required states to implement recreational creel and size limits to achieve the stock status goal of 40 percent SPR, including a maximum size limit of 27", and maintain existing commercial regulations. The management of red drum presents two particular challenges. First, the fishery removes mostly juvenile fish in state waters, which has significantly reduced recruitment to the spawning stock. Second, data on the adult population are limited, which makes assessing stock status difficult (ASMFC, 2008).

<u>Weakfish</u>

<u>Population Abundance and Distribution:</u> Weakfish *(Cynoscion regalis)* are a migratory species occurring along the Atlantic coast of North America from Nova Scotia to southeastern Florida, although they are more common between New York and North Carolina. Important wintering grounds for the stock are located in offshore waters from Chesapeake Bay to Cape Lookout (ASMFC, 2008).

<u>Habitat Requirements:</u> Feeding on microscopic animals, larval weakfish journey from inshore spawning areas to coastal nursery areas, located in deeper portions of coastal rivers, bays, sounds, and estuaries. Growing into juveniles, they stay in the nursery areas until October to December of their first year, after which they migrate to the coast. As adults, inshore weakfish are often found near the periphery of eelgrass beds, perhaps because weakfish feed primarily on shrimp, other crustaceans, and small fish that are found near these grass beds.

<u>Life History:</u> When water temperatures rise in the spring, the mature fish migrate north and inshore to the spawning grounds. In these nearshore and estuarine areas between March and September, mature females produce large quantities of eggs that are fertilized by mature males as they are released into the water. Females continuously produce eggs during the spawning season and release them over a period of time rather than once. In the fall, an offshore and southerly migration of adults, coinciding with declining water temperatures, brings the mature weakfish back to the wintering grounds.

Growth in weakfish is especially rapid in the first year and they mature at a young age. 90 per cent are mature at age one, 100 per cent by age two. Size at age one is variable but most fish are ten to eleven inches long.

<u>Population Dynamics:</u> In 2006, total weakfish harvest reached an all time low of less than 2 million pounds. For comparison, total weakfish harvest was greater than 31 million pounds in 1986. The apparent decline in abundance was supported by the

results of the 2006 weakfish stock assessment. However, the assessment found that, concurrent with the decline in abundance, fishing mortality had not increased. Instead, total mortality—fishing mortality plus natural mortality—had increased. The leading theory suggests that increased predation on weakfish and reduced forage fish for weakfish have caused natural mortality to increase, although other hypotheses may not have been fully examined.

Weakfish are currently managed under Amendment 4, and its addenda, to the Interstate Fishery Management Plan. States in the management unit have implemented regulations to achieve the biological reference points established in Amendment 4. State commercial regulations include a minimum size limit, corresponding mesh size limits, seasonal closures, bycatch reduction devices, and a bycatch limit. Recreational regulations include creel and size limits. Responding to the recent decline in abundance, the Commission also approved an addendum in 2007 to implement more conservative recreational creel limits, a reduced bycatch allowance, and two management triggers to initiate management action when the stock begins to recover.

Spotfin Killifish

Population Abundance and Distribution: The spotfin killifish, *Fundulus luciae*, has been reported infrequently in brackish coastal habitats from Long Island, New York (Butner, 1960) to Georgia (Jorgenson, 1969). Spotfin killifish was considered rare (Hildebrand, 1928)(Nichols, 1927)(Richards, 1967) prior to focused studies which documented local abundance and distribution patterns of this species in New Jersey, Georgia, and Virginia (Able, 1983)(Kneib, 1984)(Yozzo, 1994). Recent reports indicate that the northern limit for spotfin killifish is southern Massachusetts, where they have been collected in tidal tributaries of Narragansett Bay (Hartel, 2002).

Habitat Requirements: Recent collections in salt marshes of the lower Housatonic River, at Milford, CT, indicate that spotfin killifish may be common in habitats dominated by both common reed, Phragmites australis (Cav.) Trin. ex Steud., and saltmarsh cordgrass, Spartina alterniflora Loisel (Osgood, 2003). High intertidal areas in brackish, sometimes oxygen- deficient shallow ditches, mudholes, and tidal rivulets in stands of smooth cordgrass (Byrne, 1978). Recorded from freshwater ponds in Virginia and Maryland (Lee, 1980).

Life History: Members of the killifish genus *Fundulus* are renowned for their survival skills in habitats most fishes find inhospitable. The spotfin killifish, *Fundulus luciae*, is found in salt marshes on the Atlantic coast from Georgia to Massachusetts. Spotfins thrive in an environment extreme even for a *Fundulus*; their preferred niche is in salt marshes among the *Spartina* grasses along the high tide line in waters that might average 2 or 3 cm deep. This environment is subject to large swings of temperature, oxygen, and water cover. At low tide spotfins can often be found in shallow muddy troughs, or even wrapped around the bases of clumps of *Spartina.* The only other fish commonly encountered in this strip between dry land and stable water is another killifish, *F. heteroclitus* commonly known as the mummichog.

Spotfins are small fish never larger than 5 cm. They're named after a dorsal ocellus carried by males. Wild spotfins are so well adapted to their muddy environment that they don't glisten out of water like most fishes, but rather have a flat gunmetal gray base color. No other fish must complete its life cycle on the salt marsh as does the spotfin; mummichogs are often found in marsh creeks or in bays, but spotfins of any age are rarely found outside their narrow strip of upper marsh. An apparent advantage of this specific niche is safety from predatory fishes unable to navigate the watery muds of the upper marsh; but the spotfin must still contend with wading birds. Adults feed on medium-sized zooplankton and emergent insects, while juveniles search out smaller zooplankters such as rotifers and nematode worms. (Stallsmith, 2008)

Spotfins spawn from spring to early fall, mostly in spring and are sexually mature 2-3 months after hatching. Life span is probably about 1 year (Byrne, 1978)(Kneib, 1978)(NatureServe, 2008m). Spawning habitat includes Herbaceous wetland, Tidal flat/shore. Eats mainly detritus, diatoms, ostracods, dipterans, copepods, and other small organisms (Byrne, 1978).

Population Dynamics: NatureServe describes the Rounded Global Status as G4 - Apparently Secure. The species has an apparently spotty distribution from Massachusetts or Long Island to North Carolina or Georgia; common in many areas; not very threatened. National Status for the US is ranked N3N4. Global Short Term Trend: Stable (unchanged or within +/- 10% fluctuation in population, range, area occupied, and/or number or condition of occurrences). Maryland Status is S2, Imperiled. Distribution in Maryland includes Somerset (24039), St. Marys (24037), and Worcester (24047) counties Threats include alteration of saline, coastal marshes (i.e., lagoon development); currently unthreatened in New Jersey as development in saline marshes has been controlled over the past 20 years. Dependent on high salt wetlands that are inundated during spring tides; these areas are protected in New Jersey and many other areas. Not very threatened in New Jersey. (NatureServe, 2008m).

Relatively little is known about the life history and habitat preferences of spotfin killifish. Unlike mummichogs, adult and juvenile spotfin killifish tend to remain on the intertidal marsh during all stages of the lunar tidal cycle, seeking refuge in shallow micro-depressions, which retain standing water at low tide (Able, 1983). Although not widely distributed among marsh habitats, spotfin killifish are environmentally tolerant and adaptable, and are found in waters of varying temperature, salinity, and dissolved oxygen content (Byrne, 1978)(Talbot, 1984). Byrne studied habitat preferences, food habits, and reproduction in a Virginia population of spotfin killifish; this is the most intensive study of the species to date. He found the species' preferred habitat to be S. alterniflora marsh with shallow, water-filled depressions and small, seasonal pools in saltmeadow hay, Spartina patens (Ait.) Muhl., marsh. Byrne observed adults throughout the year, with greatest abundance in spring and summer months. In a North Carolina study, spotfin killifish was collected using pit traps and found to be common in irregularly flooded black needlerush, juncus roemerianus Scheele, marsh (Shields, 1983).

Likelihood of Project Impacts: Although primarily associated with intertidal marsh and brackish coastal habitats, references also note its environmental tolerance and adaptability to waters of varying temperature, salinity, and dissolved oxygen content (Byrne, 1978)(Talbot, 1984). At least one reference notes that it has been recorded from freshwater ponds in Virginia and Maryland (Lee, 1980). However, the Aquatic Field Studies Report found no specimens of any *Fundulus* in fish surveys conducted in ponds and streams within the project area (EA, 2007b). Based on these criteria, the ponds and freshwater marsh wetlands identified in the wetlands delineation report (TTNUS, 2007a) could be interpreted as potential habitat with a low probability of occurrence.

With respect to the preferred salt or brackish habitats, none of the survey reports describe any habitat in the project area that would be suitable for Spotfin killifish. The wetlands delineation report describes all of the wetlands within the project area as freshwater and nontidal (TTNUS, 2007a). The rare plant survey states that there is no fresh-to-brackish tidal shore habitat within the proposed project area (TTNUS, 2007b).

Alewife

Population Abundance and Distribution: *Alosa pseudoharengus* is an anadromous species, native to the Atlantic Ocean and the lakes and streams that drain to it from Newfoundland to North Carolina (Scott, 1998). This includes the Gulf of St. Lawrence, the outer coast of Nova Scotia, the Bay of Fundy, and the Gulf of Maine (Scott, 1988). It is also present, although non-native, in all of the Great Lakes (USA), and many lakes in northern New York.

Habitat Requirements: For anadromous populations, much is known about their freshwater spawning habits, but little is known about movements within the ocean. Alewives spend most of their time in coastal waters and most are caught in water 56-100 m deep at about 4°C. Light sensitive, they tend to be in deeper waters during daylight hours. They also follow diel movements of zooplankton in the water column. Adults can withstand temperatures up to 25°C and young of the year can live in waters up to 30°C. (Scott, 1988)

Life History: All alewives spawn in the spring. The young swim to sea in anadromous populations or to deeper water in lake populations in the fall (Grosvenor, 1965). For anadromous populations, the temperature of the river water determines the timing of spawning migrations upstream, so spawning happens first in lower latitudes. Spawning generally starts in April in the south and lasts until the end of May in upper latitudes (Scott, 1998).

In all populations, females reach the spawning grounds first and older fish are the first to spawn. The oldest fish recorded at spawning sites were 9-10 years old. Spawning occurs in groups of 3 or in pairs. (Grosvenor, 1965)(Scott, 1998)

Females broadcast their eggs simultaneously with males broadcasting sperm (USDA, 2004). Although the eggs are adhesive at first and may stick to plants or rocks, they loose their adhesive qualities after a few hours and settle to the substrate. Alewives deposit their eggs over any type of substrate (USDA, 2004). The number of eggs per female may be 10,000 to 12,000 (Scott, 1998) or 48,000-360,000. (Scott, 1988)

In anadromous populations, adult alewives spend most of their lives at sea but spawn in streams above the influence of the tide. Although they cannot jump obstacles such as dams, they surmount rapids and fish runs migrating farther upstream than the closely related American shad (Scott, 1998). Anadromous fish reach maturity at 3 years for males and 4 years for females (Scott, 1998).

Reproduction Comments: Spawns in spring or summer, depending on the locality (later in north than in south). Eggs hatch in a week or less. Males sexually mature in about 2-3 years, females in 3-4 years; all have spawned at least once by age 5 years; age of first spawning, % of repeat spawners, and longevity seem to decrease from north to south. May breed only once in some areas. Spawners move rapidly downstream after spawning. (Fay, 1983)

Ecology Comments: Important link in estuarine and marine food webs, between zooplankton and top piscivores; also may be highly utilized by gulls and terns (Fay, 1983). Lake populations often experience massive summer die-offs.

Economic Comments: In last 2 decades has gained in recognition and interest as source of fish meal, fish oil, and fish protein, especially for the animal food industries (Fay, 1983). However, has declined in commercial importance in South Atlantic region in recent decades (NatureServe 2008n).

Population Dynamics: Young alewives have a very high mortality rate. Less than 1% survive to migrate into the sea (USDA, 2004). Annual mortality for adult alewives is on the order of 70% per year. Most die during or shortly after the spawning season (USDA, 2004). Few land-locked alewives live longer than 5 years (Smith, 1970).

Alewives represent an important commercial fishery in the Atlantic Ocean. They are packaged fresh, smoked, salted, or pickled for human consumption and are often sold as "river herring." Alewives have other uses, including pet food, lobster and snow crab bait, and processing into fishmeal and fish oil (Scott, 1988).

The North American Fisheries Organization statistical bulletin includes Blueback herring and alewives in the "other fish" category so no catch data are available (Scott, 1988). The generic term of "river herring" includes both species; which are very similar in size, conformation and anadromous spawning runs. Information about population dynamics based on historic harvest patterns applies generically to either species.

In sheer numbers, river herring greatly outnumbered shad. In the 1830s, as many as 750 million herring were taken during an eight-week spawning season on the Potomac River, compared with 22.5 million for shad. While shad are rebounding — helped in large part by major hatchery-based stocking efforts in all of the Bay states — river herring abundances remain low. "As much as we've been encouraged by statistically significant increased abundances for American shad and hickory shad in the James, the bottom has just dropped out for the blueback herring and the alewife," said Greg

Garman, head of Virginia Commonwealth University's Center for Environmental Studies.

In fact, a 1991 Bay Program report stated, "Of all the anadromous fish species harvested in the Chesapeake Bay, the river herrings experienced the most drastic decline in commercial landings."

As recently as 1931, more than 25 million pounds of river herring were harvested in the Bay, making them second in quantity and fifth in value of all Chesapeake finfish.

By the 1990s, the commercial catch was almost nonexistent. In 1996, only 1.4 million pounds were caught along the entire East Coast.

Much of the population collapse was blamed on foreign fishing fleets. During the 1960s and early 1970s — before the United States restricted fishing within 200 miles of its coast — the fleets were often seen harvesting fish within sight of the beach.

In 1969 alone, the foreign fishery is estimated to have taken 74 million pounds of river herring — on top of the U.S. harvest. The heavy fishing pressure took many fish before they had a chance to spawn, sending the population into a downward spiral from which it has yet to recover.

Any comeback is hindered by plenty of other problems: the loss of essential spawning and nursery habitat because of water pollution and the construction of dams and other fish blockages. While little fishing effort is targeted at river herring today, concerns remain that large numbers may be taken as bycatch in other commercial fisheries.

Blueback Herring

Population Abundance and Distribution: The Blueback herring (*Alosa aestivalis*) is silvery in color, has a series of scutes (modified scales that are spiny and keeled) along their belly, and are characterized by deep bluish green backs. The most distinguishing characteristic of this species is the black to dusky in color of its peritoneum (the lining of the abdominal cavity). Blueback herring and alewives are difficult to distinguish from one another and are often regarded collectively as river herring. Alewives have larger eyes, greater body depth, and pearly to white peritoneal linings (Whitehead, 1985) (Burkhead, 1994)(Owens, 1998). The Blueback is distributed along the Atlantic Coast from Cape Breton, Nova Scotia, to the St. Johns River, Florida. It ascends coastal rivers during spawning season.

Blueback herring spawn from Nova Scotia to northern Florida, but are most numerous in warmer waters from Chesapeake Bay south. In the mid-Atlantic region, both alewife and blueback herring are found in Chesapeake Bay and in virtually all its' tributaries.

Habitat Requirements: Bluebacks are anadromous; living in marine systems and spawning in deep, swift freshwater with a hard substrate. They migrate to spawning grounds in the spring. In Connecticut, blueback herring spawn in 14-7°C temperatures.

Juveniles spend 3-7 months in freshwater, then migrate to the ocean (Yako, 2002). Blueback herring are a planktivorous forage species (Winkelman, 2002).

Life History: Alewife spawn earlier (February through April) than blueback (late March through mid-May, with both migrating upstream in the spring like shad. Females from both species usually reach 100% maturity by age 5 and produce from 60,000 - 103,000 eggs Males of both species generally mature at an earlier age (ages 3-4) and smaller size than females. Herring spawn in quieter, upper portions on streams and creeks, randomly releasing sticky eggs that sink and adhere to the bottom. The tiny eggs hatch in 2 to 3 days; young head for salt water when they are several months old.

Immediately after spawning, adults migrate rapidly downstream. Juveniles will remain in freshwater nursery areas in spring and summer, feeding mainly on zooplankton. As water temperatures decline in the fall, most juveniles move downstream to more saline waters, eventually to the sea; however, some will remain in deeper waters of the Bay and its tributaries for their first winter.

Herring are pelagic, schooling and feeding in midwinter or at the surface, preying on zooplankton, as well as shrimp, other small crustaceans, small fish, and fish eggs. Little information is available on the life history of subadult and adult river herring after they emigrate to the sea as juveniles, and before they mature and return to freshwater to spawn.

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Green Sea Turtle

Population Abundance and Distribution: Green sea turtles (*Chelonia mydas*) are the largest of all the hard-shelled sea turtles, but have a comparatively small head. Adult green turtles are unique among sea turtles in that they are herbivorous, feeding primarily on sea grasses and algae. This diet is thought to give them greenish colored fat, from which they take their name. A green turtle's carapace (top shell) is smooth and can be shades of black, gray, green, brown, and yellow. Their plastron (bottom shell) is yellowish white. Scientists estimate green turtles reach sexual maturity between 20 and 50 years, at which time females begin returning to their natal beaches (i.e., the same beaches where they were born) every 2-4 years to lay eggs.

Habitat Requirements: Green sea turtles live in warm tropical waters from New England to South Africa and in the Pacific from Western Africa to the Americas. In Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico. The species primarily use three types of habitat: oceanic beaches (for nesting); convergence zones in the open ocean; and benthic feeding grounds in coastal areas. Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of miles each way. After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years, feeding close to the surface on a variety of pelagic plants and animals. Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds. Once they move to these nearshore benthic habitats, adult green turtles are almost exclusively herbivores, feeding on sea grasses and algae. The nesting season varies depending on location. In the southeastern United States, females generally nest between June and September, while peak nesting occurs in June and July. During the nesting season, females nest at approximately two week intervals, laying an average of five clutches.

Population Dynamics: The principal cause of the historical, worldwide decline of the green turtle is long-term harvest of eggs and adults on nesting beaches and juveniles and adults on feeding grounds. These harvests continue in some areas of the world and compromise efforts to recover this species. Incidental capture in fishing gear, primarily in gillnets, but also in trawls, traps and pots, longlines, and dredges is a serious ongoing source of mortality that also adversely affects the species' recovery. Green turtles are also threatened, in some areas of the world, by a disease known as fibropapillomatosis. The green sea turtle was listed under the ESA on July 28, 1978. The breeding populations in Florida and the Pacific coast of Mexico are listed as endangered, while elsewhere the species is listed as threatened (NMFS, 2008b).

The green sea turtle was not observed in the Chesapeake Bay waters adjacent to CCNPP during numerous field studies conducted in 2006, 2007, and 2008 in support of the environmental permitting requirements for this project. In addition, no anecdotal reports of observations of the species by CCNPP site personnel have been made to date. A determination of "no effect" has been made for the green sea turtle, as related to the construction of the proposed facility and its affect on the species and its habitat.

Leatherback Sea Turtle

Population Abundance and Distribution: The leatherback sea turtle (*Dermochelys coriacea*) is the largest turtle and the largest living reptile in the world. The leatherback is the only sea turtle that lacks a hard, bony shell. A leatherback's carapace consists of leathery, oil saturated connective tissue overlaying loosely interlocking dermal bones. Adult leatherbacks are primarily black with a pinkish white mottled ventral surface and pale white and pink spotting on the top of the head. The ridged carapace and large flippers are characteristics that make the leatherback uniquely equipped for long distance foraging migrations.

Female leatherbacks lay clutches of approximately 100 eggs on sandy, tropical beaches. Females nest several times during a nesting season, typically at 8-12 day intervals. After 60-65 days, leatherback hatchlings emerge from the nest. Leatherbacks lack the crushing chewing plates characteristic of sea turtles that feed on hard-bodied prey. Instead, they have pointed tooth-like cusps and sharp edged jaws that are perfectly adapted for a diet of soft-bodied pelagic (open ocean) prey, such as jellyfish and salps.

Habitat Requirements: Leatherbacks are commonly known as pelagic animals but also forage in coastal waters. The species is the most migratory and wide ranging of the sea turtle species. Leatherbacks mate in the waters adjacent to nesting beaches and along migratory corridors. After nesting, female leatherbacks migrate from tropical waters to more temperate latitudes, which support high densities of jellyfish prey in the summer. Leatherback turtle nesting grounds are located around the world, with the largest remaining nesting assemblages found on the coasts of northern South America and west Africa. The Caribbean (primarily Puerto Rico and the Virgin Islands) and southeast Florida support minor nesting colonies but represent the most significant nesting activity within the United States. Adult leatherbacks are capable of tolerating a wide range of water temperatures and have been sighted along the entire continental coast of the United States as far north as the Gulf of Maine and south to Puerto Rico, the Virgin Islands, and into the Gulf of Mexico.

Population Dynamics: Leatherback turtles face threats on both nesting beaches and in the marine environment. The greatest causes of decline and the continuing primary threats to leatherbacks worldwide are long-term harvest and incidental capture in fishing gear. Harvest of eggs and adults occurs on nesting beaches while juveniles and adults are harvested on feeding grounds. Incidental capture primarily occurs in gillnets, but also in trawls, traps and pots, longlines, and dredges. Together these threats are serious ongoing sources of mortality that adversely affect the species' recovery. The leatherback sea turtle was listed under the ESA as endangered in 1970 (NMFS, 2008c).

The leatherback sea turtle was not observed in the Chesapeake Bay waters adjacent to CCNPP during numerous field studies conducted in 2006, 2007, and 2008 in support of the environmental permitting requirements for this project. In addition, no anecdotal reports of observations of the species by CCNPP site personnel have been made to date. A determination of “no effect” has been made for the leatherback sea turtle, as related to the construction of the proposed facility and its affect on the species and its habitat.

Soft-shelled Clam

The soft shell clam (*Mya arenaria*) is a bivalve mollusk with a thin, oval, elongated shell. The shell is chalky white with a thin, parchment-like covering that varies in color from brownish to yellowish to gray.

Population Abundance and Distribution: Soft-shell clams are found off the Atlantic coast from Canada to the southern states. They generally range from Eastern Bay to Pocomoke Sound on the Eastern Shore of Chesapeake Bay and from Maryland 's Severn River to Virginia's Rappahannock River on the western shore.

Habitat Requirements: Soft-shells can be found buried in soft sediments from the intertidal zone to depths of about 30 feet in the Bay and some tributaries. The soft shell clam can be found in shallow, sandy, parts of mesohaline portions of the Bay. Found in areas of low salinity and an influx of fresh water, buried 20 cm or so in mixtures of mud with sand or gravel.

The soft shelled clam has a relatively thin shell when compared to other clams. For this reason, it also has a very long siphon that stretches far to allow the clam to hide deep in the mud. However, unlike most clams, the soft shelled clam cannot retract its siphon completely inside its shell.

Habitat Requirements: Water quality requirements include:

Minimum Dissolved Oxygen Level: 1 ppm

Optimum Temperature Range:
Eggs: 10°C - 20°C
Adults: 2°C - 34°C

Minimum Salinity Range: 8 ppt

(Funderburke, 1991)

Life History: Soft-shell clams usually spawn twice per year: once in late spring and once in mid- to late autumn. Both eggs and sperm are released into the water column. The number of eggs a female releases depends on the clam's size. Eggs develop into larvae within one day of being fertilized. Larvae swim freely for about one to three weeks, during which they develop their foot and shells.

When the larvae are ready to metamorphose into juveniles they swim near and crawl on the bottom for several hours before settling. Newly settled clams, called spat, usually attach themselves to any available surface with thin threads secreted from a gland on the foot. Small juvenile soft-shell clams can be very active, crawling about with their foot. Eventually the clam burrows permanently, and, unless disturbed, spends the rest of its life in one place.

Soft shell clams are filter feeders. They draw water in through their incurrent siphon and filter out microscopic algae. Unused particles are ejected through the exhalent siphon. They are a crucial part in Bay life by filtering microscopic algae out of the water and are a major food source to many animals. Such animals that prey off them include blue crabs, eels, cownose rays, mud crabs, flatworms, mummichogs, spot, ducks, geese, swans, muskrats, and raccoons.

Population Dynamics: Since the first year of major harvesting and exploitation of Maryland soft shell clam stocks, in 1953, population levels of harvestable soft shell clams have declined. From 1964 to 1971, harvests remained steady at 3,700,000 kg. Due to tropical storm Agnes, poor harvests were reported in Maryland during the early 1970's. In 1988, harvests in Maryland rebounded to 1,400,000 kg in 1988 from 300,000 kg in 1973 (Funderburke, 1991).

Slender Sea Purslane

The Rare Plant Survey does not mention sandy beach habitat as a study area. It does report that slender sea purslane (Sesuvium maritimum) is included on the "List of Rare, Threatened, or Endangered Plant Species for Calvert County, Maryland - Maryland Natural Heritage Program, May 2004". The Rare Plant Survey describes "Typical Habitat (Fernald, 1970)" as "damp coastal sand" and describes areas of most probable occurrence on the project area as "none". The report includes a map depicting the approximate locations: of search areas walked to inspect for rare plants which clearly indicates that the beach area was not included in the search effort.

The Submerged Aquatic Vegetation (SAV) study looked for vegetation up to the shoreline, but does not clearly demonstrate that purslane would have been found if present in its on-beach habitat. The report states that "no SAV was observed at any of the stations during these surveys. In addition, no signs of SAV were observed along the shoreline or floating throughout the study area."

Since none of the studies specifically searched the beach area for sea purslane, one cannot conclude that the plant is not found on site.

The following information is from Flora of North America (eFloras, 2008).

Sesuvium maritimum (Walter) Britton, Stearns & Poggenburg, Prelim. Cat. 20. 1888.

Annual sea-purslane, slender sea-purslane

Pharnaceum maritimum Walter, Fl. Carol., 117. 1788; *Sesuvium pentandrum* Elliott

Plants annual, papillate, glabrous. Stems prostrate to ascending, usually copiously branched, 1-4 dm; not rooting at nodes. Leaves: petiole clasping; blade spatulate to ovate, 1-2.5 cm, base tapering. Inflorescences: flowers usually solitary; pedicel usually absent or to 1 mm. Flowers: calyx lobes pink or purple adaxially, with subapical abaxial appendages, ovate, 3 mm; stamens 5; pistil 2-3-carpellate; ovary 2-3-loculed; styles 2-3. Capsules ovoid, 4-5 mm. Seeds 30-50, blackish brown, 1 mm, iridescent, smooth.

Flowering summer-fall (year-round in se Tex.). Sandy shores, beaches, dune swales, brackish marshes, banks along or near coasts, waste grounds, ballast; 0-100 m; Ala., Del., Fla., Ga., Kans., La., Md., Miss., N.J., N.Y., N.C., Okla., Pa., S.C., Tex., Va.; West Indies.

Sesuvium maritimum is often overlooked in coastal environments, perhaps due to the small size of some individuals, particularly in the northern portions of its distribution. Nonetheless, this species appears to be infrequent (and possibly in decline) in coastal environments of northern states (e.g., Delaware, Maryland, New Jersey, and New York), where development of the coast has impacted sensitive environments. This species is also present in Kansas and Oklahoma but its distribution in those states is currently not well known.

The name *Sesuvium sessile* Persoon has been misapplied to this species.

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ER Impact:

No changes to the ER are required.

Item Number 17 **ER Section 2.4.2.2.6**

Request:

Provide information about pests and diseases; thermophilic bacteria. In addition, provide information about diseases (e.g., mycobacteriosis, Cryptosporidium), invasive species (freshwater and estuarine), and other pests (e.g., jellyfish and comb jellies, Pfiesteria).

Response:

Potential pests, diseases, and invasive species are described below.

Pests and Diseases

Thermophilic Bacteria

The Maryland Department of Environment, Science Services Administration monitors the Patuxent River and Chesapeake Bay for Human Health Indicator Species including total coliform, fecal coliform, and enterococcus bacteria. These bacteria in excessive amounts can harm swimmers and can accumulate in shellfish making them unfit for human consumption. These bacteria are positively affected by warm water. Limits for these indicator species in the lower Patuxent River are identified in a Total Maximum Daily Load (TMDL) Plan.

The Maryland Department of Environment, Science Services Administration has been tracking levels of *Vibrio* bacteria in the Chesapeake Bay. *Vibrio* bacteria naturally occur in warm water and thrive in highly organic water. The species that is of most concern is *Vibrio vulnificus* which is a human health pathogen for water contact and accumulation in oysters, clams, crabs, and finfish. Currently there is no monitoring program for these bacteria.

The Maryland Department of Environment, Science Services Administration, does not monitor and has no records for thermophilic bacteria. To date there have been no recognized concerns about thermophilic bacteria.

Mycobacteriosis: Mycobacteriosis is a generic term that describes diseases caused by a group of bacteria (simple single-celled organisms) known as mycobacteria. Mycobacteria are widespread in the natural world, particularly in aquatic environments. A small fraction of mycobacterial species cause disease in animals and humans.

A newly described species of mycobacteria, *Mycobacterium shottsii*, is the type most commonly associated with the current outbreak of mycobacteriosis among striped bass in Chesapeake Bay. *M. shottsii* was first identified by VIMS scientists in 2001, and is present in 76% of infected bass. Some infected striped bass from the Bay are also known to harbor multiple mycobacterial species. Other mycobacteria recovered from Bay bass include *M. peregrinum, M. marinum*, and isolates resembling *M. scrofulaceum, M. szulgai, M. interjectum, and M. simiae.*

The human health significance of *M. shottsii* is not yet known. Concern is warranted because *M. shottsii* is closely related to *M. marinum*, a species responsible for mycobacterial infections of skin and soft tissue in humans. *M. marinum* is also considered the primary cause of mycobacteriosis in fish in aquarium, aquaculture, and natural settings. Other more distantly related species of mycobacteria include *M. tuberculosis* (the cause of pulmonary tuberculosis) and *M. leprae* (the cause of leprosy).

Although *M. shottsii* is in the same genus as *M. tuberculosis*, mycobacteriosis in humans is not the same disease as tuberculosis. Contagious mycobacteria that cause serious disease in humans include *M. tuberculosis* (the cause of pulmonary tuberculosis) and *M. leprae* (the cause of leprosy). "Environmental" mycobacteria such as *M. shottsii, M. marinum*, and other species are collectively termed "non-tubercular" mycobacteria to distinguish them from the species that cause tuberculosis.

Cryptosporidium: Oocysts of *Cryptosporidium parvum* from human feces can enter surface waters through wastewater, leaky septic tanks, or recreational activities. Oocysts from other mammals, including wildlife, pets, and livestock (especially neonatal ruminants) can enter surface waters either directly or through runoff. Oysters can remove *C. parvum* oocysts from artificially contaminated water and retain them in hemocytes, on gills, and within the body for at least 1 month (Fayer, 1997). Oocysts retained for 1 week by oysters were still infectious, as determined by testing in mice (Fayer, 1997). Oocysts of *C. parvum* were found in oysters collected from tributaries of the Chesapeake Bay, at six sites selected for proximity to wastewater outfalls and cattle farms where high levels of fecal contamination might be expected (Fayer, 1998). We examined oysters at sites where oysters are harvested for human consumption to determine if *C. parvum* oocysts were present. Oocysts recovered from these oysters were examined to determine the possible sources of contamination through oocyst genotyping and to determine if the oocysts were infectious.

C. parvum oocysts were found in oysters collected from all seven commercial oyster harvesting sites sampled in the Chesapeake Bay. These findings confirm those of previous studies, in which oysters and clams acquired *Cryptosporidium* oocysts from artificially contaminated aquarium water, and oysters and mussels acquired oocysts in nature. Collectively, these findings establish that bivalve molluscs can effectively remove and retain oocysts of *Cryptosporidium* from feces-contaminated estuarine waters.

At all sites sampled, examination of gill washings and hemolymph by both IFA microscopy and PCR revealed the presence of *C. parvum* oocysts. This finding indicates that water at these sites contained human or animal feces when oysters were filtering and that oocysts excreted in those feces were acquired by the oysters. Because oocysts of this species are infectious for humans but can be rendered noninfectious by heating to temperatures above 72°C, we recommend that oysters be cooked before being eaten, especially by persons with any type of immunodeficiency. Oocysts can also be rendered noninfectious by freezing at -20°C for 24 hours, but because viral or bacterial pathogens might also be acquired by oysters from water contaminated with feces and can survive freezing, we recommend cooking rather than freezing (Fayer, 2000).

Invasive Species (freshwater and estuarine)

In May, 2002, the Chesapeake Bay Program partners (Bay states), USFWS, USGS and NPS compiled a prioritized list of invasive species impacting or potentially impacting the Chesapeake Bay. Table 1 presents the results of their species selection and prioritization (MSGC, 2002). The actions to be taken that are listed for each grouping in the table are directed toward the Chesapeake Bay Program, Invasive Species Working Group.

Table 1. Invasive Species in the Chesapeake Bay

Group 1. Species for Which Management Plans Will Be Written
Mute Swan *(Cygnus olor)* Nutria *(Myocastor coypus)* Phragmites *(Phragmites australis)* Purple Loosestrife *(Lythrum salicaria)* Water Chestnut *(Trapa natans)* Zebra Mussel *(Dreissena polymorpha)*
Group 2. Species for Which Risk Assessments Will Be Conducted
Asiatic Clam, Corbicula *(low) (Corbicula fluminea)* *Suminoe Oyster: (Crassostrea ariakensis)* *Blue Catfish (high) (Ictalurus furcatus)* *Green Crab (high) (Carcinus maenas)* *Hydrilla (high) (Hydrilla verticillata)* *Japanese Shore Crab (high) (Hemigrapsus sanguineus)* *Rapa Whelk (high) (Rapana venosa)*
Group ***3. Species for Which Gap Analysis Will Be Conducted***
Asian Long-Horn Beetle (Anoplohora glabripennis) *Gypsy Moth (Lymantria dispar)* *Japanese Honeysuckle (Lonicera japonica)* *Japanese Knotweed (Polygonum cuspidatum)* *Japanese Stiltgrass (Microstegium vimineum)* *Mile-a-Minute Weed (Polygonum perfoliatum)* *Morrow's Honeysuckle (Lonicera morrowii)* *Multiflora Rose (Rosa multiflora)* *Oriental Bittersweet (Celastrus orbiculatus)* *Tree-of-Heaven (Ailanthus altissima)* *Woolly Adelgid (Adelges tsugae)*
Group ***4: Species for Which Status and Management Will Be Assessed***
Asian Swamp Eel (Monopterus albus) *Brazilian Elodea (Egeria Densa)* *Cabomba (Cabomba caroliniana)* *Chinese Mitten Crab (Eriocheir sinensis)* *Eurasian River Ruffe (Gymnocephalus cernuus)* *Eurasian Watermilfoil (Myriophyllum spicatum L.)* *Flathead Catfish (Pylodictis olivaris)* *Giant Salvinia (Salvinia molesta)* *Grass Carp (Ctenopharyngodon idella)* *Quagga Mussel (Dreissena bugensis)* *Round Goby (Neogobius melanostromus)*

Species from the above list that have been identified by plant and faunal surveys of the project area include:

- Phragmites *(Phragmites australis)*
- Japanese stiltgrass (*Microstegium vimineum*)
- Bush honeysuckle (*Lonicera* sp.)
- Tree of Heaven *(Ailanthus altissima)*

Invasive Exotic Plant Species

As described in the Floral Survey Report, several plant species identified as invasive exotic plants by the State of Maryland (MDNR, 1997) were observed on the CCNPP Site. These include phragmites, Japanese stiltgrass (*Microstegium vimineum*), tall fescue, sericea lespedeza, bush honeysuckle (*Lonicera* sp.), tree of heaven, and paulownia. The most prevalent invasive exotic plant on the Project Site is phragmites, which infests most of the old field vegetation on the dredge spoils and the herbaceous marsh vegetation adjoining Johns Creek and other streams. Phragmites has reduced the diversity of plant cover in those plant communities and adversely affected their value as food and cover for wildlife.

Another invasive exotic plant, Japanese stiltgrass, forms scattered patches in the groundcover of some forested areas on the CCNPP Site. It mostly occurs in areas with a history of soil disturbance, such as along the sides of roadways and trails. Where it occurs, it has likely discouraged the development of other more ecologically valuable groundcover. The other invasive exotic plants are not widespread in any of the plant communities and do not appear to be jeopardizing the overall diversity and value of plant cover on the CCNPP Site.

The forested plant communities on the CCNPP Site consist mostly of regionally indigenous trees, shrubs, and herbaceous plants. As noted above, the invasive exotic plant Japanese stiltgrass occurs in areas with a history of soil disturbance, such as along the sides of roadways and trails. Japanese stiltgrass is a grass originally native to Asia that can rapidly form dense groundcover in disturbed forested areas, including both forested uplands and forested wetlands. It generally can only establish following groundcover disturbance caused by soil erosion, flooding and scour, or trampling by walkers or machinery. This may explain its frequent occurrence near streams on the CCNPP Site where erosion and sedimentation have occurred and along current or abandoned trails or fire roads. But most forested areas on the CCNPP Site away from areas of ground disturbance display a regionally typical groundcover without Japanese stiltgrass.

Group One Invasive Species

Mute Swans: Mute swans have not been reported as current residents of the project site. However, the site possesses potentially suitable habitat and their future presence is a possibility. If observed onsite, facility management should contact MD DNR for management guidance consistent with Maryland's current management plan.

In Chesapeake Bay, Mute swans utilize a variety of aquatic habitats, including ponds and lagoons and fresh to salt water marshes. In the warmer months, mute swans spend most of their time in shallow water. As shallow water freezes, the birds move to deeper water, but will utilize deeper water throughout the year.

The mean annual rate of population growth for mute swans in Maryland was 36% from 1962 to 1979. From 1986 to 1999, the mute swan numbers in Maryland increased from 264 to 3,955, an increase of 1,389%. The growth rate for mute swans in the Chesapeake Bay since 1986 has been 1,271%. A nest survey in the Patuxent River in 2000 revealed five nests; a survey conducted in 2001 revealed 40 nests. Population modeling of the Maryland mute swan population indicates that it could include over 20,000 birds by 2010 if growth is unchecked (Harvey, 2000).

Mute swans are year-round residents in the Chesapeake Bay and are not true migrants in any part of their range in North America. While occurring throughout the Bay, they are most concentrated from Rock Hall in Kent County south to Hoopers Island in Dorchester County.

Submerged aquatic vegetation (SAV) is the preferred diet of mute swans throughout the world, though they will also eat grain crops. In one Chesapeake Bay study, widgeon grass *(Ruppia maritime)* constituted 66 and 78% of the food eaten at Eastern Bay and Smith Island, respectively, whereas eel grass *(Zostera marina)* formed 2% and 32%, respectively, for these areas. Other SAV and invertebrates amounted to only 1% (Perry, no date). Other SAV important to mute swan diet in the Chesapeake Bay include sago pondweed *(Potamogeton pectinatus),* clasping-leaved pondweed *(P. perfoliatus),* horned pondweed *(Zannichella palustris)* and *Myriophyllum spicatum.* Adult mute swans consume 1.8 to 3.6 kg of plant material each day (Fenwick, 1983) and can reach SAV in 1.07 m of water (Owen, 1975). They have been observed pulling plants up by the roots or rhizomes or paddling vigorously to dislodge whole plants to consume or to make available for cygnets (Owen, 1972)(Birkhead, 1986).

Of primary concern to Chesapeake Bay ecologists is the rate of mute swan population growth in the Chesapeake Bay, its presence year-round and its preference for feeding on SAV. Certain SAV species, such as wild celery (*Vallisneria americana*), are especially vulnerable because their reproduction and growth are timed to avoid the heavy grazing of migratory waterfowl. Wild celery requires its reproduction process to be protected from grazing while its seeds are maturing. If consumed before seeds are mature, it will not reproduce and will waste living energy in this process. A large, resident mute swan population feeding on SAV all year could jeopardize the ability of SAV to recover from winter waterfowl grazing and make it less available for waterfowl the following winter. Declines in SAV abundance appear to correlate with declines in local black duck (*Anas rubripes*) abundance (Krementz, 1991). Population trends suggest that habitat degradation in Chesapeake Bay, especially loss of SAV, may be the principal cause of the decline of the Bay's canvasback *(Aythya valisineria)* population (Haramis, 1991a). Furthermore, the loss of SAV over the past several decades has prompted the near abandonment of Chesapeake Bay waters by redheads *(Aythya americana),* leaving only a remnant population today.

Maryland is developing a statewide mute swan management plan, including research projects to examine the potential impacts of mute swans on declining populations of wintering tundra swans and on SAV. The state has obtained federal permits for intensive egg addling in 2002, and is developing strict regulations for their sale, importation, breeding and captive management. It is also considering public forums to educate citizens about mute swans and their impacts and to learn more about public perception. Maryland has permitted the removal of several hundred swans by game breeders for shipment to Asia. In addition, as part of its mute swan plan, the state has identified sensitive Bay areas to target for exclusion of mute swans, including SAV restoration sites, areas where rare SAV grows naturally and nesting sites for rare birds. Maryland is also considering annual surveys of mute swan population growth and is testing the use of male sterilization in preventing the growth of the population.

Nutria: Nutria have not been reported as current residents of the project site. However, the site possesses potentially suitable habitat and their future presence is a possibility. If observed onsite, facility management should contact MDNR for management guidance consistent with Maryland's current management plan.

Nutria prefer a semi-aquatic habitat in swamps and marshes and along the shores of rivers and lakes. They generally live in pairs; however, the presence of many animals in a favorable habitat may give the impression of colonial living. Nutria feed on almost any terrestrial or aquatic green plants and occasionally consume. Important food plants in the United States include cordgrasses (*Spartina* spp.), bulrushes (*Scirpus* spp.), spikerushes (*Eleocharis* spp.), chafflower (*Alternanthera* spp.), pickerelweeds (*Pontederia* spp.), cattails (*Typha* spp.), arrowheads (*Sagittaria* spp.) and flatsedges (*Cyperus* spp.). Nutria can eat up to 25% of their body weight in plants per day (Gingerich, 1994). Where abundant, they may cause severe damage to vegetation. They seem to prefer the soft, succulent parts near the bases of plants, especially when eating course plants such as cattail, cord grass and reeds

Nutria were introduced in Maryland in the 1950s to promote the fur industry. Earlier, in 1943, the federal government brought nutria to Dorchester County, Maryland. This location on Maryland's lower Eastern Shore was part of an experimental fur station at Blackwater National Wildlife Refuge (Blackwater NWR). In a relatively short period of time, captive rearing proved unprofitable and the remaining project nutria either escaped and/or were inadvertently released; in addition, a limited number of nutria were reportedly released by adjacent landowners. These animals functioned as the origin of the now overwhelming populations in the state. Currently, there is virtually no commercial fur market and only a very small meat market for nutria. This situation combined with the animal's reproductive success has led to a population boom: for example, estimates on a 10,000 acre parcel of land located in Dorchester County have expanded from less than 150 nutria in 1968 to 35,000 to 50,000 animals today.

Because of its high rate of productivity, aggressive nature and similar habitat needs, nutria compete with and displace native muskrats. Although foxes, owls and raccoons prey upon young nutria, humans are the only predators to take adults in this region. Nutria feeding habits can also be extremely destructive to marsh vegetation: the animal forages directly on the vegetative root mat causing what is called an "eat out." This type of feeding loosens the plant's hold on the soil; without this binding mechanism, the soil washes away. Animals start the process by grazing; wind, waves and tides then remove any remaining soil and plants. "Eat-outs" can turn productive wetlands into barren mud flats that often cannot be re-vegetated

Purple loosestrife: Purple loosestrife has not been reported as a current resident of the project site. However, the site possesses potentially suitable habitat and future establishment is a possibility. If observed onsite, facility management should contact MD DNR for management guidance consistent with Maryland's current management plan..

Purple loosestrife colonizes both brackish and freshwater habitats, spreading reproductively and vegetatively from lateral shoot meristems. It commonly occurs with Typha sp., reed canary grass, sedges and rushes. Although purple loosestrife primarily invades disturbed wetlands, it also becomes established among natural wetlands, wet meadows, swamps, riverbanks and edges of ponds and reservoirs (Rawinski, 1982).

L. salicaria has been reported from 15 Maryland counties; 19 individual sites have been confirmed by the Department of Agriculture. In counties where purple loosestrife has been detected but sites not identified, reports were received from reliable sources, though they have not been verified with GPS or mapping.

Phragmites *(P. australis)*: Phragmites, is a cosmopolitan plant, occurring throughout temperate North America. The common reed occurs in and near fresh to brackish wetlands, tolerates and even thrives in alkaline and acidic wetlands, with some populations tolerating salinities as high as 40 ppt (Marks, 1994). *P. australis* is a highly successful colonizer in that it propagates in several ways, by seed dispersion and rhizomes and stolon fragments. Marks suggests that established stands of *P. australis* propagate primarily through vegetative reproduction (Marks, 1994).

P. australis colonization is commonly associated with disturbed marsh areas, which usually means areas where plant communities, hydrology and topography have been altered through natural events (e.g., storms, lightning strike fires) or anthropogenic events (e.g., logging, mining, waste disposal, intentional flooding, dredge spoils disposal). The plant can tolerate standing water, low oxygen levels and acidic sediments, which allow it to thrive in disturbed habitats often unsuitable for other plants (Marks et al., 1994)(Bart, 2000). Numerous studies report on changes in disturbed marsh hydrology with the development of *P. australis* stands (Marks, 1994)(Chambers, 2002). Other researchers (Ailstock, 2001)(Bart, 2000)(Burdick, 2002) suggest that *P. australis* has been successful in establishing itself, in part, because of an ability to modify disturbed habitats into conditions highly conducive to its further propagation and establishment.

P. australis is now the dominant macrophyte in a wide variety of intertidal environments in the Chesapeake Bay (Stevenson, 2002) and in freshwater nontidal wetlands (Ailstock, 2001). U. S. Fish and Wildlife Service (USFWS) aerial surveys over tidal marshes in Maryland and Virginia from 1995 to 1997 detected 8,500 acres of *P. australis* in 4,138 sightings in Maryland's wetlands along the Chesapeake Bay. The largest patches of *P. australis* occur in dredge spoil areas. The greatest extent of *P. australis* in natural marshes was in the lower Eastern Shore from the Nanticoke River south to the Pocomoke River, the northern Eastern Bay and Chester River area, Baltimore Harbor, C&D Canal, and Aberdeen Proving Grounds (Forsell, 2000).

The technical report "*A summary of methods for controlling* Phragmites australis" (Norris, 2002) provides a review of current control methods for *P. australis*. Additional control methods are discussed on the DNR web site (MDNR, 2008).

<u>Water Chestnut (*Trapa natans*)</u>: Water chestnut, is an annual aquatic plant with a submerged flexuous stem that anchors into the mud and extends upward to the surface of the water. Native to Europe, Asia and Africa, water chestnut grows best in shallow, nutrient-rich lakes and rivers and is generally found in waters with a pH range of 6.7 to 8.2 and alkalinity of 12 to 128 mg/L of calcium carbonate (Methe, 1993). Naturalized populations can be found in Australia and various locations of the northeastern United States.

The first population of water chestnut in Maryland was documented in 1923 in a two-acre patch on the Potomac River outside of Washington D.C. Within a few years, the plant had spread over 40 river miles on the Potomac. The 10,000-acre coverage of water chestnut reaching past Quantico, Virginia, prompted removal efforts by the Army Corps of Engineers in 1939. Water chestnut was found in the Bird River, Baltimore County, in 1955 and subsequently in the Sassafras River, Kent County, in 1964.

In Chesapeake Bay, water chestnut is presently found on the Sassafras and Bird rivers of Maryland, and in a number of ponds including a non-tidal pond above Lloyds Creek and in Urieville Lake in Kent County, Maryland. Pennsylvania has reported populations in the Lower Susquehanna, areas around Philadelphia, and in isolated lakes. Most recently, a population was reported in the Upper Delaware River.

Maryland has a harvesting program that has been in effect since 1999. The program has focused on the water chestnut populations on the Bird and Sassafras rivers.

The Bird River water chestnut population spread from approximately 50 plants in summer 1997 to over three acres in 1998, and at least 20 acres in 1999. The Sassafras population is slightly larger, though determining its exact size has been difficult due to its remote location. A massive mechanical and volunteer harvesting effort was undertaken in both rivers in 1999 and resulted in the removal of approximately 400,000 pounds of plants from the two rivers.

Despite the discovery in 2001 of several new locations in which water chestnut grew, less than 500 pounds were harvested this year – about enough to fill the bed of a small pick-up truck. This was about half of the approximately 1,000 pounds last year, and a tiny fraction of the 200,000 pounds in 1999. With declining weights of plants harvested, and declines in plant density in the most affected areas, it seems that the eradication efforts to date have been successful

Other Pests (e.g., jellyfish and comb jellies, Pfiesteria)

Sea nettle (*Chrysaora auinquecirrha*): Sea nettle occurs from Cape Cod south along the U.S. East Coast, Caribbean and Gulf of Mexico, yet it abounds in Chesapeake Bay in numbers unequaled elsewhere. It occurs most abundantly in the tributaries of the middle Bay (salinities 10 - 20 ppt), where it is white in color. In the southern Bay, it often has red/maroon markings on the long central tentacles and on the swimming bell. It has an annoying sting, but is not dangerous to swimmers.

Bottom-dwelling polyps live through the winter in a dormant state. During May through August, the polyps bud off tiny sea nettles about 1/25 of an inch in diameter, which grow rapidly into the visible jellyfish (adult bell diameter approximately 4").

The Sea Nettle prefers waters having as little as 12 ppt salinity, and may have estuaries like Chesapeake Bay, to itself without serious competition from most other jellyfish. In fact, sea nettles eat their most abundant competitors in the Bay, the comb jellies. Populations of plants and animals often are controlled by other organisms that feed on them. However, adult sea nettles may have few natural predators in the middle reaches of Chesapeake Bay. Sea turtles, which are known to eat Portuguese men of war and some other jellyfish, rarely come far into the Bay. And fish species (harvestfish, butterfish) observed feeding on sea nettles prefer waters of higher salinity (Purcell, 2008).

Moon Jelly (*Aurelia aurita*): Moon jelly occurs in southern Chesapeake Bay during the summer. This species has a very mild sting and poses no threat to swimmers.

Lion's Mane (*Cyanea capillata*): Lion's mane has a potent sting, and while it is not dangerous to swimmers, it is very unpleasant to encounter. The Lion's Mane, or Winter Jellyfish, is found in Chesapeake Bay during the winter (January - April).

Comb Jellies: Comb jellies have transparent, jelly-like bodies with bright, iridescent bands of color. The bands are made up of tiny hairs called combs, which divide the body into eight symmetrical areas. Unlike jellyfish, comb jellies do not have stinging tentacles. Species occurring in Chesapeake Bay are: the sea walnut, *Mnemiopsis leidyi*, and the pink comb jelly, *Beroe ovata*.

Pfiesteria (*Pfiesteria piscicida*): Pfiesteria is one of the relative small percentage of algal species in the world found to produce toxins. Blooms of *Pfiesteria* may be unusual in that they can generate fish kills with relatively low densities of only100-300 cells/milliliter. Its life history contains a complex life cycle characterized by various flagellated, amoeboid and cyst stages and is capable of sexual and asexual reproduction. *Pfiesteria* is most commonly found in the water column during the warmer summer months in the mid-Atlantic region but has been detected in the sediments during the cooler months. Low to moderate salinity water (Oligohaline-Mesohaline) is the preferred by *Pfiesteria*. The development of species specific genetic probes has greatly assisted in detection of *Pfiesteria* among samples of the plankton community. Research continues to focus on the molecular structure of the toxins which would greatly aid in developing a toxin-detecting probe in the future. Worldwide distribution includes Maryland's Chesapeake and Coastal Bays sub-estuaries.

Pfiesteria shumwayae is the 2nd known toxic *Pfiesteria* species has a complex life cycle with an array of flagellated, amoeboid, and cyst stages. Its life cycle and behavior are similar to those of *Pfiesteria piscicida*, except that it responds more strongly to nitrogen enrichment and less strongly to phosphorus enrichment than *P. piscicida*. This species is a heterotroph that can become mixitrophic with kleptochloroplasts. The 2nd toxic *Pfiesteria* species is distinguishable from *P. piscicida* both morphologically (plate structure) and genetically (18S ribosomal DNA sequence). Like *P. piscicida*, its toxicity is triggered by live fish, and subsequent toxicity varies depending on its history of access to live fish. (Glasgow, 2000)

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ER Impact:

No changes to the ER are required.

Item Number 18 **ER Section 2.5**

Request:

Provide citations/sources for individual tables and figures, as well as text where assertions and statistical statements regarding socioeconomics are made.

Response:

Below are the citations for the tables and figures in ER Section 2.5.

Tables

Table 2.5-1, Counties of Residence for Existing CCNPP Units 1 and 2 Operational Employees

November 2006 Plant records

Table 2.5-2, Select Demographic and Economic Characteristics of Residential Population, By Distance from the CCNPP Site, 2000

USCB, 2000c. 2000 Decennial Census, Table DP-1: Profile of General Demographic Characteristics, U.S. Bureau of Census, 2000.

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Table 2.5-3, Historical and Projected Populations in Calvert County, St. Mary's County and Maryland from 1970 to 2030

MDDP, 2005. Maryland 2005 Statistical Handbook, Maryland Department of Planning, Planning Data Services, May 23, 2006.

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Table 2.5-4, Select Demographic and Economic Characteristics of Persons in Calvert County, St. Mary's County, Maryland, and the U.S. from 2000 to 2004

USCB, 2005. 2005 American FactFinder, U.S. Bureau of Census, 2005.

Table 2.5-5, Demographic and Economic Characteristics of Residential Populations in Select Cities and Communities within Calvert County and St. Mary's County, 2000

USCB, 2000c. 2000 Decennial Census, Table DP-1: Profile of General Demographic Characteristics, U.S. Bureau of Census, 2000.

Table 2.5-6, Resident and Transient Populations, by Sector and Distance from the CCNPP Site, 2000

USCB, 2000b. U.S. Census Bureau, Census 2000, County-to-County Worker Flow, Website: www.census.gov/population/www/cen2000/commuting, Accessed: September 3, 2006.

Table 2.5-7, Commuting Patterns To and From the ROI, 2000

USCB, 2000b. U.S. Census Bureau, Census 2000, County-to-County Worker Flow, Website: www.census.gov/population/www/cen2000/commuting, Accessed: September 3, 2006.

Table 2.5-8, Current Population and Population Projections for the CCNPP Low Population Zone

CCNPP, 2002. Evacuation Time Estimates within the Plume Exposure Pathway Emergency Planning Zone for the Calvert Cliffs Nuclear Power Plant, Revision 6, Calvert Cliffs Nuclear Power Plant, Inc, August 2002.

Table 2.5-9, Population Projects from 2000 to 2060 within 50 mi (80 km) of the CCNPP Site

NRC, 2003. SECPOP 2000: Sector Population, Land Fraction, and Economic Estimation Program, Nuclear Regulatory Commission, August 2003.

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Table 2.5-10, Population Projections by Sector and Distance from the CCNPP Site from 2000 to 2060

NRC, 2003. SECPOP 2000: Sector Population, Land Fraction, and Economic Estimation Program, Nuclear Regulatory Commission, August 2003.

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VEC, 2006. State Demographer Projections Population Data, Virginia Employment Commission, Website: http://velma.virtuallmi.com, Accessed: June 22, 2007.

Table 2.5.2-1, Counties of Residence of the Existing Operational Workforce at CCNPP Units 1 and 2, November 2006

November 2006 Plant records

Table 2.5.2-2, Civilian Labor Force Data for Calvert County and St. Mary's County, October 2006

MDDLLR, 2006a. Office of Labor-Market Analysis, Maryland Department of Labor, Licensing & Regulation, 2006.

Table 2.5.2-3, Construction and Extraction Occupational Labor Force, Washington-Arlington-Alexandria Metro Area, May 2005

BLS, 2005. Construction and Extraction Occupations, Website: http://stats.bls.gov/oes/current/oes_47900.htm, Department of Labor, Bureau of Labor Statistics, Occupational Employment and Wage Estimates, Accessed: December 1, 2006.

Table 2.5.2-4, Employment by Sectors and Industry in Calvert County, St. Mary's County, and ROI, 2005

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Table 2.5.2-5, Major Non-Governmental Employers in Calvert County and St. Mary's County, 2005

MDDLLR, 2006a. Office of Labor-Market Analysis, Maryland Department of Labor, Licensing & Regulation, 2006.

Table 2.5.2-6, Fastest Growing Private Industries in Calvert County and St. Mary's County, from 2004 to 2005

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Table 2.5.2-7, Percent of Individuals in Poverty and Median Household Income in Calvert County and St. Mary's County, Maryland, and the U.S. 2000 and 2005

USCB, 2005. American FactFinder, U.S. Census Bureau, 2000.

Table 2.5.2-8, Mean Salaries in Calvert County, St. Mary's County Maryland, and the U.S. 2005

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Table 2.5.2-9, Occupied Housing Units and Vacant (available) Housing Units in Calvert County, St. Mary's County, and the ROI, 2000

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Table 2.5.2-10, New Housing Units (Single-family and Multi-family) Authorized for Construction, Calvert County and St. Mary's County from 2001 to 2005

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Table 2.5.2-12, Hotels, Motels, and Bed & Breakfasts Within About 30 Miles (48.2 km) of Lusby, Maryland

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Table 2.5.2-13, Public Schools Located in Calvert County and St. Mary's County

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Table 2.5.2-14, Private Schools Located in Calvert County and St. Mary's County

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Table 2.5.2-15, Boat Ramps and Public Landing/Launch Sites in Calvert County and St. Mary's County, Roughly from Closest to Farthest from the CCNPP Site

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Table 2.5.2-16, Marinas in Calvert County and St. Mary's County, Roughly from Closest to Farthest from the CCNPP Site

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Table 2.5.2-17, Charter Boat Services/Associations in Calvert County and St. Mary's County, Roughly from Closest to Farthest from the CCNPP Site

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Table 2.5.2-19, Property and Income Tax Rates in Calvert County and St. Mary's County, 2006

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Table 2.5.2-20, Fiscal Year 2005 Actual County Revenues and Expenditures in Calvert County and St. Mary's County

CCBCC, 2005. Adopted Operating and Capital Budget, Fiscal Year 2007, Calvert County Board of County Commissioners, Prince Frederick, Maryland, July 1, 2005.

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Table 2.5.2-21, Calvert County General Fund Revenues and County-wide Taxable Assessed Property Values, 2000 to 2005

CCBCC, 2005. Adopted Operating and Capital Budget, Fiscal Year 2007, Calvert County Board of County Commissioners, Prince Frederick, Maryland, July 1, 2005.

Table 2.5.2-22, Water Districts/Systems in Calvert County and St. Mary's County

CCWS, 2007. Calvert County Water and Sewer, Calvert County, Maryland, Website: www.co.cal.md.us/residents/water/RateInfo.asp, Accessed: June 8, 2007.

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Table 2.5.2-23, Sewer Districts/Systems in Calvert County and St. Mary's County

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Table 2.5.2-24, Fiscal Year 2005 Actual Law Enforcement Agency Staffing, Budgets, and Calls for Service in Calvert County and St. Mary's County

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Table 2.5.2-25, Fire/EMS Departments in Calvert County and St. Mary's County

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Table 2.5.2-26, EMS Calls for Service in Calvert County and St. Mary's County, June 2005 to May 2006

MIEMSS, 2006. 2005-2006 Annual Report, Maryland Institute for Emergency Medical Services Systems (MIEMSS), Website: http://miemss.umaryland.edu/AnnRpt.pdf, Accessed: May 2007.

Table 2.5.2-27, Peak Hour Traffic Volumes at Calvert Cliffs Parkway and MD 2/4

Traffic Impact Study at the Calvert Cliffs Nuclear Power Plant – Phase 1, KLD Associates, Inc., May 30, 2007

Table 2.5.3-1, Summary of Surveyed Architectural Resources

GAI, 2007. Management Summary, Phase Ib Cultural Resources Investigation, Calvert Cliffs Nuclear Power Plant, GAI Consultants Inc, February 23, 2007.

Table 2.5.3-2, Summary of Surveyed Archaeological Sites

GAI, 2007. Management Summary, Phase Ib Cultural Resources Investigation, Calvert Cliffs Nuclear Power Plant, GAI Consultants Inc, February 23, 2007.

Table 2.5.3-3, Summary of Identified Isolated Finds

GAI, 2007. Management Summary, Phase Ib Cultural Resources Investigation, Calvert Cliffs Nuclear Power Plant, GAI Consultants Inc, February 23, 2007.

Table 2.5.3-4, Summary of Potentially Eligible Archaeological Sites

MHT, 2007. Letter from J. Rodney Little, Director- State Historic Preservation Officer, Maryland Historic Trust to R.M. Krich, UniStar Nuclear, June 7, 2007.

Table 2.5.3-5, Summary of Eligible Architectural Resources

MHT, 2007. Letter from J. Rodney Little, Director- State Historic Preservation Officer, Maryland Historic Trust to R.M. Krich, UniStar Nuclear, June 7, 2007.

Table 2.5.4-1, Census Block Groups within 50 mi (80 km) of CCNPP Site with Minority and Low Income Population

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

USCB, 2000b. Poverty Status in 1999 of Households by Household Type by Age of Householder [59] – Universe: Households, Census 2000 Summary File 3

(SF 3), Page 92, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Table 2.5.4-2, Census Block Groups and Percentages of Minority People within 50 mi (80 km) of the CCNPP Site

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Table 2.5.4-3, Census Block Groups and Percentage of Households within 50 mi (80 km) of CCNPP Site with Low Income Populations

USCB, 2000b. Poverty Status in 1999 of Households by Household Type by Age of Householder [59] – Universe: Households, Census 2000 Summary File 3 (SF 3), Page 92, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Table 2.5.4-4, Estimated Chesapeake Bay Recreational Catches in Metric Tons, Maryland and Virginia Combined, 1995 and 2000

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Table 2.5.4-5, Chesapeake Bay Recreational Top Five Species Most Commonly Caught and Consumed Fish, Lower Patapsco and Back Rivers, in the Baltimore Region, Maryland, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the Elizabeth/James River Region of Concern, CMI-HDD-05-01, J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, College of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 29, 2005.

Table 2.5.4-6, Chesapeake Bay Recreational Top Five Species Most Commonly Caught and Consumed Fish, Lower Potomac and Anacostia Rivers, in the Washington, D.C. Region, 2004

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Table 2.5.4-7, Chesapeake Bay Recreational Top Ten Species Most Commonly Caught and Consumed Fish, Elizabeth and James Rivers, in the Tidewater Region, Virginia, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the Elizabeth/James River Region of Concern, CMI-HDD-05-01, J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, College of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 29, 2005.

Table 2.5.4-8, Chesapeake Bay Recreational Fishing Characteristics for Minority Populations, Lower Patapsco and Back Rivers, in the Baltimore Region, Maryland, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the Elizabeth/James River Region of Concern, CMI-HDD-05-01, J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, College of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 29, 2005.

Table 2.5.4-9, Chesapeake Bay Recreational Fishing Characteristics for Minority Populations, Lower Potomac and Anacostia Rivers, in the Washington, D.C. Region, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the Elizabeth/James River Region of Concern, CMI-HDD-05-01, J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, College of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 29, 2005.

Table 2.5.4-10, Chesapeake Bay Recreational Fishing Characteristics for Minority Populations, Elizabeth and James Rivers, in the Tidewater Region, Virginia, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the Elizabeth/James River Region of Concern, CMI-HDD-05-01, J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, College of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 29, 2005.

Table 2.5.4-11, Chesapeake Bay Recreational Fishing Characteristics for Low Income Populations, Lower Potomac and Anacostia Rivers, in the Washington, D.C. Region, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the

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Table 2.5.4-12, Chesapeake Bay Recreational Fishing Characteristics for Low Income Populations, Elizabeth and James Rivers, in the Tidewater Region, Virginia, 2004

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Three Regions of Concern, Results for the Elizabeth/James River Region of Concern, CMI-HDD-05-01, J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, College of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 29, 2005.

Figures

Figure 2.5-4, Black or African American Minority Population

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Figure 2.5-5, Asian Minority Population

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Figure 2.5-6, Some Other Minority Population

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Figure 2.5-7, Aggregate Minority Population

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Figure 2.5-8, Hispanic Ethnicity Minority Population

USCB, 2000a. Race [71] – Universe: Total Population, Census 2000 Summary File 1 (SF 1), Page 3, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

Figure 2.5-9, Low Income Population

USCB, 2000b. Poverty Status in 1999 of Households by Household Type by Age of Householder [59] – Universe: Households, Census 2000 Summary File 3 (SF 3), Page 92, U.S. Census Bureau, Website: http://factfinder.census.gov, Accessed: December 21, 2006.

ER Impact:

The listed table references will be incorporated into the ER a future ER revision.

Item Number 19 **ER Section 2.5.2.2**

Request:

Provide information relating to the areas where political structure is high level and general. Provide elaboration on political structure, tax districts, and local and regional administrative organizations that may be directly affected by CCNP construction and operation for reference by the subsequent construction and operating sections. Provide the baseline tourist economy for later impact analysis.

Response:

Political structure and Local and Regional Administrative Organizations

1) Calvert County is governed by a Board of County Commissioners. The board consists of five members elected countywide. Each of the three county districts must have at least one board member who is a resident of that district. Two other members serve at large. Officers of the Board include a President and Vice President who are elected by majority vote of the Board members. County departments include Community Resources, Economic Development, Finance and Budget, General Services, Personnel, Planning and Zoning, Public Safety, Public Works, Technology Services and Transportation (CCCAFR, 2005)

2) The county of St. Mary's is also governed by a Board of County Commissioners consisting of five members. Four of these members represent one district each. Districts are defined by election districts. For example, the first Commissioner District includes the first, second and ninth election district. The second Commissioner District includes the third and sixth election districts, and so forth. The Commission President is elected at large. St. Mary's County departments include the Department of Aging, County Attorney, Economic and Community Development, Finance, Marcey Halfway House, Information Technology, Human Resources, Land Use & Growth Management, Public Works and Transportation, Recreation and Parks and Public Safety (SMC, 2006).

3) For many of the towns in both Calvert and St. Mary's Counties, such as Lusby and Solomons, the nearest population centers to the CCNPP are census designated places but have no political or tax structure independent of the County (LMP 2006). This includes Prince Frederick, the Calvert County seat.

4) Incorporated towns include Leonardtown in St. Mary's County and North Beach, Calvert County. North Beach governance is based on a Town Council and Mayor. In addition to Administration, town departments include Public Works, Town Clerk and Code Enforcement. Its tax structure is based on property at $0.67 per hundred assessed value in addition to sewer and water fees. Leonardtown governance is based on a Board of Commissioners. Town departments include Administration, Planning and Zoning, Board of Appeals and Water and Wastewater Treatment.

Tourism Economy

1) The relative value of tourism to the state of Maryland is summarized by the Maryland Department of Labor (MDL, 2006). Between 2001 and 2004, the number of tourism related jobs increased from 215,073 to 230,537. The payroll value in those same years increased from $3.5 billion to $4.1 billion. The combined value encompassed various employment categories including scenic transportation, travel services, arts and sports, accommodations and food services. Of these, food services represented the largest value with payroll of $2.3 billion in 2004. Southern Maryland, which includes Calvert, Charles and St. Mary's county, had 11,122 tourism related jobs in 2004, representing total wages of $134.4 million.

2) The relative value of tourism in Calvert County has been summarized in a report by the Maryland Dept. of Business & Economic Development (CCM, 2006). This report provides information on various economic parameters including labor force, employment, agriculture, income, tax base, education and tourism (pg 16). Tourist expenditures in Calvert County during 2003, 2004 and 2005 were approximately $59.5M, $68.1M and $74.9M, respectively. Expenditures within the recreational boating industry in those same years were $38.7M, $36.7M and $33.8M. Tourism related county revenues derive from taxes on personnel income, admissions, amusements, hotels, restaurants and gasoline among others. Leisure and hospitality occupations accounted for 2,963 and 2,849 jobs in 2004 and 2005, respectively, representing approximately 17.4% of private employment. Average weekly wages in the leisure and hospitality sector during 2004 and 2005 were $227 and $252 respectively. In St. Mary's County, leisure and hospitality accounted for approximately 3,293 jobs in 2006 representing 8.6% of the total employment in that County.

References:

CCCAFR, 2005. Calvert County Government 2005 Comprehensive Annual Fiscal Report, Calvert County Department of Finance and Budget, Prince Frederick, Maryland, June 30, 2005.

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LMP, 2006. Lusby Town Center, Master Plan and Zoning Ordinance. Calvert County, Maryland. Amended May 2006.

MDL, 2006. Hospitality and Tourism. Maryland Department of Labor, Baltimore, Maryland, May 2006.

SMC, 2006. St. Mary's County, Maryland, Approved Revenues and Appropriations, Operating and Capital Budgets, Fiscal Year 2006. St. Mary's County Commissioners. Leonardtown, Maryland, May 2005.

ER Impact:

ER Section 2.5.2.2 and 2.5.3.6 will be updated to include the supplemental information provided in this response.

Item Number 20 **ER Section 2.5.2.8**

Request:

Provide elaboration of relevant/applicable state, county, and city plans to address growth, housing, and land use changes with numbers/data if possible. If not available, say so.

Response:

Calvert County:

Calvert County has developed two comprehensive plans for managing growth and impact on natural resources, a Comprehensive Plan (CCMP, 2004) and a Land Preservation, Parks and Recreation Plan (CCLPP, 2006). The goals are to maintain and improve the overall quality of life by:

- Promoting sustainable development
- Encouraging a stable and economic base
- Providing for safety, health and education, and
- Preserving the natural, cultural, and historic assets of Calvert County.

Benchmarks have been established for each of the critical areas:

Specific elements of the Calvert Count 2004 Comprehensive Plan are summarized below:

- Preserve at least 40,000 acres of farm and forestlands
- Locate 35% of all new households in Town Centers
- A 40% reduction in nutrients entering Chesapeake Bay
- 95% of existing forest is retained
- Specific levels of service are maintained on county and town center roads
- 20% of household waste is recycled
- 22% of commuters use public transit or carpool
- Annual average household energy use increase is less than 3%
- Meet various education performance criteria
- Expand the real property tax base from $459M in 2002 to $598M by 2007
- Increase in-county jobs by 2,700 from 2002 to 2007 (a total of 18,307 in 2007)
- Increase the number of visitors to 573,000 in 2007, and
- Maintain county debt service to less than 9.5% of revenues.

Action plans have been established to achieve each one of these goals. With respect to housing, the objectives are to:

- Encourage a variety of housing types to serve different population
- characteristics

- Locate new housing in town centers
- Encourage mix of family income ranges and housing types in new
- communities, and
- Encourage upgrades of substandard housing.

Specific objectives and policies have also been established to sustain and promote economic growth within Calvert County. Prior to the 1960s, the economy of Calvert County was tied to natural resources. Subsequently, population and economic growth was largely driven by the movement of residents out of the DC area. More recently, growth has been sustained by larger more technical companies as well as the presence of several large institutions including CCNPP, the Cove Point LNG facility and the Calvert Memorial Hospital. Between 1992 and 2002, the Calvert County labor force had grown by approximately 30% from 30,991 to 40,358 and the unemployment rate had declined to 2.3%. Tourism continued to be an important component of the regional economy. Tourism related jobs increased almost 4% from 1999 to 2001 in Calvert County.

Coincident with the economic growth, Calvert County had recognized the need to provide infrastructure including transportation, electricity, water and sewer, communications, education and industrial and commercial sites. In 1993, the County established 1,040 acres of commercial zoning which as of 2004 remained available in addition to the 4,122 acres of allowed commercial development within Town Centers (CCMP, 2004).

Elements of the Calvert County 2006 Land Preservation, Parks and Recreation Plan are summarized below:

Population growth in Calvert County increased substantially over the last three decades and as a result, the County Board of Commissioners had identified the need for a comprehensive plan to allow for sustained growth while also preserving the Counties natural resources. Between 1990 and 2000, Calvert was the fastest growing county in the State. Population size grew approximately 45.1 percent compared to 10.8 percent for the State. As a result, the County has instituted zoning changes and land preservation incentives to reduce projected building capacity. At the same time, the 2006 plan establishes benchmarks for recreation, parks, open-space, agriculture and land conservation.

A goal has been established to increase the amount of recreational acreage to 2,880 acres in year 2020. Approximately 1,889 areas of land were available for recreation and natural resource lands in 2005. Of the 78,000 acres in vacant farms and forests, the County goal is to preserve 40,000 acres. About 23,700 acres were in land preservation in 2005. Various mechanisms have been established to encourage or incentivize land protection including a Transferable Development Rights Program, a Purchase and Retirement Fund, and a Leveraging and Retirement Fund all of which limit development (CCLPP, 2006).

St. Mary's County:

A comparable Comprehensive Plan was developed for St. Mary's County in 2002 and amended in 2003 (SMCMP, 2003). Population growth and changes in land use were largely based on 1997 data but, like Calvert County, the trends showed continued population growth and lose of farm land. As of 1997, 54% of land in St. Mary's was forested and 28% in farming. Development of land increased by 28% from 1985 to 1997. Recognizing this trend, St. Mary's established the following goals in its Comprehensive Plan:

- Protection of farmland and forest resources as a component of an important local industry and rural character,
- Protection of sensitive natural characteristics or environmental features,
- Protection and enhancement of the visual qualities and characteristics of existing settlements in the county,
- Directing and managing the distribution of future land uses anticipated with a growth in population,
- Guiding of public investment in services, facilities, and improvements in a manner which is timely, cost effective and easily maintained.

The plan established a target goal of reducing residential growth in rural areas by 50%. Economic growth was tied to tourism, streamlining the zoning and permitting processes, revitalizing existing developed areas and funding of infrastructure to support a modified growth vision. The plan also envisioned development of a variety of housing types to meet the needs of the different demographic and economic characteristics of the population.

References:

CCMP, 2004. Comprehensive Plan, Calvert County, Maryland. Calvert County Board of Commissioners, December 2004.

CCLPP, 2006. Calvert County Land Preservation, Parks and Recreation Plan, St. Mary's Board of County Commissioners, December 2006.

SMCMP, 2003. Comprehensive Plan, Quality of Life in St. Mary's County - A Strategy for the 21st Century - , St. Mary's County Board of County Commissioners, March 2003.

ER Impact:

No changes to the ER are required.

Item Number 21a **ER Section 2.5.3**

Request:

Provide copies of all consultation letters with SHPO and copies of all consultation letters with Tribes and interested parties including:

- October 3, 2006, letter: RM Krich (UniStar) to Elizabeth Cole (MD Historical Trust), Request for Cultural Resource Information, CCNPP
- November 20, 2006, letter: Dixie Henry (MD Historical Trust) to RM Krich (UniStar), Request for Information about Historic Properties
- March 23, 2007, Letter: RM Krich (UniStar) to Elizabeth Cole (MD Historical Trust) (Draft Interim Report), Phase 1B Cultural Resources Investigation
- June 7, 2007 Letter: J Rodney Little (SHPO/MD Historical Trust) to RM Krich (UniStar) MD Historical Trust Review of Phase I Cultural Resources Investigations, CCNPP (Draft Interim Report)
- February 20, 2008, Email: Barbara Munford (GAI) to Mervin Savoy (Tribal Chairperson), Piscataway and Convoy Confederacy and Subtribes, Inc.

Response:

The Maryland State Historic Preservation Officer (SHPO) has been consulted with throughout completion of the Phase Ia and Ib surveys to ensure compliance and maintain a strong working relationship. The results of the Phase Ia and Ib surveys were documented in a February 2007 report (GAI, 2007). This report was submitted the Maryland SHPO for review and consultation under Section 106 of the National Historic Preservation Act (USC, 2007). Comments from the Phase Ia and Ib surveys were received from the Maryland SHPO in a letter dated June 7, 2007 (MHT, 2007). The results of the review of the Phase IA and Phase IB report consultations have been used to determine that there are four archaeological sites and four architectural resources are eligible or potentially eligible for listing on the National Register of Historic Places (NRHP). The following reports have been submitted and reviews completed by the SHPO to date:

- *Management Summary, Phase Ia Cultural Resources Investigation, Calvert Cliffs Nuclear Power Plant*, Prepared by GAI Consultants, Inc., October 20, 2006.
- *Draft Interim report, Phase Ib Cultural Resources Investigation, Calvert Cliffs Nuclear Power Plant*, Prepared by Barbara A. Munford, M.A. and Mathew G. Hyland, Ph.D., GAI Consultants, Inc., March 14, 2007.
- *Technical report, Cultural Resource Records Search Within a 10-Mile Radius of Calvert Cliffs Nuclear Power Plant*, Prepared by Mathew G. Hyland, Ph.D. and Megan L. Otten, GAI Consultants, Inc., March 5, 2007.

The following consultation letters with the SHPO have been sent or received and are attached:

- October 3, 2006, Letter: R.M. Krich (Unistar) to Elizabeth Cole (MHT), Request for Cultural resource Information, CCNPP.
- November 20, 2006. Letter: Dixie Henry (MHT) to R.M. Krich (Unistar), Request for Information about Historic Properties, CCNPP.
- March 23, 2007, Letter, R.M. Krich (Unistar) to Elizabeth Cole (MHT), Draft Interim Report, Phase Ib Cultural Resources Investigation, CCNPP.
- June 7, 2007. Letter: J. Rodney Little (SHPO/MHT) to R.M. Krich (Unistar), MHT review of Phase I Cultural Resources Investigations, CCNPP (Draft Interim Report).
- February 20, 2008, Email: Barbara Munford (GAI) to Mervin Savoy (Tribal Chairperson), Piscataway and Convoy Confederacy and Subtribes, Inc.

ER Impact:

No changes to the ER are required.

Item Number 21b **ER Section 2.53**

Request:

Describe the cultural background (prehistoric and historic) at the Calvert Cliffs site to put the historical properties in context. Provide this in the Phase II report planned for completion in August 08.

Response:

The Phase Ib survey included more extensive background research, systematic shovel testing within the 190 acres (77 hectares), and recording and evaluation of all identified archaeological and architectural resources located within the APE and visual effects APE. Background research was conducted to collect material to be used to develop a context for evaluation of recorded resources and to provide background information on specific resources. The research included review of architectural survey reports, published histories of Calvert County, historic maps of the project area, and files at the University of Baltimore's Langsdale Library. The prehistoric and historic background research was not summarized and presented in the Phase 1b interim report, but that information was available to the researchers and was used to inform the field and laboratory investigations. The combined Phase I/II report will include cultural contexts to satisfy requirements in the *Standards and Guidelines for Archaeological Investigations in Maryland* (1994).

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 21c **ER Section 2.53**

Request:

Identify status and results of the phase II investigations. Provide this in the Phase II report planned for completion in August 08.

Response:

Phase II field investigations have been completed. Preliminary results indicate that three of the four archaeological sites (18CV480, 18CV481, and 18CV482) were found to be disturbed and to lack integrity. Those sites have been recommended as not eligible for the NRHP. One site, 18CV474, was found to contain intact archaeological deposits and to contain sufficient integrity so that the site can yield significant information about the history of the area. The site is recommended as eligible for the NRHP under Criterion D.

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 21d **ER Section 2.53**

Request:

Provide copy of cultural resource survey reports including:

- Management Summary Phase 1A Cultural Resources Investigation, Calvert Cliffs Nuclear Power Plant, Prepared by GAI Consultants, Inc., October 20, 2006
- Draft Interim Report, Phase 1B Cultural Resources Investigations, Calvert Cliffs Nuclear Power Plant, Prepared by Barbara A. Mumford, M.A. and Matthew G. Hyland, PhD GAI Consultants, Inc., March 14, 2007
- Technical Report Cultural Resources Records Search within 10-mi Radius of Calvert Cliffs Nuclear Power Plant, Prepared by Matthew G. Hyland, PhD and Megan L. Otten, GAI Consultants, Inc., March 5, 2007.
- Any recorded/used best management practices that is used for units 1 and 2 and if there is one in place for unit 3.
- Phase 2 reports when they are completed

Response:

Copies of the three (3) above identified reports are attached. A copy of the following additional survey report addressing underwater cultural resources in the area for construction water intake is also attached:

> **Faught, 2008.** Submerged Cultural Resource Survey of a Proposed Outfall Pipe, Calvert Cliffs Nuclear Power Plant Unit 3 Construction, Calvert County, Maryland, Prepared by Michael K. Faught, Panamerican Consultants, Inc., May, 2008

No written best management practices statement exists for cultural resources for CCNPP Units 1 and 2. Best management practices for cultural resources within CCNPP Unit 3 and the visual effects APE that includes CCNPP Units 1 and 2 will be prepared that include a preservation plan for any identified significant sites that can be preserved in place and an emergency discovery plan that will apply to any future ground disturbing activities. The preservation plan and emergency discovery plan will be developed as part of the MOA developed for the identified CCNPP Unit 3 cultural resources.

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 21e **ER Sections 2.53, 4.1.3**

Request:

Provide copy of procedures that identify measures to be taken if cultural or historic resources are inadvertently discovered during construction.

Response:

With construction activities, there is always the possibility for inadvertent discovery of previously unknown cultural resources or human remains. An Unanticipated Discoveries Plan will be developed and included as an appendix in the combined Phase I/II Technical report. That plan will include procedures to be followed to protect cultural, historic, or paleontological resources or human remains in the event of discovery during construction. These procedures will comply with applicable Federal and State laws. These laws include the National Historic Preservation Act (USC, 2007), and Code of Maryland, Criminal Law, Title 10, Subtitle 4, Sections 10-401 through 10-404 (MD, 2004a) and the Code of Maryland, Title 4, Subtitle 2, Section 4-215 (MD, 2004b).

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 21f **ER Sections 2.53, 4.1.3, 5.1.3**

Request:

What measures for avoidance, minimization, or mitigation of any adverse effects on cultural or historic resources have been identified? Provide mitigation in the Phase II report planned for completion in August 08.

Response:

Upon completion of the Phase II investigations and SHPO consultation, assessments of effect on the National Register-eligible resources located in the APEs will be determined and consultation conducted with the SHPO to identify measures for avoidance, minimization, or mitigation of any adverse effects, per Section 106 of the National Historic Preservation Act. Strategies for avoidance or minimization of impacts to historic or cultural resources can only be determined once the Phase II studies are completed and project plans have been refined to the point that it can be determined which areas have to be dedicated to construction and which areas can be adjusted to allow preservation of a resource in place. Work plans and research designs for mitigation of adverse impacts through data recovery will be prepared for those archaeological resources that are eligible for listing on the National Register that cannot be preserved in place. Any identified measures will be delineated in a Memorandum of Agreement between NRC, the SHPO, Constellation Generation Group, UniStar Nuclear Operating Services, and Advisory Council on Historic Preservation.

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 21g **ER Sections 4.1.3, 5.1.3**

Request:

Explain how the impacts to historic properties are determined to be "moderate."

Response:

The impacts to historic properties during construction are described in ER Section 4.1.3 as being MODERATE based on the requirements for mitigation. The impacts to historic properties during operation are described in ER Section 5.1.3 as being SMALL

Adverse impacts of construction will be mitigated through implementation of a mitigation plan negotiated with state and federal agencies. Implementation of an appropriate mitigation plan tailored to each resource will result in reducing the impacts to historic properties from MODERATE to SMALL.

ER Impact:

No changes to the ER are required.

Item Number 22a **ER Sections 2.5.3, 4.1.3**

Request:

In light of the recent LWA Rule, if Constellation/UniStar will be conducting preconstruction activities and/or applying for a LWA, explain the impacts to cultural resources from pre-construction activities and then from construction activities.

Response:

UniStar has not decided to pursue an LWA at this time. Impacts to cultural resources during preconstruction activities will be essentially the same as during the construction period since these impacts will occur during land clearing. Actions being taken to avoid, minimize, or mitigate and adverse effects are as described in Section 4.1.3 of the ER.

ER Impact:

No changes to the ER are required.

Item Number 22b **ER Sections 2.5.3, 4.1.3, 5.1.3**

Request:

Describe the cumulative impacts to cultural resources and the process for making the determination. Provide cumulative impacts in the Phase II report planned for completion in August 08.

Response:

The cumulative impacts to cultural resources beyond the property boundaries are mitigated by the fact that the proposed facility will be located immediately adjacent to an existing nuclear power plant. The visual aesthetics of the area in the immediate vicinity of the facility have already been lessened due to the presence of the existing plant, and any additional visual impacts are expected to be minor. Impacts to significant archaeological resources within the plant site will be mitigated through data recovery operations conducted under an approved work plan and research design. Two architectural resources (Camp Conoy and Baltimore and Drum Point Railroad) face adverse impacts from construction.

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 22c **ER Sections 2.5.3, 4.1.3**

Request:

Provide pre- and post-construction aerial photographs when available. Provide photos in the Phase II report planned for completion in August 08.

Response:

The Phase Ia survey, as discussed in the Final Interim Phase 1b Report, was conducted on the 600 acre (243 hectare) APE in October 2006. The Phase Ia survey included background research of files and records, geomorphological reconnaissance, and archaeological reconnaissance. Background research was conducted to identify previously recorded historic properties located within the proposed project area. Examination of archaeological site files, historic structure files, National Register of Historic Places listings, historic maps, and cultural resource reports was conducted at the Maryland Historical Trust in Crownsville, Maryland, and the Calvert County Historical Society and Calvert County Department of Planning and Zoning, both located in Prince Frederick, Maryland.

The Phase II report will be provided when available and is scheduled for completion in August 2008.

ER Impact:

No changes to the ER are required.

Item Number 22d **ER Sections 2.5.3, 9.3**

Request:

Explain how cultural resources were considered in the site selection process and how the cultural background and known cultural resources were considered at the alternative site locations at a reconnaissance level.

Response:

UniStar is currently in the process of re-evaluating candidate sites for plant siting. A response to this RAI will be provided by August 15, 2008.

ER Impact:

No changes to the ER are required.

Item Number 22e **ER Sections 2.5.3, 4.1.3, 5.1.3**

Request:

Explain the status of the parallel Maryland state review process concerning cultural resources at Calvert Cliffs and the extent to which State addresses cultural resources in MD PSC application.

Response:

The Maryland State Historic Preservation Officer (SHPO) has been consulted throughout the completion of Phase Ia and Ib surveys to ensure compliance and maintain a strong working relationship. The results of the Phase Ia and Ib surveys were documented in a report that was submitted to the Maryland SHPO for review and consultation under Section 106 of the National Historic Preservation Act. Comments from the Phase Ia and Ib surveys have been received from the Maryland SHPO and the results of the review of the Phase IA and Phase IB report consultations have been used to determine that there are four archaeological sites and four architectural resources are eligible or potentially eligible for listing on the National Register of Historic Places (NRHP).

ER Impact:

No changes to the ER are required.

Item Number 23 **ER Section 2.5.2.9.2.1**

Request:

Explain the difference in amount of treated water provided and sewage treatment throughput for Calvert County.

Response:

ER Section 2.5.2.9.2.1 identifies the amount potable water consumed in Calvert County and the amount of sewage treated in 2005 (CCCAFR, 2005). As shown on page 2.5-21 of the ER, the amount of potable water consumed in the county in 2005 was approximately 459,385,053 gallons (1.7 million cubic meters). The amount of sewage treated was approximately 555,799,835 gallons (2.1 million cubic meters). The validity of these estimates was verified against the cited reference. The apparent difference is real but not explained in the reference. Possible explanations include combined sewer and storm water, the introduction of well water into the public sewer system, and the introduction of sewage from septic pump outs.

Reference:

CCCAFR, 2005. Calvert County Government 2005 Comprehensive Annual Fiscal Report, Calvert County Department of Finance and Budget, Prince Frederick, Maryland, June 30, 2005.

ER Impact:

No changes to the ER are required.

Item Number 24 **ER Section 2.5.2.9.2.6.2**

Request:

Describe St. Mary's Hospital capabilities to respond to an emergency, services provided, agreements with the applicant, and reciprocity agreements with other hospitals.

Response:

Section 2.5.2.9.6.1 provides detailed information on the hospital support services for Calvert County but corresponding little is provided in section 2.5.2.9.6.2 for St. Mary's County.

1) St Mary's Hospital had 108 beds in 2007. The number of workers was 1,090 with 252 medical staff. Patient admissions in 2007 totaled 9,254. Emergency care visits totaled 43,222 and outpatient visits totaled 48,040. The average daily census was 76.7 patients (SMH, 2007).

2) The St. Mary's Hospital emergency acute care facility is open 24 hours a day, seven days a week. Helicopter transport is available to transfer critical patients to other facilities as needed. An advanced MRI/CT technology room is under construction adjacent to the emergency room along with a room to include radiography capability. An Express Care facility is located in Charlotte Hall to treat minor injuries and illnesses.

3) Partner facilities supporting St. Mary's Hospital under the umbrella of the Chesapeake Potomac Healthcare Alliance include the Chesapeake Potomac Home Health Agency and the Chesapeake Potomac Regional Cancer Center. Therapies of the Cancer Center include external beam radiation, advanced CT simulation, 3-D treatment planning and radiation therapy (SMH, 2006; 2007).

4) In Maryland Emergency Response Region 5, which includes Montgomery, Prince George's, Charles, Calvert, and St. Mary's Counties, there were over 8,800 emergency providers of differing qualifications and over 220 emergency vehicles equipped to transport and/or treat patients, about 20% of the state's transport capacity. During June 2006 through May 2007, Calvert County reported a total of 135 scene oriented emergency cases or about 0.7% of the states total (17,686). St. Mary's County reported a total of 166 cases or 0.9% of the state's total (MIEMSS, 2008).

5) Regarding reciprocity agreements, Calvert Cliffs has a formal agreement with Calvert Memorial Hospital. This agreement is in place as part of the emergency response plans for Calvert Cliffs Units 1 and 2. There are no plans at this time to establish formal agreements with any other hospitals as part of the CCNPP Unit 3 emergency response plans.

References:

MMIEMSS, 2008. 2006-2007 Annual Report, Maryland Institute for Emergency Medical Services Systems. Annual Report, Baltimore, MD.

SMH, 2006. St. Mary's Hospital Annual Report, 2006. Leading with Innovation, Serving with Compassion. St. Mary's Hospital. Leonardton, Maryland.

SMH, 2007. St. Mary's Hospital Annual Report, 2007. Growth, Strength, Excellence. St. Mary's Hospital. Leonardton, Maryland.

ER Impact:

ER Section 2.5.2.9.6.2 will be updated to include the information in items 1 through 4 in a future revision to the ER.

Item Number 25 **ER Section 2.5.4**

Request:

Provide comments from organizations linked-to/representing vulnerable low income or minority communities located near the proposed site. If there are none, say so.

Response:

As described in ER Section 2.5.4.1, the impact on minority and low income populations was assessed based on their percent occurrence within census blocks. First, the percent of the population representing each minority classification was determined within a census block and, second, the percent of low income households within a census block was calculated. If any census block group exceeded 50% or exceeded the applicable percentage in the geographical area by more than 20 percentage points, then that group was identified as a low income or minority population block group.

ER section 2.5.4.2.2 indicates that there were no low income census blocks in Calvert County and only one in St. Mary's County. Minority population groups are described in ER 2.5.4.2.1. No census block group in Calvert County was classified as a racial minority or Hispanic minority population. Two census block groups in St. Mary's County were classified as having a minority concentration but none were classified as having an individual racial or Hispanic population.

There were no federally recognized American Indian tribes within the 50 mile comparative geographic area, although two non-recognized Native American tribes included the Piscataway-Conroy Confederacy. UniStar had requested participation from the Piscataway Indian tribes and the Commission on African History and Culture in the scoping process for the environmental review of the CCNPP Unit 3. There have been no comments from these organizations.

In summary, the socioeconomic effects of construction and operation of CCNPP Unit 3 have been evaluated in detail and presented in the Environmental Report. This process was conducted under Rev. 0 of NUREG-1555, Section 2.5.4 Environmental Justice. Based on the information already identified in ER Section 2.5.4 cited above, and the lack of comments from the affected organizations, no other activities are planned for to address comments from low income and minority communities located near the site.

ER Impact:

No changes to the ER are required.

Item Number 26 **ER Section 2.5.4.5**

Request:

Provide more extensive citation of EJ subsistence discussion.

Response:

Little information on actual subsistence living in Maryland was found other than that available from angler surveys. The references cited in the ER deal almost exclusively with the ethnic and racial distributions of fishermen. Some harvesting of plants and some hunting likely occurs although the relationship to subsistence living is unknown. An additional citation (Fedler, 2000) provides some useful comparative information on fishing demographics including gender, race and ethnicity.

Several trends are important with respect to socioeconomic drivers of fishing rates. Fedler (Fedler, 2000) reported that boating and fishing by African Americans, Asians and Hispanics was very low. Minorities comprise about 10% of all anglers and about 16% of the population. The percentage increase in anglers from 2000 through 2020 was predicted to range between 15 and 19% depending on the relative changes in age classes predicted.

The number of African American anglers was predicted to increase by about 33% while the number of Hispanic anglers was predicted to increase by over 75% over this period. By comparison the number of white anglers was only expected to increase by just over 15%. Several cultural and economic theories were advanced to explain why, historically, blacks have been under represented as anglers and that for the low income persons and minorities, fishing was more likely to be for consumption than for those African American and whites with higher incomes.

Additional information regarding the demographics of fishing relative to consumption advisories was provided by Gibson (Gibson, 2005). These are essentially the same data found in GM (GM, 2005) cited in the ER and provide the demographic characteristics of anglers in the Washington DC area.

Agricultural subsistence information can be implied from a review of national and state inventories of agricultural practices by ethic, racial and economic class (USDA, 2004). Table 1 shows the relative distribution of the number of farms and the size of farms among various racial and ethnic groups within the state of Maryland and the ROI counties. The data suggest that in the ROI, there is a slightly higher percentage of farms owned or operated by African Americans (5.5% and 2.9%) compared to the state average (1.9%) and a slightly higher percentage of farms owned or operated by Native Americans in St. Mary's County (1.2%) compared to the state (0.5%).

In general, however, there are few Native American, Asian and Latino farms in the ROI compared to those operated by Whites and African Americans. The percentage of land in farming by race and ethnic group suggested that within the ROI, there was a larger percentage of land (2.5 and 1.2%) in use by African Americans in the ROI than statewide (0.7%). The distribution of the size of farms, economic class of the farms (income) and the number of operators is consistent between the state and the ROI suggesting that there is not a disparate or disproportionate distribution of small subsistence farming by any one racial or ethnic group.

References:

Fedler, 2000. Participation in Boating and Fishing, A Literature Review. Prepared for the Recreational Boating and Fishing Foundation, Fedler, A.J, Alexandria, Virginia, September 2000.

Gibson, 2005. Fish Consumption Advisories in Tributaries to the Chesapeake Bay: Improving the Communication of Risk to Washington, DC Anglers. Gibson, J. C., PhD Thesis submitted to the Faculty of Virginia Polytechnic Institute and State University, April 2005.

GM, 2005. Chesapeake Bay Angler Interviews: Identifying Populations at Risk for Consuming Contaminated Fish in Tree Regions of Concern, Results for Elizabeth/James River Region of Concern, CMI_HDD_05-01. J. Gibson and J. McClafferty, Human Dimensions Division, Conservation Management Institute, Collect of Natural Resources, Virginia Polytechnic Institute and State University, Prepared for the Chesapeake Bay Program, March 2005.

USDA, 2006. U.S. Department of Agriculture, Maryland State and County Data, Vol. 1, Geographic Area Series, Part 20. AC-02-A-20, 2002 Census of Agriculture, issued June 2004.

ER Impact:

No changes to the ER are required.

Table 1 Maryland State and ROI Farm Data by Race and Ethnicity, 2002 (USDA, 2004)

	White	African American	American Indian or Alaska Native	Asian	Hispanic or Latino	Total
# Farms Statewide	11,837 (96.3%)	239 (1.9%)	56 (0.5%)	35 (0.3%)	118 (1%)	12,285
# Farms						
Calvert	304 (92.7%)	18 (5.5%)	1 (0.3%)	2 (0.6%)	3 (0.9%)	328
St. Mary's	560 (95.4%)	17 (2.9%)	7 (1.2%)	3 (0.5%)	0	587
Acres in Farms Statewide	2,053,857 (98.4%)	15,384 (0.7%)	5,223 (0.3%)	1,443 (0.1%)	10,368 (0.5%)	2,086,275
Acres in Farms						
Calvert	29,336 (95%)	785 (2.6%)	N/A	N/A	746 (2.4%)	30,867
St. Mary's	67,364 (98.4%)	846 (1.2%)	190 (0.3%)	93(0.1%)	0	68,493
# of Operators by Acres Statewide						
1-9 acres	1,342 (95%)	54 (3.8%)	12 (0.8%)	6 (0.4%)		1.414
10 to 40	4,238 (96.4%)	111 (2.5%)	25 (0.5%)	20 (0.4%)		4,394
50 to 179	3,497 (97.7%)	63 (1.8%)	10 (0.3%)	7 (0.2%)		3,577
160 to 499	1,814 (99%)	9 (0.5%)	8 (0.4%)	2 (0.1%)		1,833
500 or more	946 (99.7%)	2 (0.2%)	1 (0.1%)			949
MD Farms by Economic Class						
<$1,000	2,761 (95.7%)	90 (3.1%)	24 (0.8%)	9 (0.3%)		2,884
$1,000-2,499	1,724 (96.1%)	53 (3%)	11 (0.6%)	5 (0.3)		1,793
$2,500-4,999	1,336 (96.5%)	37 (2.7%)	9 (0.6%)	2 (0.2%)		1,384
>$50,000	2,805 (99%)	14 (0.5%)	3 (0.1%)	10 (0.4%)		2,832
% of Total Income from Farming						
<25%	7,677 (96.9%)	188 (2.4%)	38 (0.5%)	19 (0.2%)		7,922
25 to 49%	1,004 (97.4%)	13 (1.2%)	10 (1%)	4 (0.4%)		1,031
Number of Operators						
Calvert	436 (93.4%)	23 (4.9%)	1 (0.2%)	2 (0.4%)	5 (1.1%)	467
St. Mary's	820 (96.5%)	20 (2.3%)	7 (0.8%)	3(0.4%)	0	850
Statewide	6,873 (95.5%)	173 (2.4%)	35 (0.5%)	22 (0.3%)	91 (1.3%)	7,194

Item Number 27 **ER Section 2.5.6**

Request:

Include information on use level and/or availability of information of public and private recreational facilities.

Response:

While Calvert County has existing recreational facilities available to residents and visitors, it also recognizes the need for facility expansion. The Calvert County Land Preservation, Parks and Recreation Plan Appendix E contains detailed information on recreational facility use (demand) in 2005, carrying capacity, unmet demand and therefore projected needs. These projected needs are shown on the attached table. The data show that the current County recreational facilities exceed capacity. Needs due to population growth are projected out to the year 2020. The Plan establishes goals for meeting this demand. Included in the plan is a list of priority facilities and estimated capital needs for each (CCMP, 2004).

Reference:

CCMP, 2004. 2004 Comprehensive Plan, Calvert County, Maryland. The Basics-Quality of Life, Calvert County Master Plan, Calvert County, Maryland, 2004.

ER Impact:

ER Section 2.5.2.6.1 will be updated to include the supplemental text provided in this response, exclusive of the table.

Calvert County Land Preservation Parks and Recreation Plan Needs Analysis, 2006.

Activity	2005 Supply	Annual Carrying Capacity	2005 Demand	2005 Unmet Demand	2005 Unmet Need	2010 Demand	2010 Unmet Demand	2010 Unmet Need	2015 Demand	2015 Unmet Demand	2015 Unmet Need	2020 Demand	2020 Unmet Demand	2020 Unmet Need
Baseball &Softball	22	129,440	221,512	92,072	16	236,589	107,149	18	244,388	114,948	20	247,686	118,246	20
Field Sports														
Spring	13	100,512	133,361	32,849	4	142,440	41,928	5	147,136	44,624	6	150,266	49,754	6
Fall	25	195,984	194,343	-1,641	0	207,574	11,500	2	214,417	18,433	2	218,978	22,994	3
Basketball	7	67,500	156,912	89,412	9	167,594	100,094	10	173,119	105,619	10	176,803	109,303	11
Tennis	13	54,480	54,408	-72	0	56,629	2,149	1	58,496	4,016	1	59,740	5,260	1
Pools (outdoor)	2	182,700	446,989	264,289	2	477,418	294,718	2	493,157	310,457	2	503,650	320,950	2
Picnic Shelters	6	68,888	148,921	80,033	7	159,058	90,171	8	164,302	95,414	8	167,798	98,910	8
Playgrounds	8	220,350	235,370	15,020	0	251,392	31,042	0	259,392	39,042	0	265,205	44,855	1
Skateparks	1	26,300	150,081	123,781	5	160,297	133,700	5	165,582	139,282	5	169,105	142,805	5
Equestrian Trails	0	5,460	80,667	80,667	14.8	86,159	86,159	15.8	88,999	88,999	16.3	90,893	90,893	16.6
Fishing from Pier	260	94,640	54,790	-39,850	0	58,519	-36,121	0	60,449	-34,191	0	61,735	-32,905	0
Kayaking & Canoeing	17	60,928	63,552	2,624	1	67,879	6,951	2	70,116	9,188	3	71,608	10,680	3
Swimming at Beach/ River/Lake	1.3	384,930	446,990	62,060	0.2	477,419	92,489	0.3	493,158	108,228	0.4	503,651	118,721	0.4

Item Number 28 **ER Section 2.7**

Request:

When data from other sites are used to characterize the Calvert Cliffs site, discuss why the data are representative.

Response:

The CCNPP site and Patuxent River Naval Air Station are located in climate division MD-03, Lower Southern, as designated by the U.S. National Climatic Data Center. A climate division represents a region within a state that is as climatically homogeneous as possible. Since both sites are in the same climate division, both are located on the shoreline of Chesapeake Bay, and the sites are located within 11 miles of each other, it is deemed acceptable to use meteorological statistics from Patuxent River Naval Air Station to represent the CCNPP site.

ER Impact:

ER Section 2.7.1 will be updated to include this information in a future revision to the ER.

Item Number 29 **ER Section 2.7**

Request:

Given the X/Q values in Table 2.7-115, what X/Q value was used for the 0 to 2 hour period at the EAB and for 0 to 8 hr period at the LPZ?

Response:

The ER dose assessments have been revised to incorporate X/Q values using 50^{th} percentile meteorology. The dose analyses use the updated X/Q values in ER Table 7.1-5. Table 2.7-115 will be updated using the time dependant X/Q values from Table 7.1-5.

For the LPZ doses, the 0 to 8 hr interval was subdivided into three parts (0 to 1.5 hr, 1.5 to 3.5 hr, and 3.5 to 8 hr) for the LOCA, and into two parts (0 to 2 hr, and 2 to 8 hr) for all other DBAs.

Table 7.1-5: 50^{th} Percentile CCNPP Site Atmospheric Dispersion Factors

Time Intervals (hrs)	Atmospheric Dispersion Factor (sec/m^3) (Nominal, 50% Meteorology)	
	EAB (Worst 2-hr)	LPZ (0 to 30 days)
LOCA		
0 to 1.5	n/a	1.181E-05
1.5 to 3.5[(a)]	8.079E-05	1.527E-05
3.5 to 8	n/a	1.191E-05
8 to 24		9.391E-06
24 to 96		6.607E-06
96 to 720		3.987E-06
All Other Accidents		
0 to 2	8.079E-05	1.527E-05
2 to 8	n/a	1,181E-05
8 to 24		9.391E-06
24 to 96		6.607E-06
96 to 720		3.987E-06
(a) In accordance with Regulatory Guide 1.183 (Section 4.1.5), the period of most adverse release of radioactive materials to the environment was assumed to occur coincident with the period of most unfavorable atmospheric dispersion.		

Table 2.7-115: 50th Percentile X/Q Values

Time Intervals (hrs)	Atmospheric Dispersion Factor (sec/m^3) (Nominal, 50% Meteorology)	
	EAB (Worst 2-hr)	LPZ (0 to 30 days)
LOCA		
0 to 1.5	n/a	1.181E-05
1.5 to 3.5[(a)]	8.079E-05	1/527E-05
3.5 to 8	n/a	1.181E-05
8 to 24		9.391E-06
24 to 96		6.607E-06
96 to 720		3.987E-06
All Other Accidents		
0 to 2	8.079E-05	1.527E-05
2 to 8	n/a	1.181E-05
8 to 24		9,391E-06
24 to 96		6.607E-06
96 to 720		3.987E-06
(a) In accordance with Regulatory Guide 1.183 (Section 4.1.5), the period of most adverse release of radioactive materials to the environment was assumed to occur coincident with the period of most unfavorable atmospheric dispersion		

ER Impact:

ER Tables 7.1-5 and 2.7-115 will be revised to include 50th percentile X/Q values in a future ER revision.

Item Number 30 **ER Section 2.7.2**

Request:

List all PSD Class I areas within 100 mi of the Calvert Cliffs site.

Response:

The Clean Air Act requires major stationary sources of air pollution and major modifications to major stationary sources to obtain an air pollution permit before commencing construction. The process is called new source review (NSR). Permits for sources in attainment areas are referred to as prevention of significant air quality deterioration (PSD) permits; while permits for sources located in non-attainment areas are referred to as non-attainment area (NAA) permits. The entire program, including both PSD and NAA permit reviews, is referred to as the NSR program.

The PSD program classifies areas in terms of the amount of growth it will permit before significant air quality deterioration would be deemed to occur. Class I areas have the smallest increments and thus allow only a small degree of air quality deterioration. Class II areas can accommodate normal well-managed industrial growth. Class III areas have the largest increments and thereby provide for a larger amount of development than either Class I or Class II areas. Congress established certain areas, e.g., wilderness areas and national parks, as mandatory Class I areas. These areas cannot be re-designated to any other area classification. All other areas of the country were initially designated as Class II.

For PSD permitting purposes, Calvert County is considered a Class II area. The closest Class I area is the Shenandoah National Park, which at its nearest point is located in Virginia about 90 miles (145 km) west the CCNPP site. There are no other PSD Class I areas within 100 miles (161 km) of the CCNPP site.

ER Impact:

No changes to the ER are required.

Item Number 31 **ER Section 2.7.3.1**

Request:

What is the probability of a tornado striking the site?

Response:

NUREG/CR-4461, Revision 2, Table 5-1 presents tornado strike probabilities for the contiguous United States and for the West, Central, and East regions of the country. The listed tornado strike probability for the East region, in which CCNPP is located, is 2.58E-5. This value takes into account finite building dimensions and the variation of tornado intensity along and across the tornado path (see Section 4.0 of NUREG/CR-4461).

ER Impact:

ER Section 2.7 will be updated to include tornado strike probability information in a future revision to the ER.

Item Number 32 **ER Section 2.7.6, 7.1**

Request:

Discuss estimation of site-specific short-term dispersion factors. 2.7.6 refers to 7.1; 7.1 refers to 2.7.

Response:

Making use of the methodology in Sections 1.4 and 2.2 of Regulatory Guide 1.145, the 0-2 hour 50th percentile value, and the five percentile values for all accident time periods, the 50th percentile values for the 2-8 hour, 8-24 hours, 1-4 days, and 4-30 days time periods were determined for the LPZ.

Regulatory Guide 1.145 requires the following steps to be performed for computation of the accident atmospheric dispersion factors (X/Q) at the Low Population Zone (LPZ):

1. The 2-hour accident X/Q and the annual average X/Q are determined for each sector at the outer LPZ boundary distances.
2. The two values for any given sector (the 2-hour accident χ/Q and the annual average X/Q) are plotted on a log-log graph, and values at other time intervals of interest are determined through logarithmic interpolation between these two points.
3. The time periods should be selected to represent appropriate meteorological time regimes (an 8-hour interval for releases during the first 8 hours of the postulated accident, a 16-hour interval for releases between 8 and 24 hours, a 3-day interval for releases between 1 and 4 days, and a 26-day interval for releases between 4 and 30 days).

Since the annual average X/Q is an integral part of the model for determination of accident X/Q values, it is possible to use the Regulatory Guide 1.145 methodology in reverse order to determine the annual average X/Q which was used in the computation of the accident X/Q values. The accident X/Q values and the annual X/Q value should be on a straight line when plotted on a log-log graph.

Analysis assumptions included:

- For ground level releases modeled using the computer code AEOLUS3, terrain heights are not used. (Per Reg. Guide 1.145 Section 1.3.2, release-point and receptor elevations are assumed to be the same.)
- Releases from the Stack for DBA analyses are at a height that is less than 2.5 times the height of adjacent solid structures and are therefore assumed to be ground level releases. (Per Reg. Guide 1.145, Section 1.3.2)
- For EAB/LPZ atmospheric dispersion factors for DBAs, all post-accident release points were based on the ground level release model with no dispersion credit for

building wake effects. However, plume meander, which predominates building wake effects during short time intervals, is accounted for.

Design inputs used to calculate the 50% X/Q values used in the accident analysis are provided in the table below.

New Section 2.7 Table: Design Input for 50% Percentile Atmospheric Dispersion Factor Computer Run

Parameter	Value(s)
Wind speed group upper limits for AEOLUS3	0.224, 0.75, 1.0, 1.5, 2.0, 3.0, 5.0, 7.0, 10.0, 13.0, 18.0, 50.0 meters/second
AEOLUS3 wind speed assigned to calms	0.25 miles per hour
Anemometer starting speed for the AEOLUS3 runs	0.5 miles per hour
Temperature sensor separation	60m – 10m or 50 meters
Wind instrument heights	10m, 60m
The annual average mixing layer height	900 meters
Meteorological channel units of measure	Wind speed miles per hour Wind direction degrees from True North Delta-Temperature degrees Fahrenheit per sensor separation in feet
Downwind distances	0.25, 0.5, 0.75, 1.0, 1.5, 3.0, 3.0, 4.0, 5.0 miles

ER Impact:

ER Section 2.7 will be updated to include the 50% X/Q design inputs in a future revision to the ER.

Item Number 33 **ER Section 2.7.6**

Request:

Describe what model options were used, not what options exist.

Response:

Table 2.7-99 through Table 2.7-114 present atmospheric dispersion factors (X/Qs) determined using methodologies from Regulatory Guide 1.111, as implemented in the AREVA NP computer code AEOLUS3, and seven years of on-site meteorological data (2000-2006). The values are normal effluent annual average atmospheric dispersion and deposition factors determined using the following input data (expressed in metric units as required by the computer model) and assumptions. More detailed information on input to AEOLUS3 is provided in the new Table to be included in Section 2.7.

- Seven years of on-site meteorological data (2000 – 2006).
- Type of release: mixed mode.
- Plume meander was considered.
- The open terrain recirculation correction factors (RCF's) from RG 1.111, Rev. 0, were used since no site-specific RCF's were available.
- Wind speed extrapolation with height, where applicable, was done using the coefficients from XOQDOQ.
- Dispersion coefficients (σ_y and σ_z) were computed using the Eimutis/Konicek model in XOQDOQ.
- Depletion and deposition were computed using the RG 1.111, Rev. 1, curves.
- Wet deposition effects were not evaluated.
- No credit was taken for decay-in-transit of noble gases and iodines.
- Wind sensor height: 10 m.
- Vertical temperature difference: 60 m temperature – 10 m temperature.
- Number of wind speed categories: 12.
- Release height: 62 m.
- Cross-sectional area of building adjacent to the release point causing building wake effects: 2940 m^2.
- Height of containment building: 60 m.
- Distance from the stack to the nearest site boundary: 429.4 m.
- Distance from the stack to the nearest resident: 1770.0 m.
- Distance from the stack to the nearest vegetable garden: 1770.0 m.

New Section 2.7 Table: Input for AEOLUS3 Normal Effluent X/Q Run

Parameter	Value(s)
Anemometer starting speed	0.5 miles per hour
Wind speed group upper limits for AEOLUS3	0.224, 0.75, 1.0, 1.5, 2.0, 3.0, 5.0, 7.0, 10.0, 13.0, 18.0, 50.0 meters/second
AEOLUS3 wind speed assigned to calms	0.25 miles per hour for CC
The annual average mixing layer height at CC	748 meters
Temperature sensor separation	50 meters
Wind instrument heights	10 meters and 60 meters
CC meteorological channel units of measure	Wind speed miles per hour Wind direction degrees from True North Delta-Temperature degrees Fahrenheit per sensor separation in feet
Order of data channels in met data	Wind speed, wind direction, wind range, delta temperature, precipitation
Receptor distances for normal effluent release	Downwind distances for which atmospheric dispersion factors for normal effluent analyses will be determined using computer code AEOLUS3, Version 1.0, are: 805 meters (0.5 mile), 1000 meters (0.62 mile), 2414 meters (1.5 miles), 4023 meters (2.5 miles), 5632 meters (3.5 miles), 7241 meters (4.5 miles), 12068 meters (7.5 miles), 24135 meters (15 miles), 40225 meters (25 miles), 56315 meters (35 miles), and 72405 meters (45 miles).
Stack flow rate for normal operations	242,458 cfm This is a conservative value; the actual flow rate for normal operations will be higher.
Stack inner diameter	3.8 meters
Stack height	62 meters (2 meters above assumed Reactor Building)
Reactor Building height and cross sectional area	60 meters (used for cross sectional area for building wake – smaller height gives a lower credit for building wake; actual = 62.3 meter) 2940 m2
Maximum Terrain Heights 0.5 miles	Values in meters above plant grade. 0.0 0.0

Parameter	Value(s)
	0.0 0.0 16.8 19.8 22.9 22.9 19.8 29.0 29.0 25.9 32.0 22.9 22.9 19.8
0.62 miles	Values in meters above plant grade. 0.0 0.0 0.0 0.0 16.8 19.8 22.9 22.9 19.8 29.0 29.0 25.9 32.0 22.9 22.9 19.8
1.5 miles	Values in meters above plant grade. 0.0

Parameter	Value(s)
	0.0 0.0 0.0 16.8 19.8 25.9 22.9 25.9 29.0 29.0 25.9 32.0 25.9 25.9 19.8
2.5 miles	Values in meters above plant grade. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 25.9 29.0 29.0 25.9 32.0 25.9 25.9 19.8
3.5 miles	Values in meters above plant grade.

Parameter	Value(s)
	0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 25.9 32.0 25.9 25.9 19.8
4.5 miles	Values in meters above plant grade. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 25.9 32.0 29.6 25.9 19.8

Parameter	Value(s)
7.5 miles	Values in meters above plant grade. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 25.9 32.0 32.0 26.3 26.3
15 miles	Values in meters above plant grade. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 26.3 44.3 32.0 27.3

Parameter	Value(s)
	43.3
25 miles	Values in meters above plant grade. 0.0 0.0 6.3 6.3 19.1 22.4 28.9 28.9 29.9 32.2 31.3 26.3 45.3 49.3 52.3 61.3
35 miles	Values in meters above plant grade. 6.3 1.3 6.3 6.3 19.1 22.4 28.9 28.9 29.9 32.2 39.3 46.3 45.3 51.3

Parameter	Value(s)
	66.3 61.3
45 miles	Values in meters above plant grade. 6.3 6.3 6.3 6.3 19.1 22.4 28.9 28.9 29.9 32.2 46.3 52.3 45.3 78.3 78.3 61.3

ER Impact:

ER Section 2.7 will be updated to include the inputs for the normal effluent X/Q values in a future revision to the ER.

Item Number 34 **ER Section 2.7.6**

Request:

Provide EAB and LPZ boundaries.

Response:

The boundaries of the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) are 0.5 miles (0.8 km) and 1.5 miles (2.4 km), respectively. This information regarding both of these areas is stated in several locations within the ER, including Section 7.1.

ER Impact:

No changes to the ER are required.

Item Number 35 **ER Section 3.4.1**

Request:

Table 1.3-1 presents the necessary Federal, State, and local permits. Discuss the status of the NPDES permit and 316(a) and (b). (Cross reference with HP-1[(a)])

Response:

The industrial surface water discharge permit is a combined federal and state permit issued under the National Pollutant Discharge Elimination System (NPDES). Maryland regulations require discharge permit applications be submitted no less than 180 days before commencing any regulated activities including changes in permitted discharges into surface waters. The permit will address all applicable requirements including those associated with Clean Water Act provisions in 316(a), discharge impacts from thermal discharges, and 316(b), cooling water intake environmental impacts. The application for an NPDES permit will be submitted well in advance of the completion of construction in 2015.

ER Impact:

No changes to the ER are required.

Item Number 36 **ER Section 3.4.2**

Request:

Provide detailed discussion or figures on the bathymetry of the discharge, although a general bathymetry figure is provided in Fig. 2.3.1-27. Provide the relationship of the discharge location to the thalweg and water surface depth.

Response:

Bathymetry in the vicinity of the CCNPP Unit 3 intake structures is shown in Figure 2.3.1-27. As discussed in ER Subsection 3.4.2.2, CCNPP Unit 3 discharge structure (diffusers) would be located approximately 1200 ft or

0.227 mi (366 m) south of the CCNPP Unit 3 intake structure and approximately 550 ft or 0.104 mi (168 m) into the Chesapeake Bay (offshore). Figure 3.4-7 shows that the water depth at the discharge location would be approximately 10ft below mean low water.

Section 2.3.1.1.2.5 discusses that the Chesapeake Bay is approximately 6 mi wide near the site and the deepest seabed elevation (thalweg) across the Chesapeake Bay near the site is approximately -100 ft (-30 m) NGVD29. This thalweg is located closer to the eastern shore at approximately 4.5 mi (7.2 km) from the CCNPP Unit 3 discharge location.

Figure 2.3.1-27 will be revised to include the CCNPP Unit 3 discharge location and the Chesapeake Bay thalweg in a future revision of the ER.

ER Impact:

Figure 2.3.1-27 will be revised to include the CCNPP Unit 3 discharge location and the Chesapeake Bay thalweg in a future revision of the ER.

Item Number 37 **ER Section 3.4.2**

Request:

Provide a discussion of the impacts of deicing (Section 3.4.1.3.2), as there is a potential issue with icing in the past (page 3.4.-3). Fig. 3.4-(4-5) hard to read fine print, so please clarify. Dredging may be required to maintain the channel invert elevation for the intake, so provide a discussion associated with this potential impact.

Response:

To mitigate potential ice effects on the CCNPP Unit 3 intake, automatic and continuous raking of trash racks is used to ensure the trash racks are free of ice buildup. Additionally, the trash racks and/or the traveling water screens will be equipped with heat tracing. There is no adverse impact of this de-icing method to the environment.

Existing intake channel for CCNPP Units 1 and 2 shows slow silt accumulation over time. However, such sedimentation has not required the intake channel to be dredged to this date. The intake channel for the new CCNPP Unit 3 will experience a similar sedimentation behavior. The fine silts that would accumulate within the intake channel may need to be dredged (by hydraulic dredgers), and any such dredging activity would have to meet required federal and state regulatory requirements at the time of dredging.

The potential impact associated with the periodic dredging in the intake channel is addressed in the response to RAI Item Number HS-41.

Figures 3.4-4 and 3.4-5 will be revised to improve readability in a future revision of the ER.

ER Impact:

Figures 3.4-4 and 3.4-5 will be revised to improve readability in a future revision of the ER.

Item Number 38 **ER Section 3.5**

Request:

Provide principle release points and relative location of receptors.

Response:

ER Section 3.5 provides descriptions of the design and operation of the liquid and gaseous radioactive waste treatment systems and identifies the release points and content of plant effluents that are used in Section 5.4 to evaluate the radiological environmental impact during normal operations. Details on the liquid waste release point to the environment are given in ER Section 3.5.2.1. Additional details on the configuration of the submerged offshore diffuser discharge structure are located in ER Section 3.4.2.2 and Figure 3.4-7. Liquid pathway receptor locations are described in ER Section 5.4.2.1.

All significant gaseous effluent releases occur from the plant vent stack located next to the Reactor Building as described in ER Section 3.5.3.2. ER Figure 3.1-1 illustrates the location of the effluent releases relative to the site boundary and surrounding environment. For dose assessments from routine gaseous effluents, ER Section 5.4.2.2 and Table 5.4-5 indicate the exposure pathways and locations of maximum site boundary and critical receptors relative to the Reactor Building. ER Table 5.4-6 provides the distance and direction to all nearest site boundary, residence and vegetable garden in each of the sixteen compass directions. No milk animals have been identified within 5 miles (8 km) of the site.

ER Impact:

No changes to the ER are required.

Item Number 39 **ER Section 3.6.1**

Request:

Table 3.6-1 presents treatment system processing chemicals, but does not present the chemicals in the treatment system that these processing chemicals are being used to treat. What are the chemical levels anticipated in the liquid waste streams for CWS, ESWS, etc.? (Cross reference with HS-35[a])

Response:

Section 3.3.2 of the CCNPP Unit 3 Environmental Report (ER) indicates the following:

- Makeup treatment will consist of biocide (e.g., sodium hypochlorite) to treat marine growth and control fouling on heat exchanger surfaces.
- For the prevention of leglonella, CWS plping may be treated with hyperchlorlnation in combination with continuous or intermittent chlorination at lower levels, biocide and scale inhlbitor addition (e.g., sodium hypochlorite and dispersant and chlorine).
- Blowdown will depend on water chemistry but Is anticipated to include application of a biocide, dechlorination, and scale inhibitor to control bio-prowth, reduce residual chlorine and protect against scaling, respectively (e.g., sodium hypochlorlte, sodium bisulfite, dispersant). An antifoam may also be added since seawater has a tendency to foam due to the presence of organics.

The anticipated levels of chemicals in the liquid waste streams for CWS and ESWS are as indicated in the last column for Table 3.6-1 and are based on parameters required to be sampled per the NPDES permit for CCNPP Units 1 and 2. Analytical results for recent water samples collected at the CCNPP Units 1 and 2 intake structure are provided in Table 2.3.3-8.

Water quality trends based on NPDES data collected in 2006 to determine the nature of effluent discharges from the CCNPP site are provided In ER Section 6.1.1. Discharge parameters Included biologic oxygen demand, chlorine (total residual), bromine, cyanuric acid, fecal coliform, oil and grease, pH, temperature and total suspended solids.

ER Impact:

No changes to the ER are required.

Item Number 40 **ER Section 3.6.1**

Request:

Given some perceived potential inconsistencies in the report, provide the discharge rates associated with the waste streams or refer to figures and tables such as Figure 3.3-1 and Table 3.3-1. (Cross reference with HS-3, 10, 11, 12, 23, 24, 25, 29, 31, 36, 40, 45[(a)])

Response:

The average and maximum effluent discharge flows into Chesapeake Bay are provided in ER Table 3.3-1 and shown on ER Figure 3.3-1. ER Table 3.3-1 and Figure 3.3-1 have been updated, as provided in the response to RAI Item Number 7.

ER Impact:

ER Table 3.3-1 and Figure 3.3-1 will be updated in a future revision to the ER.

Item Number 41 **ER Section 3.6.2**

Request:

Provide procedures for offsite disposal of sanitary waste.

Response:

As described in ER Section 6.6.3, the CCNPP Unit 3 Waste Water Treatment Plant will collect sewage and waste water generated and treat these effluents using extensive mechanical, chemical, and biological treatment processes. The treated effluent will be combined with the discharge stream from the onsite waste water retention basin and discharged to the Chesapeake Bay. The discharge will be in accordance with local and state safety codes. The dewatered sludge will be hauled offsite for disposal at municipal facilities.

ER Impact:

No changes to the ER are required.

Item Number 42 **ER Section 3.6.2**

Request:

Figure 3.3-1 and Table 3.3-1 report 20 gpd from the Waste Water Treatment Plant for normal operations. Section 3.6.2 page 3.6-2 reports 19,500 gpd during construction activities. Page 3.6-2 and Table 3.6-3 suggest 19,500 gpd during normal operations. This perceived inconsistency needs to be clarified. (Cross reference with HS-34[a])

[Table referencing appears out of order. Table 3.6-7 comes before Table 3.6-2]

Response:

1) Figure 3.3-1 and Table 3.3-1 indicate that during normal operation, treated sanitary waste will be 20 gpm, not 20 gpd. Note that 20 gpm equates to 28,800 gpd.

   As stated in Section 3.6.2, during the second through fifth years of construction, sanitary waste is expected to be 19,500 gpd. It is anticipated that sanitary waste generated during construction of CCNPP Unit 3, will be less than that generated during operation of the plant.

   As noted in Table 3.6-3, the flow of 19,500 gpd is based on effluent for the CCNPP Units 1 and 2 Waste Water Treatment Plant. For clarification purposes, in lieu of listing treated waste water flow based on existing data, the anticipated treated waste water flow for CCNPP Unit 3, as indicated in Table 3.3-1, will be referenced.

   As a note, the water use values provided in ER Table 3.3-1 and ER Figure 3.3-1 have been updated.

2) Although referenced to the tables are out of sequence, they are correct. Section 3.6.2 correctly refers the reader to Table 3.6-7 for waste water treatment plant capacity and unit loading, and Section 3.6.3.2 correctly refers the reader to Table 3.6-2 for desalinization plant water quality.

An updated copy ER Table 3.3-1 and a preliminary water use diagram showing updated flow values and addition of a seal well in the effluent release flow path is attached. The water use diagram will be used to update ER Figure 3.1-1, and is considered preliminary and is marked "draft" because it has not been released for construction.

ER Impact:

For clarification purposes, treated waste water flow will be deleted from Table 3.6-3 and a note will be provided indicating that the value can be found in Table 3.3-1. Figure 3.3-1 and Table 3.3-1 will be updated to indicate the updated flow values and modified flow arrangement shown in a future ER revision.

A statement will be added at the end of the second to last paragraph of Section 3.6.2 stating that sanitary effluents generated during construction of CCNPP Unit 3 are expected to be less than those generated during operation.

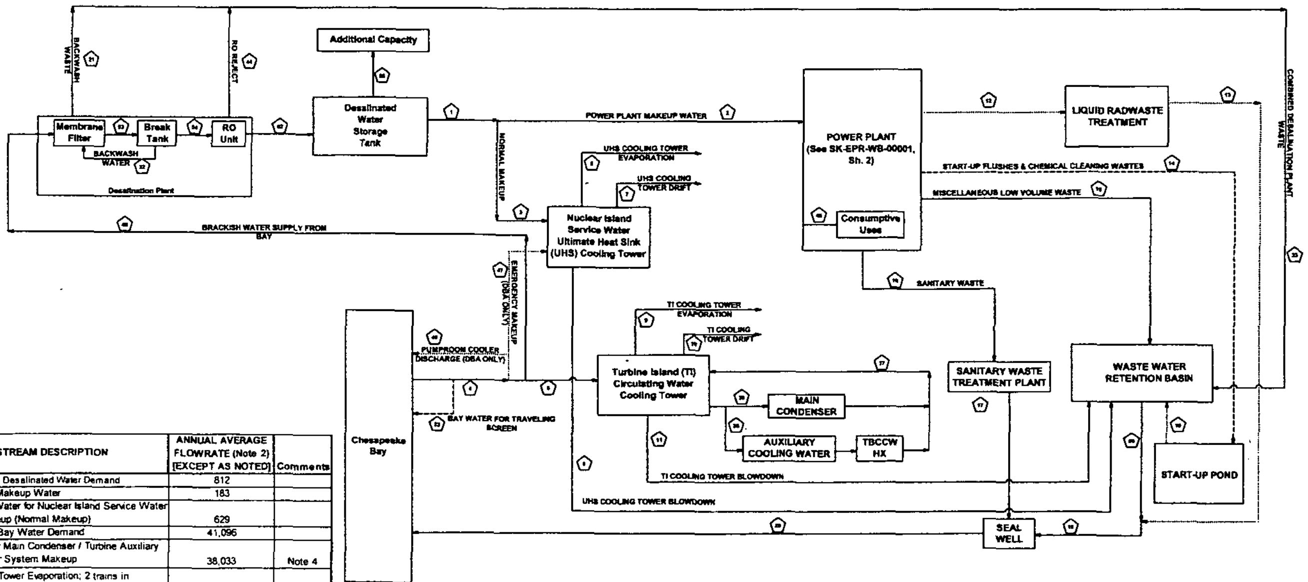
These changes, as well as the updating ER Table 3.3-1 and Figure 3.3-1 will be provided in a future revision to the ER.

Table 3.3-1: Anticipated Water Use

Water Streams	Average Flow [a] gpm (lpm)	Maximum Flow [b] gpm (lpm)
Chesapeake Bay Water Demand for Desalinization[c,d]	**3,063 (11,595)**	**3,063 (11,595)**
Membrane Filtration (Backwash)	306 (1,158)	306 (1,158)
Reverse Osmosis	2,757 (10,437)	2,757 (10,437)
Reverse Osmosis Reject [e]	*1,532 (5,799)*	*1,532 (5,799)*
Essential Service Water System (ESWS)/Ultimate Heat Sink (UHS) System Makeup [e,f]	*629* (2,381)	*1,490 (5,640)*
'ESWS' Cooling Tower Evaporation' [l]	*'566' ('2,142')*	*'1,364' ('5,163')*
'ESWS' Cooling Tower Drift'	*'2' ('8')*	*'4' ('16')*
'ESWS' Cooling Tower Blowdown'	*'61' ('231')*	*'122' ('461')*
Power Plant Makeup	*183* (693)	926 (3,505)
'Demineralized Water Distribution System'	*'80' ('303')*	*'80' ('303')*
'Potable and Sanitary Water Distribution System' [k]	*'93' ('352')*	*'216' ('818')*
"Plant Users" [k]	*"93" ("352")*	*"216" ("818")*
"Non-Plant Users" [g]	*"0" ("0")*	*"0" ("0")*
'Fire Water Distribution System' [h]	*'5' ('19')*	*'625' ('2,365')*
'Floor Wash Drains'	*'5' ('19')*	*'5' ('19')*
Additional Capacity	*413 (1,563)*	*413 (1,563)*
Chesapeake Bay Water Demand	**41,095 (155,563)**	**47,383 (179,365)**
Desalinization Plant	3,063 (11,595)	3,063 (11,595)
Circulating Water System (CWS)	38,032 (143,968)	44,320 (167,770)
CWS Cooling Tower Evaporation	*19,016 (71,984)*	*22,160 (83,885)*
CWS Cooling Tower Drift [i]	*39 (148)*	*39 (148)*
CWS Cooling Tower Blowdown	*18,977 (71,836)*	*22,121 (83,737)*
Effluent Discharge to Chesapeake Bay from Seal Well[m]	**21,019 (79,566)**	**24,363 (92,224)**
Seal Well	21,019 (79,566)	24,363 (92,224)
Waste Water Retention Basin Discharge	20,915 (79,172)	24,136 (91,364)
Miscellaneous Low Volume Waste	*39 (148)*	*55 (209)*
ESWS Cooling Tower Blowdown	*61 (231)*	*122 (461)*
CWS Cooling Tower Blowdown	*18,977 (71,836)*	*22,121 (83,737)*
Desalinization Plant Waste	*1,838 (6,957)*	*1,838 (6,957)*
'Membrane Filtration'	*'306' ('1,158')*	*'306' ('1,158')*
'Reverse Osmosis Reject' [e]	*'1,532' ('5,799')*	*'1,532' ('5,799')*
Start-up Temporary Storage Discharge [j]	---	---
Trash Screen Cleaning Water Discharge [j]	---	---
Treated Sanitary Waste	93 (352)	216 (818)
Treated Liquid Radwaste	11 (42)	11 (42)

Key:
gpm – gallons per minute
lpm – liters per minute

NOTES:
1. ADDITIONAL CAPACITY ALLOTTED FOR LATER USAGE.
2. WATER FLOW RATES ARE BASED ON THE SPECIFIED PROCESS CONDITIONS FOR THE PLANT CONFIGURATION AND ARE SHOWN IN GPM (GALLONS PER MINUTE) UNLESS OTHERWISE SPECIFIED.
3. NORMAL FLOW RATE IS SHOWN. MAXIMUM INSTANTANEOUS FLOW RATE MAY BE GREATER.
4. MAIN CONDENSER / TURBINE AUXILIARY COOLING WATER SYSTEM FLOWRATE CONSIDERED UNDER MAXIMUM (SUMMER) CONDITIONS.
5. UHS COOLING TOWER EVAPORATION FLOWRATE IS BASED UPON THE WORSE CASE 72 HOUR PERIOD OF THE TIMEFRAME FROM 1975 - 2005.
6. TI COOLING TOWER EVAPORATION FLOWRATE IS BASED UPON A 2.42% SUMMER EVAPORATIVE LOSS FOR CONTINUOUS TOWER OPERATION WITHOUT PLUME ABATEMENT.



LEGEND

————	Normal Flows
- - - - -	Start-up/ Commissioning Flows
····················	No flow or intermittently no flow per operating requirements
(pentagon symbol)	Stream Number

STREAM NO.	STREAM DESCRIPTION	ANNUAL AVERAGE FLOWRATE (Note 2) [EXCEPT AS NOTED]	Comments
1	Total Required Desalinated Water Demand	812	
2	Power Plant Makeup Water	183	
3	Desalinated Water for Nuclear Island Service Water System Makeup (Normal Makeup)	629	
4	Chesapeake Bay Water Demand	41,096	
5	Bay Water for Main Condenser / Turbine Auxiliary Cooling Water System Makeup	38,033	Note 4
6	UHS Cooling Tower Evaporation; 2 trains in operation	566	Note 5
7	UHS Cooling Tower Drift	2	
8	UHS Cooling Tower Blowdown	61	
9	TI Cooling Tower Evaporation	19,016	Note 6
10	TI Cooling Tower Drift	39	
11	TI Cooling Tower Blowdown	18,977	
12	Liquid Radwaste	11	
13	Treated Liquid Radwaste	11	
14	Startup Flushes & Chemical Cleaning Wastes	0	Note 3
15	Miscellaneous Low Volume Waste	39	
16	Sanitary Waste	93	
17	Treated Sanitary Waste	93	
18	WWRB & Liquid Radwaste Discharge to Seal Well	20,925	
19	Startup Pond Discharge	0	Note 3
20	Seal Well Discharge	21,019	
21	Desal Membrane Filter Backwash Waste	306	
22	Water Required to Clean Trash Screens	0	Note 3
32	Desal Membrane Filter Backwash	306	
33	Combined Desalination Plant Waste	1,838	
35	Auxiliary Cooling Water Flow	21,720	
36	Main Condenser flow	764,082	
37	Combined flow back to TI cooling tower	785,802	
44	RO Reject from Desalination Plant	1,531	
46	Consumptive Losses	40	
47	Emergency Makeup Water [Design Basis Accident (DBA) Only]	0	Note 3
48	Brackish Water Influent to Desalination Plant	3,063	
49	Emergency Makeup Pumproom Cooler (DBA Only)	0	Note 3
52	Desalinated Water Effluent	1,225	
53	Influent to RO Break Tank	3,063	
54	Influent to RO membrane	2,756	
55	Additional Capacity Usage	413	
56	WW Retention Basin to Discharge	20,914	

DRAFT

NS

REV 00B SIGNOFF

Brian T. Pick 3/27/08

ERNESTINE JOHNSON 3/27/08

Joseph M. Mate 3/27/08

N/A

N/A

SHANKAR RAO 3/27/08

EA Sherow 3/27/08

N/A

N/A

DESIGN VERIFICATION REPORT: N/A

U.S. EVOLUTIONARY POWER REACTOR (EPR)

CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 3

AREVA

N/A

CONTRACT NO. 300065 | JOB NO. 25237

WATER BALANCE DIAGRAM

REVISION DESCRIPTION	AREVA SERIAL NO.	N/A	N/A
ISSUED FOR	BECHTEL DOCUMENT NO.	25237-209-M5-YA-00001	00B
OWNER'S ACCEPTANCE	UNISTAR DOCUMENT NO.	CCNP3-002-YA-MG00-00001	00B
	SIZE: D	SCALE: NTS	PAGE 1 OF 1 · REV

22" x 34" D SIZE

Item Number 43 ER Section 3.6.3

Request:

Provide applicable Federal, and State atmospheric emission standards.

Response:

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

EPA has also established a National Emission Standard for Hazardous Air Pollutants (NESHAP) standard that applies to Stationary Reciprocating Internal Combustion Engines located at major sources of hazardous air pollutants (HAPs) (40 CFR Part 63, Subpart ZZZZ). The requirements in this rule that apply to emergency generators are limited to notification provisions and do not apply to these new generators because CCNPP will not be a major source of HAP emissions.

Maryland regulations prohibit the burning of distillate fuel oil with greater than 0.3 percent sulfur in designated geographic "Area V" which includes Calvert County (COMAR 26.11.09.07). The federal requirement for burning off-road diesel fuel oil containing 500 ppm (0.05%) sulfur or less at time of installation will be considerably more stringent than the state requirement. Fuel-burning equipment consuming distillate oil are exempt from Maryland particulate limitations for fuel combustion because of low levels of particulate emissions (COMAR 26.11.09.06.A (3) (c)). Maryland regulations do not include a limit on NO_x emissions for fuel-equipment that operate less than 500 hours with a capacity factor of less than 15%. Thus, there are no applicable emission regulations for NO_x for the Unit 3 generators.

The cooling towers as a source of particulate emissions must comply with Maryland's total particulate matter (PM) limitation in COMAR Regulation 26.11.06.03B (a). Sources installed in Area V (i.e., Calvert County), must meet a PM emission limit of 0.05 grains per dry standard cubic foot of exhaust air. This regulation was developed for industrial sources of PM emissions, and could technically apply to cooling towers. However, the Unit 3 cooling towers even without any drift eliminators (uncontrolled) would never approach the allowed level of emissions from this regulation, i.e., the allowable PM emissions are 24,604 lb/hr and there is only 69.6 lb/hr of PM in all of the water droplets that could pass through the drift eliminators.

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

The cooling tower is subject to the best available control technology (BACT) requirements through permitting under the under the Prevention of Significant Deterioration of Air Quality (PSD) regulations (40 CFR 52.21) implemented by the State of Maryland. The BACT demonstration for controlling particulate emissions from the cooling tower is controlling emissions to a design specification for drift elimination of 0.0005 percent of the towers recirculated cooling water rate.

ER Impact:

No changes to the ER are required.

Item Number 44 **ER Section 4.1.1**

Request:

What is the status of the consistency determination for the proposed project by the Maryland Department of the Environment under the Coastal Zone Management Act? If no application has been submitted, please specify the planned date of submittal.

Response:

The Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland (USACE Application Number NAB-2007-08123-MO5) to the state of Maryland and the US Army Corps of Engineers was submitted on May 16, 2008. This application provided certification that the project was consistent with the Maryland Coastal Zone Management Plan.

ER Impact:

No changes to the ER are required.

Item Number 45 **ER Section 4.1.1**

Request:

What is the status of approval by the Chesapeake Bay Critical Area Commission for the proposed project?

Response:

The Chesapeake Bay Critical Commission Committee and Board meetings on the CCNPP Unit application are scheduled for early July 2008.

ER Impact:

No changes to the ER are required.

Item Number 46 **ER Section 4.1.1**

Request:

Does Constellation/Unistar plan to conduct any preconstruction activities for Unit 3 that do not require NRC authorization? (LWA rule, ESRP 4.1.1)

Response:

Site preparation and preconstruction activities not requiring NRC authorization are anticipated to occur; however, the scope and extent of those activities have not yet been finalized. It is currently planned to clear the relevant land, perform preliminary grading, and possibly begin construction of non-safety related support structures (e.g., including but not limited to a warehouse and a concrete batch plant) that may support construction. Such activities do not require prior NRC authorization. However, such activities are contingent upon the receipt of other required permits and authorizations from other state and federal agencies.

ER Impact:

No changes to the ER are required.

Item Number 47 **ER Section 4.1.1**

Request:

Does Constellation/Unistar plan to submit an application to NRC for a limited work authorization? (LWA rule)

Response:

UniStar has not decided to pursue an LWA at this time.

ER Impact:

No changes to the ER are required.

Item Number 48 **ER Section 4.1.1**

Request:

The Surficial Aquifer is primarily tapped by irrigation wells and some old farm and domestic wells. Not widely used as a potable water supply (pp. 4.2-2, 2.3-36). How is removing a good portion of the Surficial Aquifer going to impact the water resources and water availability to the irrigation wells and old farm domestic wells? Bio-retention ditches are designed to allow for runoff to infiltrate. Recharge areas for the Surficial Aquifer will shift, slightly, and the amount of recharge may increase. What is the shift, and how much more infiltration is anticipated? This will be controlled by NPDES permits. (pp. 4.2-7). How will this increased infiltration impact on St. Johns Creek and the wetlands? (Cross reference with HI-1, HS-14[a])

Response:

The statement, "The Surficial Aquifer is primarily tapped by irrigation wells, and some old farm and domestic wells...," was taken from a Maryland Geological Survey report dated June 2005 ("Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles and St. Mary's Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers"), which related to groundwater conditions in the three counties—Calvert, Charles and St. Mary's. Hence, the statement is a generalization about the Surficial aquifer for the entire three-county region.

No irrigation wells are known to exist in the vicinity of the plant, and no nearby offsite wells are known to tap the Surficial aquifer. This is because the aquifer's saturated thickness is limited and variable, and consequently any shallow wells tapping the unit would tend to dry up during periods of drought. The known offsite wells (primarily domestic) within 1.5-mile radius of the site tap the Piney Point-Nanjemoy aquifer, as do seven of the 12 wells on the plant property (the remaining five onsite wells tap the deeper Aquia aquifer). The Piney Point-Nanjemoy aquifer in the plant vicinity occurs in the approximate depth range of 300 to 400 feet.

At the site and vicinity, the Surficial aquifer is considered a terrace deposit and, as such, is found only in the upland areas and is usually of limited areal extent. Each distinct area where the deposits exist is separated and bounded by the streams and tributaries of the area. In the power block area, Figures 2.3.1-38 and 2.3.1-39 illustrate how the aquifer pinches out due to its being dissected by the streams and tributaries of the plant area. Groundwater from the Surficial aquifer deposits discharges through seeps into the bounding tributaries and streams.

Removal of a portion of the Surficial aquifer in the area of the CCNPP Unit 3 and its replacement with buildings, paved areas and other impermeable surfaces will effectively eliminate direct recharge into that aquifer via precipitation. As explained above, the Surficial aquifer in that area is physically and hydraulically isolated from neighboring expressions of the aquifer. Sand-filter ditches will receive and drain off surface runoff from the CCNPP Unit 3 area. On the east side, the ditches draining the power block and the adjacent laydown area will convey runoff to a wetland creation area located east of the power block. On the west side, ditches draining the switch yard area will discharge into an unlined storm water basin located to the west, and runoff from sand filter ditches in the cooling tower area and the parking area will discharge directly into tributaries to Johns Creek. The outflow structure for the storm-water basin will be designed to release water at low enough rates so that the receiving stream will not be subject to either erosion or sedimentation, beyond what is naturally occurring now.

The bottom of the drainage ditches will consist of a permeable layer of sand or gravel and this will permit infiltration down into the remaining (lower) portion of the Surficial aquifer. The ditches will be designed to accommodate as much as a two-year 24-hour rain event

Recharge to this local Surficial aquifer will shift in that direct recharge via precipitation will largely cease, while recharge to the aquifer will occur through the bottoms the sand-filter ditches, and the storm-water basin. This infiltration into the remaining portion of the Surficial aquifer will compensate in large part for the elimination of recharge through infiltrating precipitation. Based on observations made at other sites where the land surface has been lowered, it is expected that at the power block the post-construction steady-state water table in the aquifer may be a few feet lower than that indicated in Figures 2.3.1-42 through -45. While such lowering of the water table may reduce the rate of groundwater discharge into the bounding tributaries somewhat, this would be compensated for by the runoff flow contributed from the sand-filter ditches to the wetland creation area on the east side and to the tributaries to Johns Creek on the west side. Thus, no significant change in the long term or short term flow to the streams and wetlands from the power block area is expected.

ER Impact:

No changes to the ER are required.

Item Number 49 **ER Section 4.2.1.1**

Request:

Section 4.2.1.1 notes that streams are typically fed by springs and seeps. The Surficial aquifer is replenished by precipitation-generated infiltration {Section 2.3.1.2.2.1, pg 2.3-13}. Provide an analysis of how construction activities, associated with the diversion of runoff, will impact streams and wetlands, other than noting that a State discharge permit will protect the natural resources. (page 4.2-(1-2); 4.2.1.4 page 4.2-5; 4.2.1.5 page 4.2-6) (Cross reference with HS-13, 19[a])

Response:

Sand-filter ditches will receive and drain off surface runoff from the Unit 3 area. On the east side, the ditches draining the power block and the adjacent laydown area will convey runoff to a wetland creation area located east of the power block. On the west side, ditches draining the switchyard area will discharge into an unlined storm-water basin located to the west, and runoff from sand filter ditches in the cooling tower area and the parking area will discharge directly into tributaries to Johns Creek. The outflow structure for the storm-water basin will be designed to release water at low enough rates so that the receiving stream will not be subject to either erosion or sedimentation, beyond what is naturally occurring now.

The bottom of these ditches will consist of a permeable layer of sand or gravel and thus will permit infiltration down into the Surficial aquifer. These ditches will be designed to accommodate as much as a two-year 24-hour rain event

Based on observations made at other sites where the land surface has been lowered, it is expected that at the power block the post-construction steady-state water table in the aquifer may be a few feet lower than that indicated in Figures 2.3.1-42 through -45. While such lowering of the water table may reduce the rate of groundwater discharge into the bounding tributaries somewhat, this would be compensated for by the runoff flow contributed from the sand-filter ditches to the wetland creation area on the east side and to the tributaries to Johns Creek on the west side.

A detailed storm-water management study will be conducted to evaluate adequate sizes of the several components of the storm-water system to maintain both quality and quantity requirements for the downstream area. This will include analyzing the pre-development and post-development site hydrology for the 1-, 2-, 5-, 10- and 100-year 24-hour rainfall events. The planned storm-water management system will be sized such that the downstream flow rates, sediment loads and water quality will be similar to the existing conditions and such that the post-development peak discharges will not exceed the pre-development rates.

ER Impact:

No changes to the ER are required.

Item Number 50 **ER Section 4.2.1.5**

Request:

Wetlands are described as the reason for a MODERATE surface water impact; yet no wetlands analysis is provided to justify the impact on the wetlands or this conclusion. (page 4.2-6) (Cross reference with HI-1, HS-9, HS-18, HS-19[(a)])

Response:

As indicated on page 4-2-6, surface-water use impacts are considered MODERATE primarily due to the loss of wetlands and wetland buffers. As a result, this loss will require mitigation. An analysis of the nine wetland assessment areas identified in the site area is provided in Section 4.3.1.3 of the report, and the planned mitigation measures are described in Section 4.3.1.6.

The planned construction will involve the permanent filling of an estimated 8,350 linear feet (2,545 m) of intermittent and upper perennial stream channels and approximately 11.7 acres (4.7 hectares) of the delineated wetland areas. The project would also disturb approximately 30.9 acres (12.5 hectares) of land defined by Calvert County as non-tidal wetland buffer (lands within 50 feet [15 m] of the landward edge of non-tidal wetlands). Most of the wetland fill would take place in Wetland Assessment Areas I, II, IV VII and IX.

As defined in Section 1.2.6 of the report, MODERATE effects are environmental effects that are sufficient to alter noticeably, but not to destabilize, important attributes of a resource. In order to mitigate the noticeable alteration to the site wetlands, several mitigation measures will be considered based on the results of a planned field survey to be conducted during construction activities to determine the appropriate areas for onsite wetland mitigation (Section 4.3.1.6). This will include, in consultation with state and local resource agencies, consideration of (1) the construction of new replacement wetlands in favorable areas of the site and (2) enhancement of existing contiguous wetlands. The soils and surface hydrology of any candidate area for wetland creation would be evaluated in detail to determine that new wetland construction is feasible. Wetland enhancement could include (a) eradication of the invasive grass *Phragmites* and its replacement with regionally indigenous wetland vegetation, and (b) stabilization of any eroding stream channel and stream channel banks in an area potentially impacted by site construction.

ER Impact:

No changes to the ER are required.

Item Number 51 **ER Section 4.2.2**

Request:

A quantitative analysis assessing dredging activities around the new intake and discharge structures has not been addressed, although this is to be covered by the permitting process. Likewise, construction activities associated with road construction, laydown areas, sedimentation basins, etc. are also to be covered by the permitting process. Provide these analyses. (Cross reference with HP-1, HS-13, HS-19[a])

Bio-retention ditches are designed to allow for runoff to infiltrate. Recharge areas for the Surficial Aquifer will shift slightly, and the amount of recharge may increase. What is the shift, and how much more infiltration is anticipated? This will be controlled by NPDES permits. (pp. 4.2-7). How will this increased infiltration impact St. Johns Creek and the wetlands? (Cross reference with HP-1, HS-13, HS-19[a])?

Response:

Section 4.3.2.2 of the report provides an assessment of the impacts of excavation and dredging for the intake structure, discharge pipe and the barge slip, all of which will take place from the time of site preparation into plant construction.

The excavated and dredged materials will be transported to the onsite Lake Davies dredge spoils area. Control of sedimentation and soil erosion from this spoils area will be effected by planned controls including silt fencing, straw bale dikes, sediment traps or temporary sediment ponds, and mulching combined with seeding.

Enlargement of the barge slip is estimated to require removal of approximately 15,000 cubic yards (11,500 cubic meters) of sediment. Important species that may be temporarily affected by each of the dredging activities include eggs, larvae and adults of invertebrates and fishes. Based on the monitoring of the baffle wall and intake screens for CCNPP Units 1 and 2, Bay anchovy and Atlantic menhaden are the most common mid-water fish species in the immediate area. These species may be temporarily affected by high levels of suspended sediment, which can interfere with foraging and respiration. Although no invertebrate sampling data are available for the intake area, in a study of dredging in Chesapeake Bay, benthic communities survived the deposition of suspended sediment despite the exceedances of certain water quality standards (Nichols, 1990).

Because the assemblage of aquatic species present in the Chesapeake Bay near the CCNPP varies throughout the year, the season of the year in which dredging and construction occur will determine to a large extent the impact on specific aquatic resources with the Chesapeake Bay. Nevertheless, because the area to be dredged is small and is a protected near-shore area that is already dedicated to intake functions, the overall impact on eggs and larvae is expected to be small and temporary.

Regarding a shift in the recharge of the Surficial aquifer and a possible increase in infiltration, removal of a significant portion of the Surficial aquifer in the area of the

CCNPP Unit 3 and its replacement with impermeable surfaces will effectively eliminate direct recharge into that aquifer via precipitation. Sand-filter ditches will receive and drain off surface runoff from the CCNPP Unit 3 area. On the east side, the ditches draining the power block and the adjacent laydown area will convey runoff to a wetland creation area located east of the power block. On the west side, ditches draining the switchyard area will discharge into an unlined storm-water basin located to the west, and runoff from sand filter ditches in the cooling tower area and the parking area will discharge directly into tributaries to Johns Creek. The outflow structure for the storm-water basin will be designed to release water at low enough rates so that the receiving stream will not be subject to either erosion or sedimentation, beyond what is naturally occurring now. Hence the impact on Johns Creek and wetlands is expected to be low to negligible.

The bottom of these ditches will consist of a permeable layer of sand or gravel and thus will permit infiltration down into the remaining (lower) portion of the Surficial aquifer. These ditches will be designed to accommodate as much as a two-year 24-hour rain event.

Recharge to this local Surficial aquifer will shift in that direct recharge via precipitation will largely cease, while recharge to the aquifer will occur through the bottoms of the sand-filter ditches, and the unlined storm-water basin. No increased infiltration into the aquifer is expected. Recharge through the bottom of the storm-water basin will be limited as during intense storms, water will be released gradually from the basin to the tributaries to Johns Creek, thus removing stored water that would otherwise recharge the aquifer.

Based on observations made at other sites where the land surface has been lowered, it is expected that at the power block the post-construction steady-state water table in the aquifer may be a few feet lower than that indicated in Figures 2.3.1-42 through -45. While such lowering of the water table may reduce the rate of groundwater discharge into the bounding tributaries somewhat, this would be compensated for by the runoff flow contributed from the sand-filter ditches to the wetland creation area on the east side and to the tributaries to Johns Creek on the west side.

Reference

Nichols, 1990. Nichols, M., Diaz, R. and L. Schaffner, Effects of hopper dredging and sediment dispersion, Chesapeake Bay, *Environmental Geology,* 1990.

ER Impact:

No changes to the ER are required.

Item Number 52 **ER Section 4.2.2**

Request:

Construction of Unit 3 will take approximately 68 months. During years 1 through 4, the "water for construction will be supplied from existing CCNPP Units 1 and 2 groundwater production wells and from offsite sources as required." The desalinization plant would supply water needs for years 5 and 6. Groundwater appropriations (permits) allow for 450,000 gpd with a limit of 865,000 gpd. Current average use by Units 1 and 2 is 387,000 gpd. Unit 3 average water demands will be 360,000 gpd [supplied by the Aqui Aquifer (pp 4.2-12)] with a peak demand of 1,728,000 gpd. Subtracting the current average (387,000 gpd) use from the permitted appropriation (450,000 gpd) and factoring in the needs for Unit 3 (360,000 gpd) leaves an average short-fall of 297,000 gpd (450,000 - 387,000 - 360,000). Because no information was provided, if one assumes that the current limits for Units 1 and 2 are equal to or less than the permitted appropriation (865,000 gpd) and factoring in the peak needs of Unit 3 (1,728000 gpd), then the peak water shortfall for Unit 3 will be less than 1,728,000 gpd. It is noted that the desalinization plant would provide up to 1,750,000 gpd, but this would be for years 5 and 6. For construction years 1 through 4, it is unclear 1) where all the water needs for Unit 3 will be coming from, 2) what impacts permitted pumping rates will have on the aquifer supplying the water, if the pumpage is held to the current permitted limits, 3) how permitted pumping rates will impact water resources and other users of the water in the same aquifer, and 4) exactly how the water needs will be met. (Cross reference with HS-7[a])

Response:

Sources of Water During Construction

During construction years 1 through 4, there are three potential sources of water for construction: (1) authorization to use available onsite groundwater allowed under the CCNPP Units 1 and 2 current appropriation limits, (2) water collected during dewatering of onsite excavations, largely for dust control, and (3) offsite water trucked to the construction site and stored until used. UniStar does not intend to construct any new wells to address water demand during construction.

UniStar will provide a copy of a letter from Calvert Cliffs Nuclear Power Plant, Inc. consenting to the use of excess water in the current appropriations permit for the construction of CCNPP Unit 3 once it is received and will identify the date when the appropriations permit modification will be submitted once that date becomes available from Calvert Cliffs Nuclear Power Plant, Inc. UniStar is not pursuing a request to increase the daily average and monthly maximum use limits to meet the construction water demands. No plans have been made to replace the groundwater withdrawal provided under the existing appropriations permit. Water usage during 2003 and 2004 is not reflective of normal usage patterns for CCNPP Units 1 and 2 because of significant leakage at the site that has been repaired and no longer occurs.

The anticipated volume of water generated from dewatering is identified in ER Section 5.4.1.2. The current design for CCNPP Unit 3 requires the following major excavations:

- Power Block Area – 750,000 square feet of surface area to a depth of 45 feet
- CWS Cooling Tower – 250,000 square feet of surface area to a depth of 10 feet
- Retention Pond – 50,000 square feet to a depth of 30 feet.
- Circulating Water Pipe laydown – 25,000 square feet to a depth of 45 feet

The flow rates were estimated based on:

- Annual average flow rate of 44 gallons per minute (gpm), which equates to 63,360 gpd and adjusted up to 75,000 gallons per day (gpd)
- Maximum monthly rate of 64 gpm, which equates to 92,160 gpd and adjusted up to 100,000 gpd

Excavation is expected to be completed during the project's first year, during which the need to dewater and to implement dust control will begin. Backfilling of excavated sites would follow extensive concrete work during the second year, at which time the need to dewater and dust control would decrease significantly. At this time, we have no estimate of the expected duration of dewatering excavations. Dewatering will decrease in the third year, but so should the amount of dust control required as earth moving activities decrease.

Not all of the additional 50,000 to 100,000 gpd of needed water will be provided by truck. For the quantity that will be trucked to the site and stored, a typical water truck has a capacity of approximately 5,000 gallons. Therefore, the number of trucks needed per day will be a function of the total amount of water required from this source. The source of the trucked water has not yet been identified; however, UniStar will only contract with water truck companies that have the appropriate approvals for water withdrawal or who can demonstrate that the water was obtained from an appropriate permitted entity.

<u>Impact on Aquifer and Current Users</u>

UniStar prepared an inventory of current water users in Calvert County as part of the ER. ER Tables 2.3.2-4 and 2.3.2-5 list surface and groundwater authorizations. This inventory identifies the aquifer serving as the water source for each well. We do not anticipate that dewatering and other related construction activities will impact these aquifers and the local groundwater users. The excavations will reach what is expected to be saturated sands within the <u>Superficial aquifer.</u> The Surficial aquifer is present above an elevation of 65 to 70 feet mean sea level (msl) at the CCNPP site. Groundwater surface contour maps indicate groundwater elevations between 68 to 83.5 feet. The minimum design depth for construction activities will reach 44 feet msl in elevation at the location of the power block (reactor building). The elevation of the next water source, the Upper Chesapeake Unit, averages approximately 20 feet msl in elevation, with a maximum elevation of 41.7 feet msl as determined in the vicinity of the power block (i.e., lower than power block excavation). The Upper Chesapeake Unit is described as a "confirming" unit that provides thin and discontinuous sand units capable of producing small quantities of groundwater. The power block excavation is expected to reach the clay and silt layer separating these two aquifers. The groundwater users in the vicinity do not rely on either of these aquifers, but rather have wells that are fed from deeper water sources, i.e., the Nanjemoy, Piney Point and Aquia aquifer formations.

Aquia aquifer: The CCNPP Units 1 and 2 Water Appropriation Permit CA69G010 authorizes 450,000/865,000 gallons per day (annual average/month of maximum usage). Based on the usage data presented in ER Table 5.4-2 (Section 5.4.2.10), the daily usage rate averaged 387,000 gallons per day over a five year period. The highest annual average was determined to be 416,353 gpd. Based on complete utilization of the CCNPP Units 1 and 2 authorization, the increase in water withdrawn from the Aquia aquifer would be an average of 63,000 gpd or a 16% increase. Based on the highest annual usage, the increase at full authorization would be 34,000 gpd or an 8% increase. Increases of this magnitude (within the levels allowed under the current authorizations) are not considered significant or expected to impact local users in the vicinity of the CCNPP.

ER Figure 2.3.2-20 presents data on water levels in the Aquia aquifer taken from a well on the CCNPP site, Well CA Ed 42. The data appears to indicate that groundwater elevations have stabilized during the recent five year period. The potential for a relatively minor, temporary, increase in use of water at the CCNPP site during the construction period is not expected to impact these current water elevation levels or the other wells.

ER Impact:

No changes to the ER are required.

Item Number 53 **ER Section 4.2.2**

Request:

It is noted that impacts to groundwaters are "SMALL." Under the construction phase, the final elevations associated with the switch yard, turbine building, and reactor area will be ~85 ft, (Pg 4.2-13). Figures 2.3.1-(38-39) indicate that most of the vadose zone (and hence recharge surficial area) would be removed. The Surficial Aquifer water table sits near the 78- to 85-ft level [Fig 2.3.1-(42-45)]. To what degree could removal of a good portion of the Surficial Aquifers vadose zone, coupled with increased impervious zones, vegetation removal, etc., impact recharge to the wetlands and other water resources? (Cross reference with HI-1, HS-13, HS-19[(a)])

Response:

At the site and vicinity, the Surficial aquifer is considered a terrace deposit and, as such, is found only in the upland areas and is usually of limited areal extent. Each distinct area where the deposits exist is separated and bounded by the streams and tributaries of the area. In the power block area, Figures 2.3.1-38 and 2.3.1-39 illustrate how the aquifer pinches out due to its being dissected by the streams and tributaries of the plant area. Groundwater from the Surficial aquifer deposits discharges through seeps into the bounding tributaries and streams.

Removal of the upper portion of the Surficial aquifer in the area of the CCNPP Unit 3 and its replacement with impermeable surfaces will effectively eliminate recharge into that aquifer via precipitation. Based on observations made at other sites where the land surface has been lowered, it is expected that at the power block the post-construction steady-state water table in the aquifer may be a few feet lower than that indicated in Figures 2.3.1-42 through 45. While such lowering of the water table may reduce the rate of groundwater discharge into the bounding tributaries somewhat, this would be compensated for by the runoff flow contributed from the sand-filter ditches to the wetland creation area on the east side and to the tributaries to Johns Creek on the west side, as described below.

Sand-filter ditches will receive and drain off surface runoff from the Unit 3 area. On the east side, the ditches draining the power block and the adjacent laydown area will convey runoff to a wetland creation area located east of the power block. On the west side, ditches draining the switch yard area will discharge into an unlined storm-water basin located to the west, and runoff from sand filter ditches in the cooling tower area and the parking area will discharge directly into tributaries to Johns Creek. The outflow structure for the storm-water basin will be designed to release water at low enough rates so that the receiving stream will not be subject to either erosion or sedimentation, beyond what is naturally occurring now.

The bottom of these ditches will consist of a permeable layer of sand or gravel and thus will permit infiltration into the remaining (lower) portion of the Surficial aquifer. These ditches will be designed to accommodate as much as a two-year 24-hour rain event.

Although recharge via precipitation to this local Surficial aquifer will essentially cease, this loss will be largely compensated for in large part by infiltration into the aquifer through the bottoms of the sand-filter ditches and the storm-water basin. However, no increase in infiltration into the aquifer is anticipated. We conclude that due to the planned drainage ditches and storm-water basin, the impact on downstream tributaries and wetlands will be small to negligible.

ER Impact:

No changes to the ER are required.

Item Number 54 **ER Section 4.2.2**

Request:

It is generally alluded to that the actual calculations assessing the impacts of proposed construction activities will be addressed in construction permits. For example, pg 4.2-10 notes that a quantitative calculation and evaluation of the construction effluents and runoff will be done as part of the state construction permit process. Provide quantitative impacts associated with surface water (e.g., bio-retention and storm water basins, dewatering, effluent discharges, wetland impacts, increased runoff volume and velocity, etc.) and groundwater (e.g., Surficial Aquifer recharge, local irrigation wells, salt-water intrusion, subsidence, etc.) alterations. (Cross reference with HI-1[a]).

Response:

No analysis has been performed to date to assess quantitatively the impacts of plant construction and operation on surface and groundwater. During the permitting and final design process some of these impacts will be quantitatively assessed, while other impacts will be addressed indirectly through conservative design of the components of the storm water management system and sediment and erosion control measures. The following paragraphs convey the basis for the assertion that the impacts to surface and groundwater are expected to be small to moderate.

Removal of the upper portion of the Surficial aquifer in the area of the CCNPP Unit 3 and its replacement with impermeable surfaces will effectively eliminate direct recharge into that aquifer via precipitation. Sand-filter ditches will receive and drain off surface runoff from the Unit 3 area. On the east side, the ditches draining the power block and the adjacent laydown area will convey runoff to a wetland creation area located east of the power block. On the west side, ditches draining the switchyard area will discharge into an unlined storm-water basin located to the west, and runoff from sand filter ditches in the cooling tower area and the parking area will discharge directly into tributaries to Johns Creek. The outflow structure for the storm-water basin will be designed to release water at low enough rates so that the receiving stream will not be subject to either erosion or sedimentation, beyond what is naturally occurring now.

The bottom of these ditches will consist of a permeable layer of sand or gravel and this will permit infiltration down into the remaining (lower) portion of the Surficial aquifer, which will compensate in large part for the elimination of recharge through infiltrating precipitation. Based on observations made at other sites where the land surface has been lowered, it is expected that at the power block the post-construction steady-state water table in the aquifer may be a few feet lower than that indicated in Figures 2.3.1-42 through 45. While such lowering of the water table may reduce the rate of groundwater discharge into the bounding tributaries somewhat, this would be compensated for by the runoff flow contributed from the sand-filter ditches to the wetland creation area on the east side and to the tributaries to Johns Creek on the west side.

Surface-water use impacts are considered moderate primarily due to the loss of wetlands and wetland buffers, which implies that mitigation will be required. An analysis of the nine wetland assessment areas identified in the site area is provided in Section 4.3.1.3 of the report, and the planned mitigation measures are described in Section 4.3.1.6. The planned construction will involve the permanent filling of an estimated 8,350 linear feet (2,545 m) of intermittent and upper perennial stream channels and approximately 11.7 acres (4.7 hectares) of the delineated wetland areas. The project would also disturb approximately 30.9 acres (12.5 hectares) of land defined by Calvert County as non-tidal wetland buffer (lands within 50 feet [15 m] of the landward edge of non-tidal wetlands). Most of the wetland fill would take place in Wetland Assessment Areas I, II, IV VII and IX. In order to mitigate this noticeable alteration to the site wetlands, several mitigation measures will be considered based on the results of a planned field survey to be conducted during construction activities to determine the appropriate areas for onsite wetland mitigation.

As described in Calvert Cliffs Unit 3 Storm Water Management Plan dated April 2008 (Revision 00A) , a detailed storm-water management study will be conducted to evaluate adequate sizes of the several components of the storm-water system to maintain both quality and quantity requirements for the downstream area. This will include analyzing the pre-development and post-development site hydrology for the 1-, 2-, 5-, 10- and 100-year 24-hour rainfall events. The planned storm-water management system will be sized such that the downstream flow rates, sediment loads and water quality will be similar to the existing conditions and such that the post-development peak discharges will not exceed the pre-development rates. Thus, no significant change in the long- or short-term flow to the streams and wetlands from the power block area is expected.

ER Impact:

No changes to the ER are required.

Item Number 55 **ER Section 4.2.2**

Request:

Impacts to surface water quality downstream of the construction site is deemed "SMALL" due to BMPs (pg 4.2-14). Provide a quantitative analysis to identify when SMALL becomes MODERATE. (Cross reference with HI-1[(a)]).

Response:

As defined in Section 1.2.6 of the report, SMALL impacts are those in which environmental effects are not detectable or are so minor they will neither destabilize nor noticeably alter any important attribute of a resource, while MODERATE environmental effects are those that are sufficient to alter noticeably, but not to destabilize, important attributes of a resource.

Best management practices will be selected and implemented to insure that the water quality downgradient of the power block area and the adjoining construction laydown area will neither be noticeably altered nor destabilized. The maintenance of acceptable water quality will be largely effected by implementation of the erosion and sediment control measures detailed in the Calvert Cliffs Unit 3 Storm Water Management Plan dated April 2008 (Revision 00A). These measures will be implemented by installation of *initial, intermediate,* and *final* erosion and sedimentation controls, which will be planned, conducted and maintained according to the Calvert County Soil Conservation District standards and specifications.

Initial controls will be installed prior to construction commencement and will include perimeter protection fencing and controls and strictly-controlled construction exits. *Intermediate* controls will include silt fencing, sediment ponds, diversion dikes and stone check dams if necessary to control erosion and storm-water runoff. During the grading and construction phase, additional intermediate erosion controls will be put in place as land disturbance occurs. Erosion control devices will be implemented or modified as the drainage patterns for storm water are constructed. All disturbed land left exposed for 7 days (steep slopes) to 14 days (gentle slopes) will be mulched or temporary grass cover will be provided.

Final erosion and sediment controls will be integrated with establishment of the permanent storm-water management system and will include, among other things, construction of filtration ditches, stream enhancements, stabilization of construction roads, application of rolled erosion control product on steep slopes during final grading, and permanent stabilization by grassing of final grades and open pervious areas.

Implementation of a sequenced, systematic erosion and sedimentation control plan, as summarized above and to be approved by Calvert County Soil Conservation District, will limit the water-quality impacts of the planned construction activities to SMALL.

ER Impact:

No changes to the ER are required.

Item Number 56 **ER Section 4.3.1.3**

Request:

Need to know total wetland area within each assessment area.

Response:

The table below provides a summary of the total wetland area within each wetland assessment area. This data was taken from the Wetland Master Plan document that was submitted as a supplement to the "*Joint Federal/State Application for The Alteration Of Any Floodplain, Waterway, Tidal Or Nontidal Wetland In Maryland,*" dated May 20, 2008.

Assessment Area	Wetland Area (Acres)
I	2.20
II	6.18
III	0.77
IV	12.79
V	9.13
VI	14.01
VII	11.55
VIII	0.45
IX	1.12

ER Impact:

No changes to the ER are required.

Item Number 57 **ER Section 4.3.2**

Request:

Identify potential downstream (i.e., offsite) impacts of plant installation; include potential ecological impacts of organic debris addition (mentioned in Section 4.2.2.7) to streams on site and downstream.

Provide an evaluation of the potential downstream ecological effects on lower Johns Creek and St. Leonard Creek of the removal of two of the main headwater sources for Johns Creek. Clarify the status of, and potential impacts to, two downstream tributaries (Branch 4 and Laveel Branch) that are shown as part of an Ecologically Sensitive Area (MD DNR 2004 Lower Patuxent River in Calvert County Watershed Characterization; Map 19.)

Response:

Potential downstream (i.e., offsite) impacts of plant installation include temporary and permanent impacts to biochemical processes associated with offsite surface waters. Construction debris residing on the pads and temporary staging areas could mix with construction wash-down water or storm water, exit the site via untreated runoff and produce chemical reactions adverse to downstream ecology.

Possible contaminants include: sediment, alkaline byproducts from concrete production, concrete sealants, acidic byproducts, heavy metals, nutrients, solvents, and hydrocarbons (fuels, oils, and greases). There could be a high potential for contaminants to mix with site wash-down water or rainwater/precipitation runoff and be washed downstream into surface water bodies existing on the CCNPP site due to the persistent nature of local precipitation. There could also be the potential for spills within the construction areas consisting of fuels, solvents, sealants, paints, or glues. Construction dusts not suppressed could drift outside of the construction zones and contaminate nearby water supplies. If these contaminants enter the surface water bodies unchecked there could be a potential for infiltration and subsequent groundwater contamination.

The addition of sediment and organic debris to the local streams resulting from clearing, grubbing, and grading could decrease water quality. Organic debris could dam or clog existing streams, increase sediment deposition, and increase potential for future flooding. Organic debris decomposing in streams can cause dissolved oxygen and pH imbalances and subsequent releases of other organic and inorganic compounds from the stream sediments. Sediment laden waters are prone to reduced oxygen levels, algal growth, and increases in pathogens. If heavy metals or chemical compounds spill and/or wash into surface waters, there could be a direct toxicity to aquatic organisms. These potential pollutant releases could impact aquatic species and in turn affect the recreational aspects associated with fishing, canoeing, or kayaking.

In addition to the potential downstream ecological effects mentioned above, the removal of two of the main headwater sources for Johns Creek would eliminate a source of organic nutrients, habitat, and biogeochemical cycling for downstream aquatic flora and fauna in lower Johns Creek and St. Leonard Creek. However, the effect of this impact is expected to lessen in a downstream manner as downstream headwater sources provide required biogeochemical inputs to sustain aquatic life.

The status of Branch 4 (UT to Johns Creek) and Laveel Branch that are shown as part of an Ecologically Sensitive Area in Map 19 of the *Lower Patuxent River in Calvert County Watershed Characterization* (MDNR, 2003) could not be readily determined because these streams were not discussed in this document, nor sampled in the *Lower Patuxent Stream Corridor Assessment Survey* (MDNR, 2004). However, potential impacts to Branch 4 and Laveel Branch are not anticipated since the proposed construction footprint of the CCNPP Unit 3 is located to the north, and in a different subwatershed than these two streams.

References

MDNR, 2003. *Lower Patuxent River in Calvert County Watershed Characterization*. Maryland Department of Natural Resources, Technical Watershed Assessment Services. December 2003.

MDNR, 2004. *Lower Patuxent Stream Corridor Assessment Survey*. Maryland Department of Natural Resources, Watershed Assessment and Targeting Division, Watershed Services Unit. April 2004.

ER Impact:

No changes to the ER are required.

Item Number 58 **ER Section 4.3.2**

Request:

Provide more information about dredging and discharge pipeline installation. Include in this item through item 63 the dredging method and potential for anchor scarring of the benthos.

Response:

Dredging will take place within the Chesapeake Bay within the existing CWIS embayment behind the baffle wall for installation of the new CWIS for Unit 3. Dredging will also occur for installation of the discharge pipeline from the circulating water system and at the barge slip area to accommodate delivery of large components. Dredging locations are shown on Figure 3.1-1. Dredged material will be disposed of in the previously used disposal area known as Lake Davies, which is shown on Figure 4.3-1.

Enlargement of the barge slip is estimated to require removal of about 15,000 cubic yards (11,500 cubic meters) of sediment. Dredging of the barge slip will be performed using a shore based clamshell dredge. Dredging of the discharge pipe trench will be performed using a barge mounted clamshell dredge. Dredge material will be transported to the Lake Davies area, which is shown on Figure 3.1-1, and allowed to dry. The dredge materials will be used as fill within the Lake Davies area. When large woody debris is encountered it will either be recovered with the sediments (small items) as practicable or will be removed (larger limbs and tree items).

Small-scale dredging like that required to construct CCNPP Unit 3 is not considered a significant impact to the Chesapeake Bay. A report by the NOAA Chesapeake Bay Office, developed by a Technical Advisory Panel comprised of top fisheries scientists from area universities and senior government fisheries scientists, presented a Fisheries Ecosystem Plan for the Chesapeake Bay. It is notable that the only mention of the effects of dredging in the 450 page report was the following two general statements: "Dredging and the displacement of dredge spoil to other parts of the Chesapeake Bay can affect fish and shellfish by removing or inundating slow-moving or sessile species and their prey. Dredge spoil can also reintroduce sedimentary inventories of nutrients and contaminants into the water" (NOAA, 2006). The report also acknowledged that the effects of even widely-used methods of harvest that disturb bottom sediments, such as trawling and crab dredging, remain unknown.

Excavation and dredging of the intake structure, discharge pipe, and barge slip will continue through CCNPP site preparation into plant construction. Minimal effects of sedimentation or runoff into the Chesapeake Bay are expected. However, construction of the intake structure and discharge pipeline and enlargement of the barge slip will cause some disturbance in the Chesapeake Bay. As described in Section 4.2.1, the slip will be restored by dredging to receive larger barge shipments that have roll-on, roll-off capability. Potential impacts associated with use of larger vessels include increased air, noise, and water pollution, as well as an increased amount of excavation needed to accommodate the restored barge slip. Concurrently, crane foundations will be placed to erect a heavy lift crane. A sheet pile cofferdam and dewatering system will be installed on the south side of the CCNPP Units 1 and 2 intake structure to facilitate the construction of the CCNPP Unit 3 circulating and service water intake structure and pump house. Pilings may also be driven into the seabed to facilitate construction of new discharge system piping.

The potential for anchor scarring of the benthos is expected to be minimal during dredging activities. Existing benthos in the affected areas will have been impacted due to the dredging activities themselves.

Reference

NOAA, 2006. Fisheries Ecosystem Planning for Chesapeake Bay, American Fisheries Society, Trends in Fisheries Science and Management 3, Chesapeake Bay Fisheries Ecosystem Advisory Panel, National Oceanic and Atmospheric Administration Chesapeake Bay Office, 2006.

ER Impact:

No changes to the ER are required.

Item Number 59 **ER Section 4.3.2**

Request:

Describe impacts of the use of larger vessels; pipeline installation methods. With regard to vessels, include information on the potential impacts of prop wash on the benthos near the barge dock and wave run-up on the beach adjacent to the barge dock (including cliff area).

Response:

Potential impacts that may occur as a result of the use of larger vessels include increased air, noise, and water pollution, as well as increased amount of excavation needed to accommodate the restored barge slip (Section 4.3.2.2.1). Potential impacts of prop wash on the benthos near the barge dock are expected to be minimal and may include temporary suspension of sediments. The proposed barge slip depth of sixteen feet will minimize the potential effects of prop wash.

Potential impacts of wave run-up on the beach adjacent to the barge dock will be minimized by the new sheet pile bulkhead that will be installed (Figure 3.9-3).

ER Impact:

No changes to the ER are required.

Item Number 60 **ER Section 4.3.2**

Request:

Describe specific dredging methods; pipeline installation methods.

Response:

Dredging will take place within the Chesapeake Bay within the existing CWIS embayment behind the baffle wall for installation of the new CWIS for Unit 3. Dredging will also occur for installation of the discharge pipeline from the circulating water system and at the barge slip area to accommodate delivery of large components. Dredging locations are shown on Figure 3.1-1. Dredged material will be disposed of in the previously used disposal area known as Lake Davies, which is shown on Figure 4.3-1.

Restoration of the barge slip is estimated to require removal of about 15,000 cubic yards (11,500 cubic meters) of sediment. Dredging of the barge slip will be performed using a shore based clamshell dredge. Dredging of the discharge pipe trench will be performed using a barge mounted clamshell dredge. Dredged material will be transported to the Lake Davies area, which is shown on Figure 3.1-1, and allowed to dry. The dredge materials will be used as fill within the Lake Davies area. When large woody debris is encountered it will either be recovered with the sediments (small items) as practicable or will be removed (larger limbs and tree items).

Potential turbidity from clamshell dredging will be mitigated via lowering and raising the clamshell bucket slowly and/or using a closed bucket. Floating silt curtains will be used at the edges of dredged areas to contain suspended sediments. On-land construction areas will utilize silt fencing at their periphery.

Small-scale dredging like that required to construct CCNPP Unit 3 is not considered a significant impact to the Chesapeake Bay. A report by the NOAA Chesapeake Bay Office, developed by a Technical Advisory Panel comprised of top fisheries scientists from area universities and senior government fisheries scientists, presented a Fisheries Ecosystem Plan for the Chesapeake Bay. It is notable that the only mention of the effects of dredging in the 450 page report was the following two general statements: "Dredging and the displacement of dredge spoil to other parts of the Chesapeake Bay can affect fish and shellfish by removing or inundating slow-moving or sessile species and their prey. Dredge spoil can also reintroduce sedimentary inventories of nutrients and contaminants into the water" (NOAA, 2006). The report also acknowledged that the effects of even widely-used methods of harvest that disturb bottom sediments, such as trawling and crab dredging, remain unknown.

Excavation and dredging of the intake structure, discharge pipe, and barge slip will continue through CCNPP site preparation into plant construction. Minimal effects of sedimentation or runoff into the Chesapeake Bay are expected. However, construction of the intake structure and discharge pipeline and enlargement of the barge slip will cause some disturbance in the Chesapeake Bay. As described in Section 4.2.1, the slip will be widened by dredging to receive larger barge shipments that have roll-on, roll-off capability. Potential impacts associated with use of larger vessels include increased air, noise, and water pollution, as well as an increased amount of excavation needed to accommodate the enlarged barge slip.

The construction approach for the discharge pipe includes the following activities: survey and layout the outfall; installation of floating silt curtains around the work area; dredge a trench for the outfall pipe and diffuser; launch (pulled into the trench) the outfall pipe and diffuser; cover the pipe with stone and/or rip-rap; place rip-rap around the diffuser for protection; and remove the floating silt curtains after sediments have settled. The anticipated slope for this dredged area is 4:1. Pilings may also be driven into the seabed to facilitate construction of new discharge system piping.

<u>Reference</u>

NOAA, 2006. Fisheries Ecosystem Planning for Chesapeake Bay, American Fisheries Society, Trends in Fisheries Science and Management 3, Chesapeake Bay Fisheries Ecosystem Advisory Panel, National Oceanic and Atmospheric Administration Chesapeake Bay Office, 2006.

ER Impact:

No changes to the ER are required.

Item Number 61 **ER Section 4.3.2**

Request:

Describe design conditions and parameters for pipeline installation. Include use of imported fill, if any. With regard to pipeline installation, describe the type and extent of any imported fill material that would be used, including the use of any rock (or similar) fill material to create a "rip-rap" zone to reduce the potential scour footprint from the cooling-water discharge.

Response:

Treated wastewater from the CCNPP Unit 3 Cooling Tower Blow Down Retention Basin will be conveyed for disposal in the Chesapeake Bay through the outfall/discharge pipe. Prior to entering the discharge pipe, the wastewater will enter a seal well where the velocity of the water will be significantly reduced.

The discharge point is near the southwest bank of the Chesapeake Bay, approximately 1,200 feet (366 m) south of the intake structure for CCNPP Unit 3, and extends approximately 550 feet (168 m) into the Chesapeake Bay through a buried nominal 30 inch (76 cm) discharge pipe with diffuser nozzles at the end of the line. The preliminary centerline elevation of the discharge nozzles of the diffuser is 3 feet (0.91 m) above the Chesapeake Bay bottom elevation. The three 16 inch (40.6 cm) diameter nozzles are spaced center-to-center at 9.375 feet (2.86 m) located 3 feet (0.91) above the bottom. The angle of discharge is 22.5 degrees to horizontal.

The length of the diffuser flow after exiting the nozzles will be approximately 26 feet (7.9 m). Riprap will be placed around the discharge point to resist potential erosion due to discharge jet from the diffuser nozzles. Fish screens are not required on the diffuser nozzles since there will always be flow through the discharge piping, even during outages, to maintain discharge of treated liquid effluents within concentration limits of the applicable local, state, and federal requirements.

The trench for the discharge pipe will be dredged using a barge mounted clamshell dredge. Trench excavation during installation will be limited to the construction of a trench within which the discharge line will be placed. Riprap or stone will be placed over the pipe (ER Section 4.3.2.2.5). Potential turbidity from clamshell dredging will be mitigated via lowering and raising the clamshell bucket slowly and/or using a closed bucket. Floating silt curtains will be used at the edges of dredged areas to contain suspended sediments. On-land construction areas will utilize silt fencing at their periphery.

ER Impact:

No changes to the ER are required.

Item Number 62 **ER Section 4.3.2**

Request:

Describe potential impacts associated with pile driving.

Response:

Potential impacts that may occur as a result of pile driving include sediment deposition, noise pollution, and disturbances associated with intense vibrations.

ER Impact:

No changes to the ER are required.

Item Number 63 **ER Section 4.3.2**

Request:

The ER describes the dredging as occurring within the dedicated intake area. This does not seem correct as the barge area is SE of the intake area. Please confirm.

Response:

Dredging will take place within the Chesapeake Bay within the existing CWIS embayment behind the baffle wall for installation of the new CWIS for CCNPP Unit 3. Dredging will also occur for installation of the discharge pipeline from the circulating water system and at the barge slip area to accommodate delivery of large components. Dredging locations are shown on the attached figures 3.7-2 and 3.9-1A. Dredged material will be disposed of in the previously used disposal area known as Lake Davies, which is shown on attached figure 3.1-1.

A sheet pile cofferdam and dewatering system will be installed on the south side of the CCNPP Units 1 and 2 intake structure to facilitate the construction of the CCNPP Unit 3 circulating and service water intake structure and pump house. The expansion of the CCNPP Units 1 and 2 Intake Forebay will include the following construction activities. Floating silt curtains will be installed. A wedge will be dredged as defined by the CCNPP Units 1 and 2 Intake Forebay, and extension of the CCNPP Units 1 and 2 Forebay, and the shoreline below the pipe inverts. A new sheet pile wall will be installed across the wedge, consistent with the existing braced sheet pile walls. New armor rock will be placed at the base of the new length of the Intake Forebay. The dredging activities will be completed using a combination of a shore based clamshell dredge as well as a barge mounted clamshell dredge.

Restoration of the barge slip is estimated to require removal of about 15,000 cubic yards (11,500 cubic meters) of sediment. Dredging of the barge slip will be performed using a shore based clamshell dredge. Dredging of the discharge pipe trench will be performed using a barge mounted clamshell dredge. Dredge material will be transported to the Lake Davies area, which is shown on Figure 3.1-1, and allowed to dry. The dredge materials will be used as fill within the Lake Davies area. When large woody debris is encountered it will either be recovered with the sediments (small items) as practicable or will be removed (larger limbs and tree items).

Small-scale dredging like that required to construct CCNPP Unit 3 is not considered a significant impact to the Chesapeake Bay. A report by the NOAA Chesapeake Bay Office, developed by a Technical Advisory Panel comprised of top fisheries scientists from area universities and senior government fisheries scientists, presented a Fisheries Ecosystem Plan for the Chesapeake Bay. The only mention of the effects of dredging in the report was the following two general statements: "Dredging and the displacement of dredge spoil to other parts of the Chesapeake Bay can affect fish and shellfish by removing or inundating slow-moving or sessile species and their prey. Dredge spoil can also reintroduce sedimentary inventories of nutrients and contaminants into the water"

(NOAA, 2006). The report also acknowledged that the effects of even widely-used methods of harvest that disturb bottom sediments, such as trawling and crab dredging, remain unknown.

Excavation and dredging of the intake structure, discharge pipe, and barge slip will continue through CCNPP site preparation into plant construction. Minimal effects of sedimentation or runoff into the Chesapeake Bay are expected. However, construction of the intake structure and discharge pipeline and restoration of the barge slip will cause some disturbance in the Chesapeake Bay. As described in Section 4.2.1, the slip will be restored by dredging to receive larger barge shipments that have roll-on, roll-off capability. Potential impacts associated with use of larger vessels include increased air, noise, and water pollution, as well as an increased amount of excavation needed to accommodate the restored barge slip. Concurrently, crane foundations will be placed to erect a heavy lift crane.

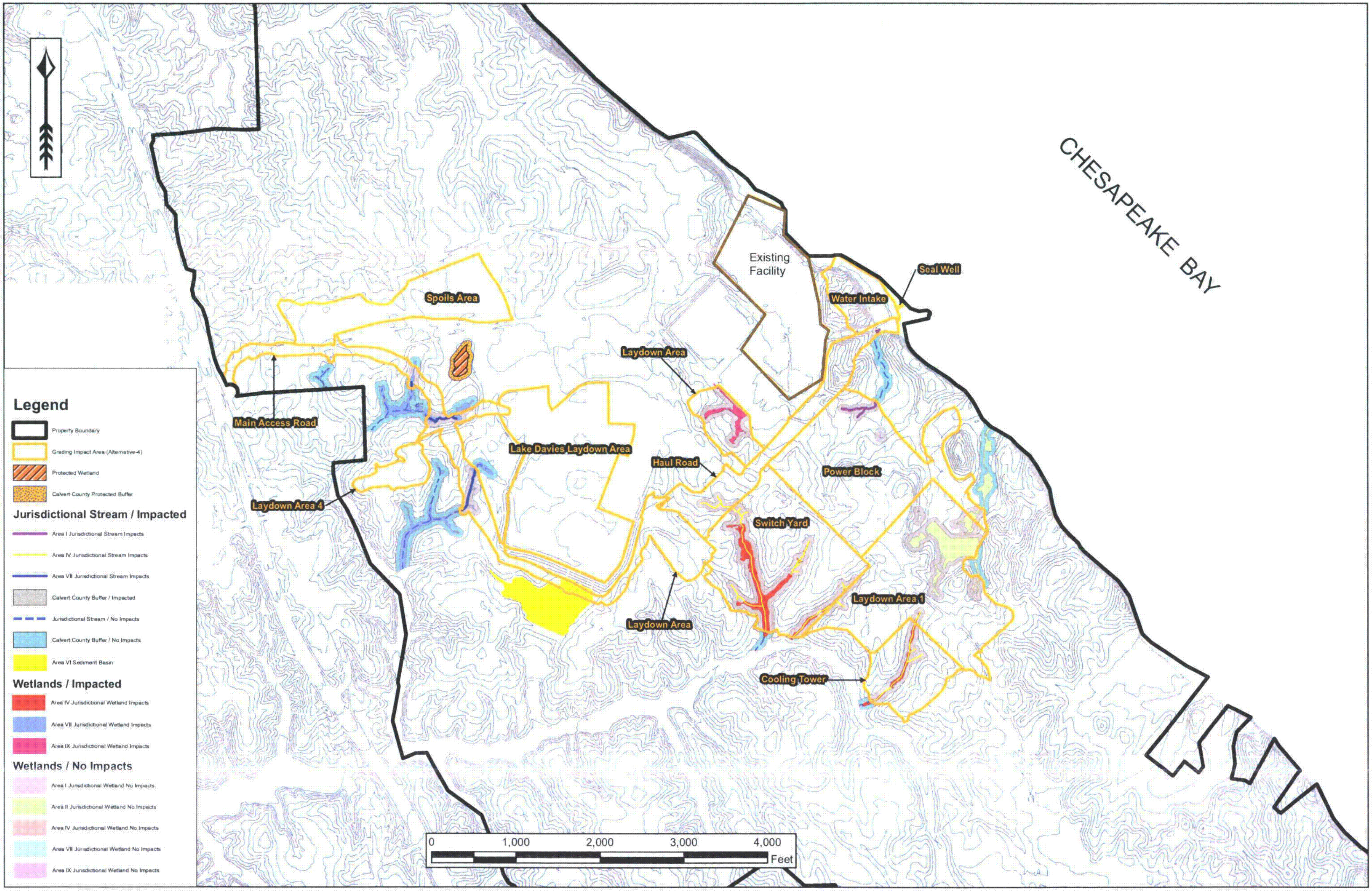
The potential for anchor scarring of the benthos is expected to be minimal during dredging activities. Existing benthos in the affected areas will have been impacted due to the dredging activities themselves.

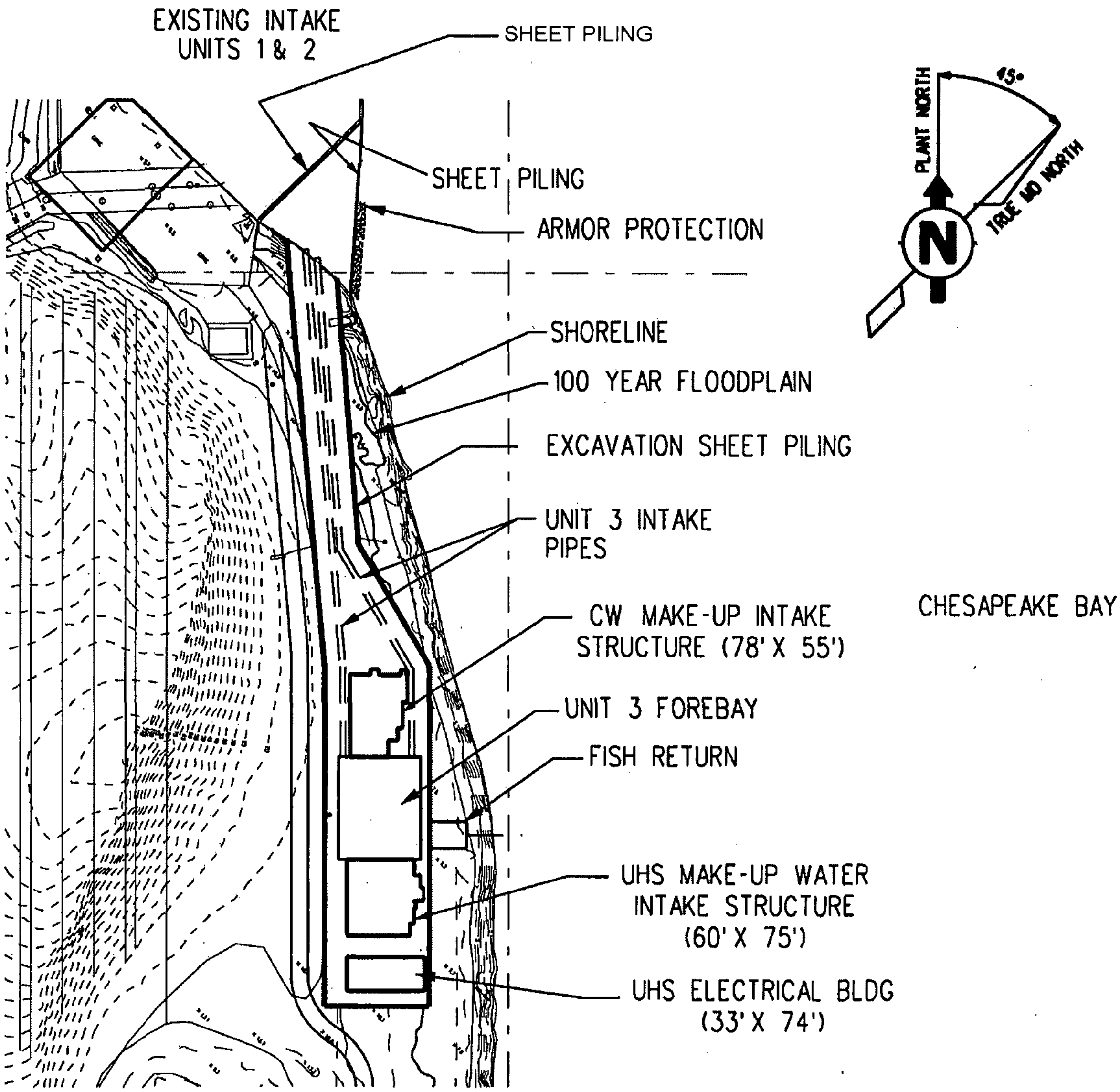
Reference

NOAA, 2006. Fisheries Ecosystem Planning for Chesapeake Bay, American Fisheries Society, Trends in Fisheries Science and Management 3, Chesapeake Bay Fisheries Ecosystem Advisory Panel, National Oceanic and Atmospheric Administration Chesapeake Bay Office, 2006.

ER Impact:

No changes to the ER are required.

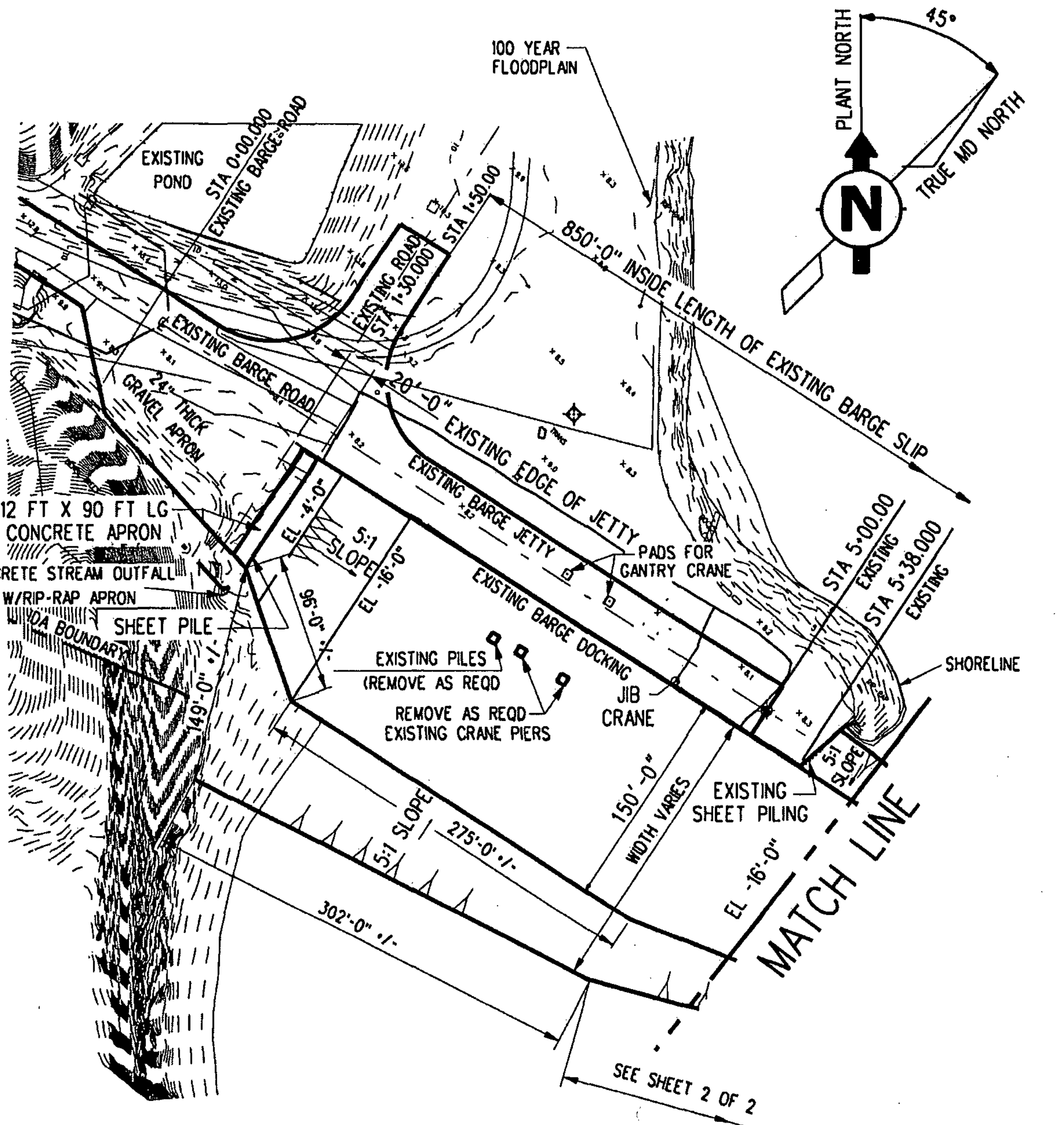

CHESAPEAKE BAY
Existing Facility
Seal Well
Water Intake
Spoils Area
Laydown Area
Main Access Road
Lake Davies Laydown Area
Haul Road
Power Block
Laydown Area 4
Switch Yard
Laydown Area 1
Laydown Area
Cooling Tower
Legend
Property Boundary
Grading Impact Area (Alternative-4)
Protected Wetland
Calvert County Protected Buffer
Jurisdictional Stream / Impacted
Area I Jurisdictional Stream Impacts
Area IV Jurisdictional Stream Impacts
Area VII Jurisdictional Stream Impacts
Calvert County Buffer / Impacted
Jurisdictional Stream / No Impacts
Calvert County Buffer / No Impacts
Area VI Sediment Basin
Wetlands / Impacted
Area IV Jurisdictional Wetland Impacts
Area VII Jurisdictional Wetland Impacts
Area IX Jurisdictional Wetland Impacts
Wetlands / No Impacts
Area I Jurisdictional Wetland No Impacts
Area II Jurisdictional Wetland No Impacts
Area IV Jurisdictional Wetland No Impacts
Area VII Jurisdictional Wetland No Impacts
Area IX Jurisdictional Wetland No Impacts
0
1,000
2,000
3,000
4,000
Feet



NOTES: 1. - MEAN HIGH WATERLINE: 0.57'
- MEAN LOW WATERLINE: -0.60'
- MAXIMUM SPRING WATERLINE: 1.47'

2. NAVIGATION CHANNEL (MIDDLE OF BAY) APPROX. 3 MILES FROM SHORELINE.

PURPOSE: PLANT EXPANSION DATUM: (NAVD 27) PROJECT LATITUDE/LONGITUDE: 38.424133 -76.441598	FIGURE 3.7-2 SITE PLAN @ INTAKE STRUCTURE 0 150 300FT	CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 3 IN: PATUXENT/WEST CHEASPEAKE BAY COUNTY OF: CALVERT STATE: MD



NOTES: 1. - MEAN HIGH WATERLINE: 0.57'
- MEAN LOW WATERLINE: -0.60'
- MAXIMUM SPRING WATERLINE: 1.47'
2. NAVIGATION CHANNEL (MIDDLE OF BAY) APPROX. 3 MILES FROM SHORELINE.

CHESAPEAKE BAY

PURPOSE: PLANT EXPANSION

DATUM: (NAVD 27)

PROJECT LATITUDE/LONGITUDE:
38.424133
-76.441598

FIGURE 3.9-1A

MODIFICATIONS @ EXISTING BARGE UNLOADING FACILITY

0 50 100 150FT

CALVERT CLIFFS NUCLEAR POWER PLANT UNIT 3

IN: PATUXENT/WEST CHEASPEAKE BAY

COUNTY OF: CALVERT STATE: MD

Item Number 64 ER Section 4.3.2
Request:

Provide data on expected chemical concentrations in sediments to be dredged.

Response:

In 1999, the Chesapeake Bay Program (CBP) issued a toxics characterization report of the Chesapeake Bay tidal rivers. The report focused on tidal rivers versus the mainstem because of the historically low levels of chemical contamination in the mainstem Chesapeake Bay (CBP, 1999). Sediment toxics data is available from the Chesapeake Bay Toxics Database between 1973 and 2001 and there are 21 monitoring stations within Calvert County (CBP, 2008).

In September 2006, sediment samples were collected from three locations in the Chesapeake Bay at the proposed discharge location and at two locations within 500-feet of this point (Figure 3 of Attachment A). General chemistry parameters and physical properties of the sediment samples were measured. In addition, the samples were analyzed for metal concentrations, polycyclic aromatic hydrocarbon (PAH) concentrations, polychlorinated biphenyl (PCB) congener concentrations, chlorinated pesticide concentrations, semi-volatile organic compound (SVOC) concentrations, and volatile organic compound (VOC) concentrations. The results of these analyses are presented in Tables 12-1 through 12-8 of Attachment A (EA, 2007).

General chemistry parameters measured in the sediment samples were ammonia as nitrogen, total Kjeldahl nitrogen (TKN), total organic carbon (TOC), and total phosphorus. Ammonia as nitrogen was detected below the reporting limit of 7.00 milligrams per kilogram (mg/kg) at each location. The estimated concentration of ammonia as nitrogen among the locations ranged from 4.9 to 6.8 mg/kg. TKN was detected at two locations but was below the reporting limit of 210.0 mg/kg at one location. The detected TKN concentrations were 316 mg/kg and estimated to be 186 mg/kg. TOC concentrations among the locations ranged from 23,600 mg/kg to 30,700 mg/kg. Total phosphorus concentrations ranged from 615 to 1110 mg/kg. (EA, 2007)

The physical properties measured in the sediment samples were grain size, specific gravity, and percentage solids. The sediment samples were comprised of 93.5 to 96 percent sand, 1.5 to 5.1 percent gravel, 2.1 to 2.7 percent clay, and 0 to 0.2 percent silt. Specific gravity ranged from 2.667 to 2.681 among the locations, and percentage solids ranged from 67.3 to 73.4 among the locations. (EA, 2007)

The sediment samples were analyzed for the metals arsenic, cadmium, chromium, copper, lead, mercury, and zinc. All detected metal concentrations were below the Buchman, 1999 threshold effects level (TEL) and probable effects level (PEL). Mercury was not detected in any of the samples. Cadmium and copper were detected below the reporting limit at each location. Cadmium concentrations were estimated to range from 0.17 to 0.20 mg/kg among the locations. Copper concentrations were estimated to range from 1.2 to 1.3 mg/kg among the locations. Arsenic was detected at each location, but was detected below the reporting limit of 0.98 mg/kg at one location. Arsenic concentrations among the locations ranged from 0.95 (estimated) to 1.2 mg/kg. Lead was detected at each location at concentrations ranging from 1.1 to 1.4 mg/kg. Zinc was detected at each location at concentrations ranging from 7.5 to 9.4 mg/kg.

The sediment samples were analyzed for fifteen PAHs. PAHs were not detected in the sediment samples.

The sediment samples were also analyzed for 27 PCB congeners, and two congeners were detected. PCB 18 was detected at each location but was detected below the reporting limit of 0.24 µg/kg at two locations. The concentration of PCB 18 among the locations ranged from 0.18 (estimated) to 0.27 µg/kg. PCB 101 was detected below the reporting limit of 0.24 µg/kg at one location, and the estimated concentration of PCB 101 in the sample was 0.058 µg/kg.

The sediment samples were analyzed for 21 chlorinated pesticides. Four chlorinated pesticides were detected. All detected concentrations were below the reporting limit of 1.7 µg/kg, and chlorinated pesticide concentrations were estimated. Estimated concentrations of each detected chlorinated pesticide at each sampling location were below the Buchman, 1999 TEL and PEL. 4,4'-DDT was detected at one location at a concentration estimated to be 0.18 µg/kg. Alpha-BHC was detected at each location at estimated concentrations ranging from 0.15 to 0.17 µg/kg. Endrin aldehyde was detected at one location at a concentration estimated to be 0.41 µg/kg. Heptaclor was detected at each location at estimated concentrations ranging from 0.29 to 0.63 µg/kg.

The sediment samples were analyzed for 42 SVOCs. SVOCs were not detected in the sediment samples. The sediment samples were analyzed for 29 VOCs. One VOC was detected. Methylene chloride was detected below the reporting limit of 7.00 µg/kg at each location. The estimated concentrations of methylene chloride among the locations ranged from 4.5 to 5.0 µg/kg. (EA, 2007)

CBP, 1999. Targeting Toxics: A Characterization Report, A Tool for Directing Management and Monitoring Actions in the Chesapeake Bay's Tidal Rivers, Chesapeake Bay Program, June 1999.

CBP, 2008. CBP Toxics Database, Chesapeake Bay Program, Website: http://www.chesapeakebay.net/data_toxics.aspx, Date accessed: March 2008.

EA, 2007. EA Engineering, Science, and Technology, Inc. Aquatic Field Studies for UniStar Calvert Cliffs Expansion Project. Draft Report. May 2007.

ER Impact:

No changes to the ER are required.

Item Number 65 **ER Section 4.3.2**

Request:

Provide documentation for the Stormwater Pollution Prevention Plan and the Spill Prevention, Control and Countermeasure Program. During the site tour, it was stated that the stormwater discharge system and retention basins were changing from that described in the ER. Provide the final plans for this system, including information about the nature and locations of the retention basins.

Response:

Construction activities that may cause erosion that could lead to harmful deposition in aquatic water bodies would be of (1) relatively short duration and (2) would be required to meet conditions set forth in the erosion and sediment control plan and a stormwater management plan that will be submitted for the CCNP construction site. Those plans, required by the Maryland General NPDES Permit (Number MDR10), include requirements to obtain approved erosion and sediment control plans in accordance with COMAR 26.17.01 and an approved stormwater management plans in accordance with COMAR 26.17.02.

Approval of these plans will be performed by regulators working for the Calvert Soil Conservation District (Erosion and Sediment Control) and the Engineering Department within the Calvert County Public Works (Stormwater Management Plans). Compliance with the requirements for both plans satisfies the need for mitigation of impacts associated with constructing activities in the state of Maryland and will meet the SWPPP and Spill requirements in 40 CFR 122.26.

These plans are required prior to the commencement of construction activities at the site. Implementation of the Erosion and Sediment Control Plan and the Stormwater Management Plan will put in place both structural and non-structural pollution prevention controls. Structural controls for sedimentation will include sediment control devices that will provide for containment and or filtration of sediment laden water through the use of such items as sediment basins, temporary rock inlet protection devices, silt fencing, and minimization of exposed areas. Non-structural controls will include preventive maintenance of construction equipment, good housekeeping procedures and development of spill prevention and response procedures.

The operators of the construction site will also be required to conduct periodic visual inspections of construction areas, and ensure erosion and sediment control measures are in place and functioning properly. Reporting procedures, as required by these plans, will be available to verify viability and compliance with the plans in place.

All of the above actions will provide for protection of the surrounding habitat and receiving waters from construction activities. Some sensitive habitats occur within the area expected to be impacted by construction activities; however, no important aquatic species are expected to be affected. The mitigation measures put in place in response to the State of Maryland construction permitting process are anticipated to be sufficiently robust and can be expected to provide a reasonable level of protection to the receiving waters and surrounding habitat.

ER Impact:

No changes to the ER are required.

Item Number 66 **ER Section 4.4.1.1**

Request:

Provide more information and reference to the baseline on the distribution and the quality of buildings, roads, and recreational facilities to describe construction impacts. .

Response:

The total population within 1 mi (1.6 km) of the site is 30, with no residential properties located within the CCNPP site boundary. Within 2 mi (3.2 km), the total population is less than 2,500 as discussed in Section 2.5.1. Portions of the towns of Lusby and Calvert Beach are within 2 mi (3.2 km) of the CCNPP site. Table 2.5.1-5 presents population distributions, by residential population and transient population in 2000, within each of the sixteen geographic directional sectors at radii of 0 to 1 mi (0 to 2 km), 1 to 2 mi (2 to 3 km), 2 to 3 mi (3 to 5 km), 3 to 4 mi (5 to 6 km), 4 to 5 mi (6 to 8 km) and 5 to 10 mi (8 to 16 km) from the CCNPP site.

Besides the residential or farm buildings in the surrounding community, there is an elementary school approximately 2 mi (3.2 km) from the CCNPP site. The Town of Lusby located southwest of the CCNPP site has commercial buildings in the town center. Economic development plans include expanding and improving the town center and developing a nearby business park.

Figure 2.2.1-4 shows roads/highways that are in the vicinity of the CCNPP site. There is no operating rail line within 8 mi (13 km) of the CCNPP site.

Recreational facilities in the immediate area around the CCNPP site are Flag Ponds Park to the north and Calvert Cliffs State Park to the south as denoted in Figure 2.2.1-4. The onsite area that was formerly a youth camp known as Camp Canoy will be removed as it lies within the construction area footprint.

ER Impact:

No changes to the ER are required.

Item Number 67 ER Section 4.4.1.2

Request:

List state noise limits. List state limits on pile-driving activities.

Response:

The noise limits are detailed in Code of Maryland Regulations (COMAR), Title26, Department of the Environment, Subtitle 02, Occupational, Industrial, and Residential Hazards, Chapter 03, Control of Noise Pollution, and generally referred to as COMAR 26.02.03.

Noise levels emanating from construction or demolition may not exceed 90 d8A during daytime hours (7 a.m. to 10 p.m.) and 66 d8A during nighttime hours (10 p.m. to 7 a.rn.) in residential areas (COMAR 26.02.03A(2)). Pile driving equipment is exempt from regulation during the daytime hours of 8 a.m. to 5 p.m, (COMAR 26.02.02.8(2)(i)).

ER Impact:

No changes to the ER are required.

Item Number 68 ER Sections 4.4.1.2, 4.4.1.3

Request:

Provide applicable federal and/or state noise and dust/particulate standards and relate impacts to these standards.

Response:

As noted in the response to RAI Item Number 67, the state noise standards are detailed in COMAR 26.02.03. Typical noise levels from equipment that is likely to be used during construction are provided in Table 4.4.1-1, along with the expected level at 3,000 ft, the distance from edge of the construction footprint to the nearest resident. As listed in Table 4.4.1-1, the noise levels are below the state daytime limits. Non-routine activities such as blasting will be conducted during weekday business hours to mitigate impact noise levels.

The state dust/particulate standards are those listed in the federal National Ambient Air Quality Standards for particulate matter, namely, PM_{10} (40 CFR 50.6). To mitigate particulate matter emissions, a dust control program will be incorporated into the Storm Water Pollution Prevention Plan. A typical SWPPP includes both construction and administrative best management practices (BMPs) to control dust. Examples of construction BMPs include sedimentation basins, placement of aggregate or stone at vehicle entrance/exit(s) and short-term vegetative cover such as seeding, plants, or mulching with a soil binder. Administrative BMP examples include routine inspections and vehicle speed limits.

ER Impact:

No changes to the ER are required.

Item Number 69 **ER Sections 4.4.1.2, 4.4.1.3**

Request:

Provide more detail on types of measures/actions that will be taken to maintain impacts within "regulatory limits."

Response:

Regulatory limits in some cases are part of a needed permit, an example being the NPDES Construction General Permit. As such, specific programs or controls are required such as the Storm Water Pollution Prevention Plan (SWPPP) described in the response to RAI Item Number 68. In other cases, a regulatory threshold limit can initiate required measures and actions. For instance, implementation of a Spill Prevention Control and Countermeasure (SPCC) Plan is required if specific on-site oil quantities are exceeded. Finally, in locations where air emissions could exceed limits (e.g., the concrete batch plant), emissions will be monitored.

ER Impact:

No changes to the ER are required.

Item Number 70 **ER Section 4.4.1.3**

Request:

Provide additional information needed regarding mitigation program (3rd paragraph).

Response:

As described In the response to RAI Item Number 68, a typical Storm Water Pollution Prevention Plan (SWPPP) includes both construction and administrative best management practices (BMPs) to control dust. Examples of construction BMPs include sedimentation basins, placement of aggregate or stone at vehicle entrance/exit(s) and short-term vegetative cover such as seeding, plants, or mulching with a soil binder. Administrative BMPs examples include routine inspections and project policies such on-site vehicle traffic speed limits.

ER Impact:

No changes to the ER are required.

Item Number 71 **ER Section 4.4.1.5**

Request:

Provide more complete statement of plans to supplement public facilities and services to support expansion during construction.

Response:

ER Section 4.4.1.5 is related to transportation routes. Within the Phase II traffic impact study (KLD, 2008) for CCNPP Unit 3, UniStar Nuclear has identified traffic mitigation measures that, when implemented, will relieve the impact of increased traffic loads on the roads in the vicinity of the CCNPP site during construction of CCNPP Unit 3. There are no other plans to supplement public facilities or services to support expansion during construction. A copy of the Phase II traffic impact study has been attached as part of the response to RAI Item Number SE-4.

ER Impact:

No changes to the ER are required.

Item Number 72 **ER Section 4.4.1.5**

Request:

Provide more quantitative basis of traffic flow, capacity, and impacts that led to conclusion and the anticipated reduction due to the mitigation measures presented. It would be useful to relate Tables 4.4.1 (noise) and 4.4.2 (traffic) to baseline to show the anticipated impact.

Response:

The Phase II traffic impact study (KLD, 2008) for CCNPP Unit 3 includes baseline traffic conditions for roads and intersections in the vicinity of the plant. A copy of the Phase II traffic impact study is attached. Baseline noise studies have also been prepared for the area surrounding the CCNPP site for leaf-on and leaf-off conditions (Hessler, 2006) (Hessler, 2007). A copy of these noise studies is attached.

Figure 2.0.2 in the report, *Baseline Environmental Noise Survey, Leaf-off Season,* provides an hourly plot of baseline residual sound levels at various locations in the vicinity of the CCNPP site and Maryland State Route 2/4.(Hessler, 2006). A similar figure is not provided in the report, *Baseline Environmental Noise Survey, Leaf-on Season* (Hessler, 2007); however, the results from the leaf-off season study are most meaningful since traffic noise will be less attenuated due to interference with foliage during the leaf-off season. The results in Figure 2.0.2 support the conclusion that increased noise resulting from increased traffic on Maryland State Route 2/4 due to CCNPP Unit 3 construction and operations will be more significant at locations that are close to the highway, and become significantly less pronounced as separation distance increases.

The State of Maryland limits maximum sound levels from industrial sources at residential receptors to 65 dBA during the day, and 55 dBA during night periods. The Maryland statute also states that a limit of DNL = 55 dBA is the environmental "goal" of the state standards. A DNL limit of 55 dBA would require maximum day and night limits of 55 dBA and 45 dBA, 10 dBA lower than the State maximum levels to achieve this goal. Alternately, a plant could emit a maximum continuous day and night noise level of 49 dBA which would sum up to a DNL value of 55 .(Hessler, 2006).

Leaf-off noise levels at a survey site located close to Maryland State Route 2/4 indicate noise levels in the range of 30 dBA (night) to 60 dBA (day), which slightly exceeds State noise goals during peak daytime hours. Increased traffic due to CCNPP Unit 3 construction and operations would only be expected to increase these noise levels slightly, and it would not be expected to result in exceedance of State noise limits.

<u>References:</u>

Hessler, 2006, Baseline Environmental Noise Survey, Leaf-off Season, Report Number 121106-1, Hessler Associates, Inc., Marlborough, Massachusetts, December 2006.

Hessler, 2007. Baseline Environmental Noise Survey, Leaf-on Season, Report Number 082007-1, Hessler Associates, Inc., Marlborough, Massachusetts, August 2007.

KLD, 2008. Traffic Impact Study at the Calvert Cliffs Nuclear Power Plant, Draft Final Report, KLD Engineering, P.C., Baltimore, Maryland, May 2008.

ER Impact:

No changes to the ER are required.

Item Number 73 **ER Section 4.4.1.5**

Request:

Resolve apparent contradiction of this section to statements in Section 4.4.2.9 regarding traffic impacts.

Response:

Results of the attached Phase II traffic impact study (KLD, 2008) have concluded that the existing roadway system in the vicinity of CCNPP Unit 3 has sufficient capacity to handle peak traffic demand, but that mitigation in the form of additional traffic control is required. ER Section 4.4.1.5 will be updated to reflect this information. This will resolve the discrepancy between ER Sections 4.4.1.5 and 4.4.2.9. No changes are necessary for ER Section 4.4.2.9.

Reference:

KLD, 2008. Traffic Impact Study at the Calvert Cliffs Nuclear Power Plant, Draft Final Report, KLD Engineering, P.C., Baltimore, Maryland, May 2008.

ER Impact:

ER Section 4.4.1.5 will be revised in a future revision to the ER.

Item Number 74 **ER Section 4.4.2.3**

Request:

The discussion assumes a family size of 2.6 (including the in-migrating worker). Most analyses assume 2.6 ADDITIONAL family members. Explain the difference?

Response:

As stated in the Notes in Table 4.4.2-5, the 2.61 multiplier is based on the number of people per household in Maryland taken from the U.S Census data (USCB, 2008). It was assumed that an incoming worker was included within the 2.6 family members per household.

Reference:

USCB, 2008. US Census Bureau Factfinder. Maryland State Summary File 1 (SF 1) and Summary File 3 (SF 3)

ER Impact:

No changes to the ER are required.

Item Number 75 **ER Section 4.4.2.3**

Request:

The discussion of additional worker impacts does not include outage workers for 1&2, or operations workers on site during construction for 3&4. What will the cumulative impacts be?

Response:

information from Tables 4.4.2-5 and 5.8.2-1 has been combined in Table 1 to estimate the cumulative potential impact of CCNPP Unit 3 construction workers and operators that would occur, assuming 20% of the construction workforce relocates to the area. While the number of operators will likely increase over time, it is assumed for the purposes of this assessment that both sets of workers occur on site simultaneously. It is estimated that the total workforce needs are small due to the contribution of spouses as demonstrated in the table. The total combined workforce population from in-migration is estimated to be approximately 2,466 persons in Calvert County and 834 in St. Mary's County.

The total potential impact of CCNPP Construction and Operation is shown in Table 2. This analysis combines the CCNPP Unit 3 construction workforce with that of CCNPP Units 1 and 2 operations and assumes that one outage is taking place at either of the existing Units. The analysis also accounts for indirect workers regardless of where they might work. Similarly, during CCNPP Unit 3 operations, the cumulative workforce would be the sum of operations staff from all three units, outage staff from one unit and other workers that result from in-migration.

ER Impact:

ER Section 4.4.2.3 will be updated to add the text shown below:

> As shown in Table 4.4.2-7, the total maximum potential number of workers on site at any one time is approximately 5,783 personnel. This total represents the sum of the CCNPP Unit 3 construction workforce, CCNPP Units 1 and 2 operations staff (833), and CCNPP Units 1 or 2 outage personnel (1,000), assuming only one unit is in outage at a time. The total influx of workers to the area would include approximately 562 indirect workers assuming a 35% emigration of construction workers to Calvert and St. Mary's Counties.
>
> The number of workers potentially entering and leaving the site on a daily basis would be mitigated by shift rotation of the operations, outage and construction staff. In addition, the construction workforce is expected to ramp up gradually to its peak and them diminish as construction nears completion.
>
> The number of construction and indirect workers potentially residing in the ROI is shown in Tables 4.4.2-5 and 4.4.2-6.

Additionally, Table 2 will be added to ER Section 4.4, and the reference to Tables 4.4.2-5 and 4.4.2-6 will be removed from the first paragraph of Section 4.4.2.3 for the 20% in-migration scenario.

Table 1. In-migration Direct and Indirect Workforce Characteristics from CCNPP Unit 3 Construction and CCNPP Unit 3 Operations Personnel in Calvert and St. Mary's Counties -- 20% Immigration Scenario.

In-Migration Characteristics	Construction Period		
	Calvert County	St. Mary's County	ROI
Maximum Direct Construction Workforce			3,950
In-Migrating Direct Construction Workforce	537 (68%)	182 (23%)	719
In-Migrating Direct Population	1,402	474	1,876
Peak Indirect Workforce	368	125	493
Indirect Workforce Needs*	-148	-50	-196
Direct Operations Work Force			363
In-Migrating Direct CCNPP Unit 3 Operator Workforce	247	83	330
Indirect CCNPP Unit 3 Operator Workforce	494	167	661
Indirect and Direct Operator Workforce Population	1,064	360	1,424
Indirect Workforce Needs From Operations	161	54	215
Net Workforce Needs*	13	4	
Total Construction and Operations Populations	**2,466**	**834**	**3,300**

* Assumes 59.5% of spouses contribute to the workforce.

Table 2. Total Peak Workforce Potential

Workforce Groups	Workforce Potential	Total
Units 1 and 2 Operations and Outage		
CCNPP Units 1 & 2 Operations	833[1]	
CCNPP Units 1 & 2 Outage Workers	1,000[2]	
CCNPP Max. Existing Operational Workforce		1,833
Unit 3 Construction		
Peak CCNPP Unit 3 Direct Construction Workforce	3,950[3]	
Cumulative CCNPP Units 1 & 2, Outage plus Peak Direct Construction Workforce		5,783
Indirect In-Migration	862	
Cumulative Peak Operations, Construction & Outage Workforce		6,645
Unit 3 Operations		
Peak CCNPP Unit 3 Direct Operations Workforce	363[4]	
Cumulative CCNPP Units 1 & 2 Outage and Peak Direct Workforce	1,833	
CCNPP Unit 3 Operations and Units 1 and 2 w/outage		2,196
Indirect In-Migration Workforce	562	
Cumulative Peak Operation & Outage		2,758

Notes:

[1] ER Table 2.5-1

[2] ER Section 5.8.2.1.2

[3] ER Section 4.4.2.3

[4] ER Section 5.8.2.3

Item Number 76 **ER Section 4.4.2.8**

Request:

Provide quantification of expected impacts and/or similar construction activities to show levels/numbers of police calls, EMS calls, fire calls, students, and relate to baseline.

Response:

1) The incremental number of emergency calls due to in-migrating direct and indirect workers can be estimated by comparing the existing inventory of calls to the relative percentage increase in population that may occur. Table 2.5-3 provides the 2005 population estimates for Calvert County (88,750) and St. Mary's County (96,550). The percentage increase in population attributed to the influx of construction workers and operators in these counties was estimated to be approximately 2,466 people in Calvert County and 834 people in St. Mary's County for the 20% immigration scenario. The relative increase is approximately 3% for Calvert County and less than 1% for St. Mary's.

2) Table 2.5.2-25 provides a listing of the fire/EMS calls that were experienced in Calvert County during 2005. There were a total of 16,797 calls during that period or about 0.2/person. Applying an increase in population size on the order of 3%, and assuming that the rate of calling is proportionate to population size, number of calls would increase by approximately 500 annually. Comparable data were not available for St. Mary's County.

3) There were 17,431 students enrolled in Calvert County public schools in 2006. St. Mary's had 16,552 students enrolled (ER Section 2.5.2.5) (Table 2.5.2-13). The number of students in Calvert County represents about 20% of the county population and in St. Mary's, about 17%. If we apply these percentages to the estimated increase in population due to construction worker in-migration, approximately 490 new students would enroll in Calvert County (an increase of about 2.8%) and about 140 in St. Mary's (an increase above about 0.8%).

4) Assuming that of the 2.6 household members, 0.6 are students and a 20% in-migration during CCNPP Unit 3 construction, there would be a total of about 720 new households in the ROI (ER Section 4.4.2.4). This results in approximately 432 new students in the ROI. Approximately 68% of these, or 294, would reside in Calvert County and 23% in St. Mary's, or about 99 students.

ER Impact:

ER Section 4.4.2.8 will be updated to include the information contained in the items above in a future ER revision.

Item Number 77 **ER Section 4.4.2.9**

Request:

Expand the discussion of the following housing effects: upward pressure on all housing prices? Usage of RV parks and campgrounds? Trailer parks? The potential for "crowding out" of tourist places to stay and the resulting effect on tourism?

Response:

As stated in ER Section 4.4.2.4, there is adequate housing in the ROI to accommodate the expanded construction work force. As a result it is not likely that upward pressure on house prices would be experienced. Further, given the current housing crisis, falling house prices, and foreclosures, the ROI may experience a housing surplus. Also, as stated in ER Section 2.5.2.6.1 and 2.5.2.6.2 Calvert and St. Mary's Counties have established Comprehensive Plans to manage economic growth while preserving the natural heritage of the region and providing for enhanced recreational opportunities. (CCMP, 2004)(CCLP, 2006)(SMCMP, 2003)

Currently, Calvert County has 2 facilities with 155 camping/RV spaces while St. Mary's County has 6 facilities totaling 631 spaces. Open space permanently preserved and available to the public in Calvert Count totals 23,700 acres. Calvert has established a goal of preserving up to 40,000 acres of agricultural and forestry land. A needs assessment has been formed for recreational facilities in Calvert County and a goal established to increase recreational acreage from 1.889 in 2005 to 2.880 acres in 2020. Since these plans recognize and respond to increased population growth, there is a reasonable expectation that opportunities for public recreation will be addressed.

<u>References:</u>

CCMP, 2004. Comprehensive Plan, Calvert County, Maryland. Calvert County Board of Commissioners, December 2004.

CCLPP, 2006. Calvert County Land Preservation, Parks and Recreation Plan, St. Mary's Board of County Commissioners, December 2006.

SMCMP, 2003. Comprehensive Plan, Quality of Life in St. Mary's County - A Strategy for the 21st Century - , St. Mary's County Board of County Commissioners, March 2003.

ER Impact:

No changes to the ER are required.

Item Number 78 **ER Section 4.4.3**

Request:

Provide expected environmental and socioeconomic effects (impacts, pathways, comparison to the geographic area) on minority and low income populations. If there are no expected impacts in this category, state this.

Response:

The ER discussion on potential differential impacts implies strongly that there are no disproportionate impacts; however, additional supporting information will be inserted from previous sections to reinforce the conclusion that there will be no harmful impacts to minority and low income populations. The information identified below was drawn from ER Sections 2.5.4.1.1 and 2.5.4.1.2, and supports the conclusion of no expected impacts to minority and low income populations based on distribution alone.

1) Among Calvert County's 41 census blocks, there are no minority census blocks. In St. Mary's County, there were only two minority census blocks among the 55 identified. Maryland has 1,116 census blocks and of these 463 are considered minority blocks.

2) Of the 1,116 census blocks in Maryland, 27 were classified as having low income populations. By comparison, Calvert had none while St. Mary's County had one. The percentage of low income households was also comparatively low; 4.11% in Calvert County and 6.75% in St. Mary's compared to 8.32% in the Maryland within the 50 mi zone.

ER Impact:

The information identified in Item 1 of the response text will be incorporated into ER Sections 4.4.3, and a sentence stating that "Construction and operation of CCNPP Unit 3 are expected to have no disproportionate effect on minority and low income populations" will be added to ER Section 4.4.3.1 in a future ER revision.

Item Number 79 **ER Section 4.5**

Request:

Provide copy of offsite dose calculation manual (ODCM) for Units 1 and 2.

Response:

The CCNPP Unit 1 & 2 Offsite Dose Calculation Manual was submitted on July 14, 2005 (ADAMS Accession Number ML052020232).

ER Impact:

No changes to the ER are required.

Item Number 80 **ER Section 4.5**

Request:

Provide last 3 years Radiological Environmental Monitoring Operating Report (REOR) for Units 1 and 2.

Response:

The Radiological Environmental Operating Reports for CCNPP Units 1 & 2 for 2004, 2005, and 2006 were submitted on May 13, 2005 (ML051370609), May 15, 2006 (ML061440213), and May 10, 2007 (ML071590393), respectively.

ER Impact:

No changes to the ER are required.

Item Number 81 **ER Section 4.5**

Request:

Provide last 3 years annual Radiological Effluent Release Report for Units 1 and 2.

Response:

The Radioactive Effluent Release Report for CCNPP Units 1 and 2 for 2004, 2005, and 2006 were submitted on July 14, 2005 (ML052020232), July 13, 2006 (ML061980021), and July 11, 2007 (ML072050475 (cover letter) and ML072050478 (report)).

ER Impact:

No changes to the ER are required.

Item Number 82 **ER Sections 4.5, 4.5.6**

Request:

Provide the input code information regarding the location of and number of construction workers and other details of collective dose calculations (see 104).

Response:

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The number of workers (in terms of Full Time Equivalents) and their location by zone are given in the attached Table 1. Revised zone locations are shown by 100 x 100 foot squares in the attached Figure 4.5-7. The details of the collective dose calculations are given in the following discussion.

As noted in ER Section 4.5.4, dose rates from all sources combined were calculated for each 100 x 100 foot square on the plant grid. The dose rates were the sum of the dose rate from the four main sources; gases, liquids (only on the shoreline), ISFSI, and Resin Storage Area and assume the occupancy for construction workers is 2,200 hours per year.

The equation for dose rate during year t at location x,y on the plant grid is:

$$\dot{D}_{x,y} = \dot{D}_{gas} + \dot{D}_{liq} + \dot{D}_{N,2005} + \dot{D}_{S,t} + \dot{D}_{resin}$$

where the terms are explained in the ER subsections.

The equation for the average dose rate in a zone is:

$$\overline{\dot{D}}_Z = \frac{1}{N_Z} \sum_{(\text{all } x,y \text{ in } Z)} \dot{D}_{x,y}$$

where N_Z is the number of squares in the zone.

The equation for collective dose for the construction period is:

$$D = \frac{2200}{8760} \sum_t \sum_Z \overline{\dot{D}}_Z \mathrm{FTE}_{Z,t}$$

where

$\frac{2200}{8760}$ = fraction of work hours per year

$\overline{\dot{D}}_Z$ = average dose rate in zone, Z.

$\mathrm{FTE}_{Z,t}$ = Full Time Equivalents in zone Z during year t.

The equation for full time equivalents is:

$$\text{FTE}_{Z,t} = \text{P}_Z \text{ Census}_t$$

where P_Z = probability of worker in zone, Z

Census_t = FTE of workers on site in year t.

The probability of a worker in each zone, P_Z, reflects the average construction worker and is based on an approximation of how much time the average worker spends in each zone. For example, the time in the parking lot and road is low, in the construction area is high, in the offices is less. These are estimates based on construction experience.

The spatial distribution of zones on the site is shown in revised ER Figure 4.5-7 (attached). The figure is annotated with red letters indicating a zone code. There are many locations where construction workers are not expected to be, so they are not marked in the Figure. Those zones that are marked were chosen because of planned activities at those locations, for example, the parking lots, roads, and the construction area.

Note that a description of the calculation of solid angle for the estimation of ISFSI dose rate was not previously provided and will be added to ER Section 4.5.4.3 as follows:

> The equation for solid angle is derived empirically from dosimetry and distance measurements at the ISFSI site. The height, H, and radius, R, are effective values derived from the fit. They are 400 and 124 feet respectively. The equation is:

$$\omega = 2\arcsin\left(\left(\frac{H}{\sqrt{H^2 + r^2}}\right)\left(\frac{R}{\sqrt{R^2 + r^2}}\right)\right)$$

The calculation of the collective doses was performed using Excel spreadsheets to calculate results using the equations described above. New Tables reflecting these calculations are provided as attached Tables 1 and 2. Additionally, ER Table 4.5-13 has been revised to include collective dose results based on using effluent release and meteorological data through 2006 vs. 2005 for the original table.

An example of the calculation is provided below:

Example Dose Rate Calculation

As an example, the dose rate to the location N8050, E9150 is calculated. This location is at the center of the square that is nearest to the center of the containment. The ISFSI will be at its maximum load for the construction period (projected in 2015). The distances between the sources and the receptor are shown in the following table. Note, that the first grid coordinate on the map is shown as N8050, but, mathematically is -8050. The distance between the gas stack and the receptor is

$$r = \sqrt{(-10474 - -8050)^2 + (9996 - -8050)^2} = 2567$$

The other distances are similarly calculated

Location	N	E	r (ft)
Receptor	-8050	9150	
Gas Stack	-10474	9996	2567
ISFSI North Half	-9703	7936	1927
ISFSI South Half	-9403	7936	1694
Resin Area	-10100	7600	2570

The dose rate from gases released from the stack are

$$\dot{D}_{gas} = 220256 \cdot 2567^{-1.8} = 0.16064$$

The dose rate from liquids is zero because the receptor is not near the shoreline nor any effluent liquids. The dose rate from the ISFSI is calculated assuming the 2005 load at both the North and South halves. Both dose calculations depend upon the solid angles in streradians (sr) which as calculated as follows:

$$\omega_N = 2\arcsin((\frac{400}{\sqrt{400^2 + 1927^2}})(\frac{124}{\sqrt{124^2 + 1927^2}})) = 0.02611 sr$$

Similarly for the south half:

$$\omega_S = 2\arcsin((\frac{400}{\sqrt{400^2 + 1694^2}})(\frac{124}{\sqrt{124^2 + 1694^2}})) = 0.03356 sr$$

Note, that arcsin() calculates planar angle in degrees or radians. Units of degrees are converted by $\theta(\text{radians}) = \theta(\text{degrees})\,\pi / 180$. The dose rate from the North half of the ISFSI is

$$\dot{D}_{N,2005} = 76 \cdot 0.02611 \cdot e^{-0.00195 \times 1927} = 0.04631$$

From the south half the dose rate is calculated assuming it is loaded like the north half in 2005:

$$\dot{D}_{N,2005} = 76 \cdot 0.03356 \cdot e^{-0.00195 \times 1694} = 0.09381$$

Correcting for ISFSI loading out to the year 2015:

$$\dot{D}_{S,t} = (-170.8456 + 0.08521 \cdot 2005)\, 0.04631 = 0.07998$$

The dose rate from resins is:

$$\dot{D}_{resin} = \frac{2.23E6\, e^{-0.000951 \times 2570}}{2570^2} = 0.2931$$

Thus, the dose rate near the center of the containment in 2015 is:

$$\dot{D} = 0.16064 + 0 + 0.04631 + 0.07998 + 0.02931 = 0.316\,(\text{mrem/y})$$

ER Impact:

ER Section 4.5.4 will be revised to include the above discussion related to the calculation of collective doses (not including the example).

Additionally, the equations throughout ER Section 4.5.4 will be revised to make the variable notations in the equations consistent with other equations within the subsections.

An equation will be added to ER Section 4.5.4.2 for liquid dose rate (which had been previously described in words).

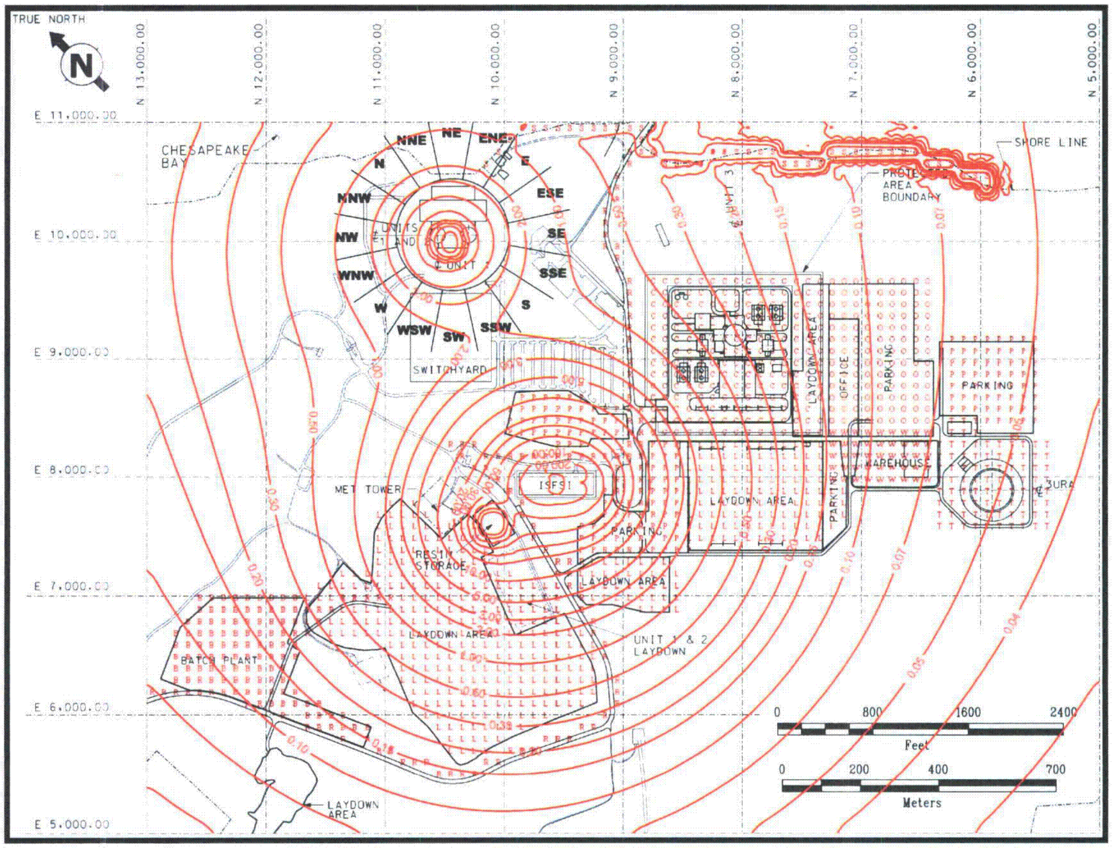
A description of the calculation of solid angle for the estimation of ISFSI dose rate was not previously provided and will be added to ER Section 4.5.4.3 as noted above.

ER Figure 4.5-7 will be revised to reflect changes in contour lines and to add a notes key to define occupational zones (updated figure attached).

Figures 4.5-9 and 4.5-11 will be revised for clarity (updated figures are attached).

Attached Tables 1 and 2 will be incorporated into the ER to provide FTE and average dose rate data.

Revised Figure 4.5-7: Dose Rate Estimated in 2015 (mrem per 8760 hours)

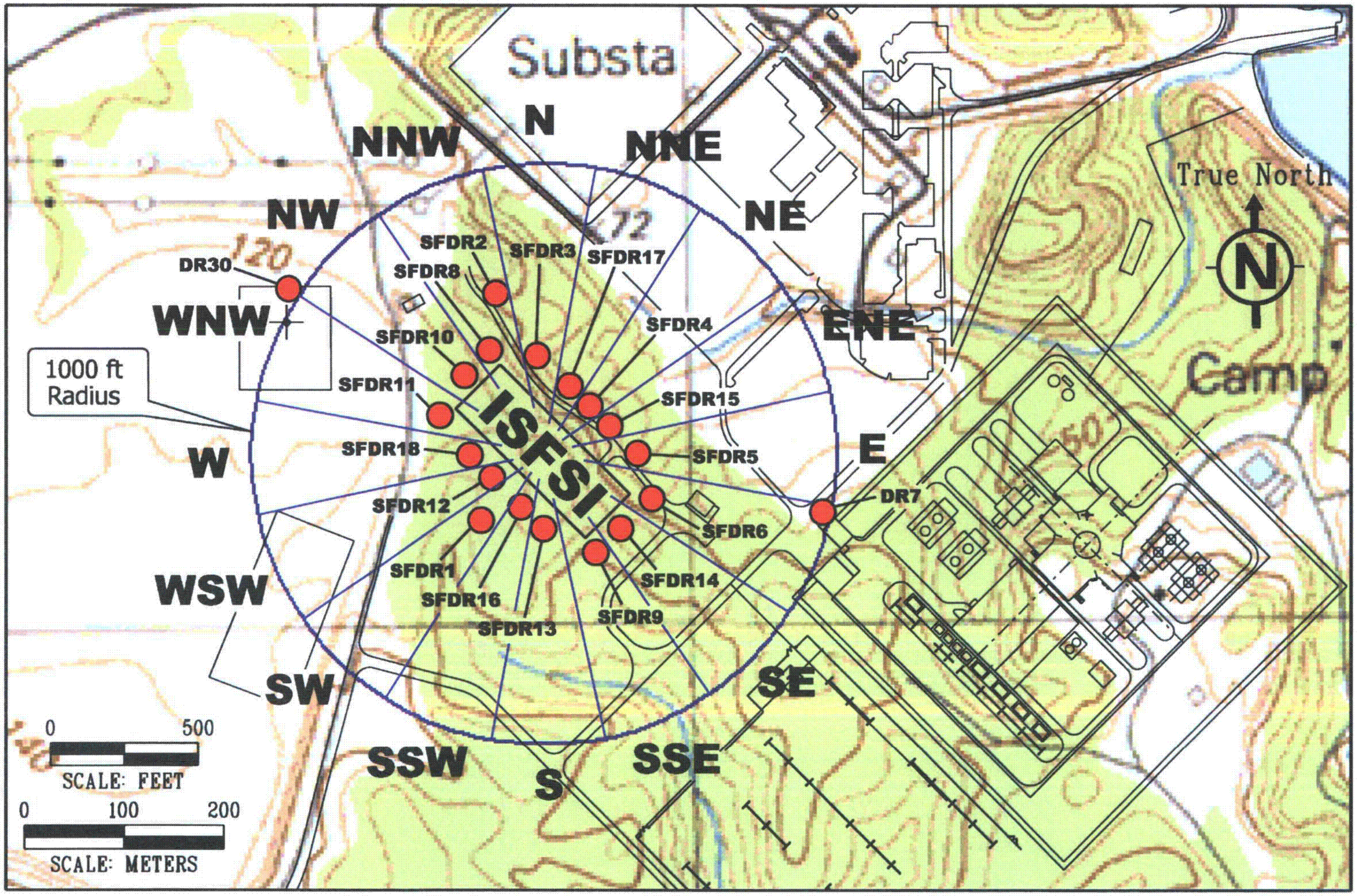


Note 1 – the plant grid is in feet and is labeled every 1000 feet.

Note 2 – the following provides a key to the zones indicated in the figure.

Zone	Description
B	Batch Plant
C	Construction on main structures
L	Laydown
O	Office/Trailer
P	Parking
R	Roads
S	Shoreline, tunnel, barge, in/out flow
T	Tower/Basin/Desalinization
W	Warehouse

Revised Figure 4.5-9: ISFSI TLD Locations



Revised Figure A4.5-11: Resin Area TLD Locations

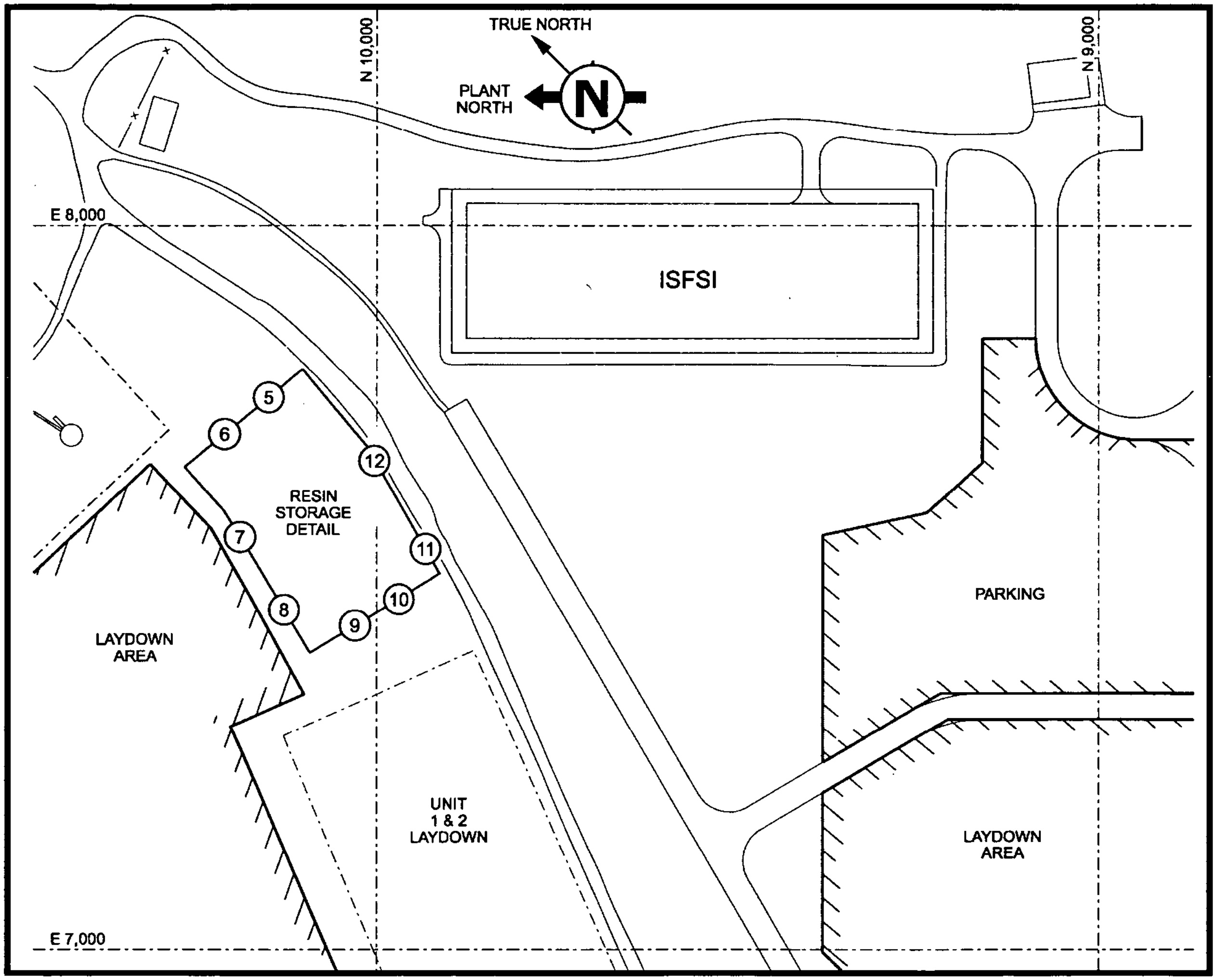


Table 1. FTE for CCNPP Unit 3 Construction Workers

		FTE (Number of Workers by Zone)					
Zone	Count	2010	2011	2012	2013	2014	2015
B	93	0.5	2.3	4.0	4.0	4.0	3.2
C	209	353.1	1516.9	2660.0	2660.0	2660.0	2138.0
L	444	10.6	45.6	80.0	80.0	80.0	64.3
O	117	85.0	365.0	640.0	640.0	640.0	514.4
P	148	10.6	45.6	80.0	80.0	80.0	64.3
R	139	10.6	45.6	80.0	80.0	80.0	64.3
S	47	35.0	150.5	264.0	264.0	264.0	212.2
T	86	35.0	150.5	264.0	264.0	264.0	212.2
W	45	1.6	6.8	12.0	12.0	12.0	9.6
		542.2	2328.9	4084.0	4084.0	4084.0	3282.5

Zone	Description
B	Batch Plant
C	Construction on main structures
L	Laydown
O	Office/Trailer
P	Parking
R	Roads
S	Shoreline, tunnel, barge, in/out flow
T	Tower/Basin/Desalinization
W	Warehouse

Table 2. Average Dose Rates (mrem/y) by Zone – CCNPP Unit 3

Average Dose Rates (mrem/y) by Zone							
Zone	Count	2010	2011	2012	2013	2014	2015
B	93	0.133	0.133	0.133	0.133	0.134	0.134
C	209	0.468	0.494	0.520	0.546	0.573	0.599
L	444	2.226	2.267	2.308	2.350	2.391	2.432
O	117	0.095	0.095	0.096	0.097	0.097	0.098
P	148	7.818	8.434	9.049	9.665	10.280	10.896
R	139	12.567	13.200	13.833	14.465	15.098	15.731
S	47	0.613	0.614	0.614	0.614	0.614	0.614
T	86	0.052	0.052	0.052	0.053	0.053	0.053
W	45	0.092	0.093	0.095	0.096	0.097	0.098

Zone	Description
B	Batch Plant
C	Construction on main structures
L	Laydown
O	Office/Trailer
P	Parking
R	Roads
S	Shoreline, tunnel, barge, in/out flow
T	Tower/Basin/Desalinization
W	Warehouse

Table 3. Collective Dose to CCNPP Unit 3 Construction Workers (updates Table 4.5-13)

Collective Dose (person-rem) (person-sievert) by Zone								
Zone	Zone Description	2010	2011	2012	2013	2014	2015	By Zone
B	Batch Plant	0.000/ 0.00000	0.000/ 0.00000	0.001/ 0.00001	0.001/ 0.00001	0.001/ 0.00001	0.000/ 0.00000	0.002/ 0.00002
C	Construction on main structures	0.165/ 0.00165	0.749/ 0.00749	1.384/ 0.01384	1.454/ 0.01454	1.524/ 0.01524	1.281/ 0.01281	6.556/ 0.06556
L	Laydown	0.024/ 0.00024	0.103/ 0.00103	0.185/ 0.00185	0.188/ 0.00188	0.191/ 0.00191	0.156/ 0.00156	0.847/ 0.00847
O	Office/Trailer	0.008/ 0.00008	0.035/ 0.00035	0.061/ 0.00061	0.062/ 0.00062	0.062/ 0.00062	0.050/ 0.00050	0.279/ 0.00279
P	Parking	0.083/ 0.00083	0.385/ 0.00385	0.724/ 0.00724	0.773/ 0.00773	0.822/ 0.00822	0.701/ 0.00701	3.488/ 0.03488
R	Roads	0.133/ 0.00133	0.602/ 0.00602	1.107/ 0.01107	1.157/ 0.01157	1.208/ 0.01208	1.012/ 0.01012	5.219/ 0.05219
S	Shoreline, tunnel, barge, in/out flow	0.021/ 0.00021	0.092/ 0.00092	0.162/ 0.00162	0.162/ 0.00162	0.162/ 0.00162	0.130/ 0.00130	0.731/ 0.00731
T	Tower/Basin/ Desalinization	0.002/ 0.00002	0.008/ 0.00008	0.014/ 0.00014	0.014/ 0.00014	0.014/ 0.00014	0.011/ 0.00011	0.063/ 0.00063
W	Warehouse	0.000/ 0.00000	0.001/ 0.00001	0.001/ 0.00001	0.001/ 0.00001	0.001/ 0.00001	0.001/ 0.00001	0.005/ 0.00005
		0.437/ 0.00437	1.976/ 0.01976	3.638/ 0.03638	3.812/ 0.03812	3.985/ 0.03985	3.343/ 0.03343	17.190/ 0.17190

Zone	Description
B	Batch Plant
C	Construction on main structures
L	Laydown
O	Office/Trailer
P	Parking

Zone	Description
R	Roads
S	Shoreline, tunnel, barge, in/out flow
T	Tower/Basin/Desalinization
W	Warehouse

Item Number 83 **ER Section 5.2.1**

Request:

Although the ER discusses flood mitigation activities, provide an analysis that describes the ramifications of the designs and what situations would need to occur for the designs to move from a SMALL to a MODERATE problem. These include flood handling capability of the floodplain, flow and circulation patterns, dredging operations, erosion subsidence, thermal plume issues, and sediment transport. A universal theme is that these analyses would be part of the permitting process. The specific analysis is needed for the EIS. (Cross reference with HI-1[(a)])

Response:

A comprehensive plant design has been developed that will result in a SMALL impact to the environment of the site and vicinity during the construction phase as well as the plant operation phase. Examples of the elements of the design that can affect the environment are: 1) intake structure; 2) discharge structure, 3) storm water management system; 4) erosion and sedimentation control measures; and 5) the location of CCNPP Unit 3.

1. Physical impacts at the CCNPP Unit 3 intake that have been considered to be potentially significant during previous licensing activities for CCNPP Units 1 and 2 included altered current patterns, salinity gradients, and scouring. Based largely on the results of extensive hydrodynamic modeling and subsequent design modifications, it was concluded that the impacts related to these issues were small and that plant-specific mitigation measures were not warranted.

   As noted in ER Section 5.3.1.1, the design criteria resulting from the model study included; 1) a limitation in temperature rise across the condensers; 2) withdrawal of cooler waters from below the thermocline; 3) limiting impact on organisms in the upper photosynthetic zone; and 4) intake velocities less than 0.5 ft/sec. Taken together, these measures served to limit the potential impact of the addition of a closed-cycle unit to the CCNPP site. Considering this and the facts that (1) the amount of cooling water that will be withdrawn for CCNPP Unit 3 is small compared to that of CCNPP Units 1 and 2; and (2) the CCNPP Unit 3 intakes for the CWS and UHS will be located within the existing intake embayment, the physical impacts of the CCNPP Unit 3 intakes are considered small.

   Less conservative modifications to these design elements would be likely to result in the environmental impacts to the Chesapeake Bay moving from SMALL to MODERATE.

2. The State of Maryland enforces the appropriate environmental design of discharge structures to protect against negative impacts from possible pollutants, including thermal pollution, and low oxygen content. The discharge structure for CCNPPUnit 3 has been designed not only to meet applicable navigation and

maintenance criteria, but also to provide an acceptable mixing zone for the thermal plume to meet the State of Maryland regulations for thermal discharges.

A 30-inch buried discharge pipe will extend 550 feet into the Chesapeake Bay, at which point it will be connected to a multi-port diffuser having its centerline elevation 3 feet above the Chesapeake Bay bottom elevation. Three 16-inch diffuser nozzles will discharge the effluent at an angle of 22.5 degrees to the horizontal. This design will provide for rapid mixing of the thermal effluent with the ambient tidal flows, and will also minimize scouring.

Using a less conservative design could result in the impact of the discharge structure moving from SMALL to MODERATE.

3. One of the primary design elements affecting the environment is the storm water management system, when properly designed and implemented it is expected to minimize negative impacts on streams, wetlands and important species. Storm water control structures to be included in the design of the storm water management system for CCNPP Unit 3 will serve to significantly minimize the downstream flooding effects of large storms.

   Based on a planned storm water management study, the storm water management system will be sized such that the downstream flow rates, sediment loads and water quality will be similar to the existing conditions and such that the post-development peak discharges will not exceed the pre-development rates. Thus, no significant change in the water-quality characteristics or in the long term or short term flow to the streams and wetlands from the switchyard or from power block area is expected.

   In the absence of such a storm water management study with the resulting conservative design of the water conveyance structures, the potential impact on downstream wetlands and water bodies could move from SMALL to MODERATE.

4. The minimization of soil erosion and sedimentation will be largely effected by implementation of the erosion and sediment control measures detailed in the Calvert Cliffs Unit 3 Storm Water Management Plan, dated April 2008. These measures will be implemented by installation of *initial, intermediate,* and *final* erosion and sedimentation controls, which will be planned, conducted and maintained according to the Calvert County Soil Conservation District standards and specifications.

   Initial controls will be installed prior to construction commencement and will include perimeter protection fencing and controls and strictly-controlled construction exits. *Intermediate* controls will include silt fencing, sediment ponds, diversion dikes and stone check dams if necessary to control erosion and storm-water runoff. During the grading and construction phase, additional intermediate erosion controls will be put in place as land disturbance occurs. Erosion control devices will be implemented or modified as the drainage patterns for storm water

The above elements of construction planning and impacts mitigation strategies have been undertaken to maintain environmental impacts SMALL. Alteration of any of the above, either individually or collectively, in a non-conservative manner, or revision of any other assumption of extreme environmental design parameters (e.g., larger PMP (Probable Maximum Precipitation)) could result in environmental impacts moving from SMALL, to MODERATE or LARGE.

ER Impact:

No changes to the ER are required.

Item Number 84 **ER Section 5.2.1**

Request:

The arithmetic difference (18,386 gpm) between Chesapeake Bay withdrawals (37,778 gpm Table 3.3-1) and the effluent discharge to the Chesapeake Bay (19,426 gpm Table 3.3-1) does not appear to be equivalent to the CWS & ESWS Evap and drift (17,354 gpm, 940 gpm, 39 gpm, and 2 gpm), and Fire, portable, sanitary (20 gpm, 3 gpm), which totals 18,358 gpm. (Cross reference with HS-31[(a)])

Response:

As reflected in the current revision of the ER, the difference between Chesapeake Bay withdrawal of 37,788 gpm listed in Table 3.3-1, and the effluent discharge to the Chesapeake Bay of 19,426 gpm, equates to 18,362 gpm. Referring to Figure 3.3-1, the amount of water consumed is the sum of the following: [940 gpm + 2 gpm (ESWS cooling tower evaporation and drift)] + [17,354 gpm + 39 gpm (CWS cooling tower and drift)] + [103 gpm – (1 gpm + 20 gpm + 55 gpm) (power plant usage)] which also equates to 18,362 gpm.

The values for Chesapeake Bay withdrawal and discharge flow have been updated since the ER was last submitted. The updated value for withdrawal from the Chesapeake Bay is 41,095 gpm, and the updated effluent discharge to the Chesapeake Bay is 21,019 gpm, resulting in a difference between the two of 20,076 gpm. Subsequent revisions in water consumption flows which will be listed in Table 3.3-1, and shown on Figure 3.3-1, are as follows: (566 gpm + 2 gpm) ESWS cooling tower evaporation and drift + (19,016 gpm + 39 gpm) CWS cooling tower evaporation and drift + (413 gpm) additional capacity + (40 gpm) power plant consumption = 20,076 gpm.

A water use diagram with updated flow values is provided in the response to RAI 42. Figure 3.3-1 and Table 3.3-1 will be updated to indicate the updated flow values and modified flow arrangement shown in a future ER revision.

ER Impact:

Figure 3.3-1 and Table 3.3-1 will be revised in a future ER revision to reflect the anticipated water use flows. The updated figure and table are shown in the response to RAI Item Number 7.

Item Number 85 **ER Section 5.2.2**

Request:

The discharge levels associated with Unit 3 are very small when compared to those associated with Units 1 and 2, so expected problems from Unit 3 are not anticipated. Provide analyses associated with discharges to the Chesapeake Bay substantiating negligible impacts, subject to Federal, State, and local permitting processes.

Response:

The following analysis illustrates that the expected impact of discharges from CCNPP Unit 3 will be insignificant. Table 1 summarizes the estimated amounts of effluents to be discharged to the Chesapeake Bay from CCNPP Unit 3 on an annual average basis. As can be seen from the table, cooling tower blowdown dominates all other discharges, contributing over 90% of the total discharge. The only other significant contributor is the desalinization plant effluent, which releases about 8.7% of the total effluent. The remaining effluent streams, miscellaneous low volume waste, treated sanitary waste, and treated liquid radwaste, contribute about 0.7%.

As a result, the constituents in the blowdown and desalinization plant effluents are the only ones that significantly affect the constituents of the total effluent. The constituents of these waste streams are driven by their original source of water, the Chesapeake Bay. The constituents of the other waste streams will be diluted by a factor of from about 225 to over 1,900. Nevertheless, estimates of the concentrations of expected constituents in the total effluent based on currently-available design data have been generated. Those concentrations are shown in Table 2. More precise determinations of the amounts of these constituents will be made as part of the NPDES permitting process.

The concentrations shown in Table 2 will be present in the combined discharge from CCNPP Unit 3 to the Chesapeake Bay. Those concentrations will rapidly diminish as the effluent mixes with the water in the Chesapeake Bay. However, to illustrate the insignificance of those concentrations prior to any mixing in the Bay, a comparison was made to the Aquatic Life chronic salt water limits (µg/l) specified in COMAR 26.08.02.03-2G (COMAR, 2008) . The only substances in the effluent for which limits exist are arsenic, chromium, copper, nickel and zinc. The CCNPP Unit 3 effluent concentrations (prior to mixing in the Chesapeake Bay) are compared to the Aquatic Life limits below:

Substance	Aquatic Life Limit (μg/l)	CCNPP Unit 3 Concentration (μg/l)
Arsenic	36	0.062
Chromium	50	0.18
Copper	3.1	0.097
Nickel	8.2	0.12
Zinc	81	0.27

It is concluded that any impacts to aquatic biota will be SMALL, and will not warrant mitigation.

Table 1 Effluent Discharge to Chesapeake Bay on Annual Average Basis

Wastewater Stream	Flow* gpm (lpm)	Percent of Total Flow
CWS Cooling Tower Blowdown	18,977 (71,836)	90.3
ESWS Cooling Tower Blowdown	61 (231)	0.3
Total Cooling Tower Blowdown	*19,038 (72,068)*	*90.6*
Desalinization Plant Waste	1,838 (6958)	8.7
Miscellaneous Low Volume Waste	39 (148)	0.2
Waste Water Retention Basin Discharge	*20,914 (79,168)*	*99.5*
Treated Sanitary Waste	93 (352)	0.4
Treated Liquid Radwaste	11 (42)	0.005
Total Effluent from Seal Well	*21,019 (79,566)*	*100.0*

*Taken from Water Balance

Table 2 Estimated Effluent Constituent Concentrations for CCNPP Unit 3

Effluent Stream[1]	Flow gpm (lpm)[1]	Constituent Concentration (mg/l) NaOCl	NaOH	HEDP	Petrol. Distil.	Sodium Bisulfite	TDS	Silica	Nitrates	NH3	BOD
CWS Blowdown[3]	71,828 (272,075.8)	1.45	3.61	1.01	1.73	1.01	35,000	6	20	2	
ESWS Blowdown[4]	231 (875)	0.098	0.244	1.01			743	0.2	4.32	0.74	
Desal Plant[5]	6,957 (36,352.3)						39,700	5.9	16.07	1.63	
Treated Sanitary[6]	352 (1,333.3)									1	10.6
Misc Aqueous	148 (560.6)										
Treated Radwaste[7]	42 (175)										
Total	79,557 (301.352.3)	1.31	3.26	0.91	1.56	0.91	35,073	5.9	19.5	1.95	0.047

[1] Taken from Water Balance.

[2] These chemicals are added to effluents other than rad waste in the Liquid Waste Storage System as part of biological and chemical treatment and thus are substantially depleted prior to release of the effluent to the Chesapeake Bay.

[3] NaOCl, NaOH, HEDP, Petroleum Distillates, and Sodium Bisulfate based on chemicals added from Technical Report Table 6.4-2 and CWS blowdown; TDS based on value used for air emissions calculations; silica, nitrates, and NH3 based on constituent data in Calvert Cliffs Desalination Study Table 4.4-1 (50% recovery); and other concentrations taken from Environmental Report Table 3.6-1 that provides data on concentrations of total reduced chlorine, total organic carbon, and total suspended solids.

[4] NaOCl, NaOH, HEDP, Petroleum Distillates, and Sodium Bisulfate based on chemicals added from Technical Report Table 6.4-2 and ESWS blowdown; TDS, silica, nitrates, and NH3 based on constituent data in Calvert Cliffs Desalination Study Table 4.4-1; and other concentrations taken from Environmental Report Table 3.6-1.

[5] TDS, silica, nitrates, and NH3 based on constituent data in Calvert Cliffs Desalination Study Table 4.4-1.

[6] Constituent concentrations (except TRC and TSS) are from Technical Report Table 6.4-4 and are based on effluent for CCNPP Units 1 and 2 wastewater treatment plant and do not reflect tertiary treatment for Unit 3, which will result in improvements in effluent quality. TRC and TDS data from Environmental Report Table 3.6-1.

[7] Waste stream contains only very small amounts of radioactive material that would be diluted by a factor of 1,900 when combined with the other effluent streams.

Table 2 Estimated Effluent Constituent Concentrations for CCNPP Unit 3 (cont'd)

Constituent Concentration (mg/l)

COD	TOC	TSS	Arsenic	Chromium	Copper	Nickel	Zinc	TRC	Fecal Col	H2SO4[2]	NaOH[2]
	1.4	5.2						0.1			
								0.1			
26	5.6	3.4	0.014	0.041	0.022	0.028	0.06	0.1	12		
0.115	1.29	4.71	6.2E-05	1.8E-04	9.7E-05	1.2 E-04	6.2E-05	0.091	0.053		

<u>Reference</u>

COMAR,2008. Code of Maryland Regulations 26.03.02-2 Numerical Criteria for Toxic Substances in Surface Waters. 2008

ER Impact:

No changes to the ER are required.

Item Number 86 ER Section 5.2.2

Request:

Units 1 and 2 sampling indicate that there are minimal toxic impacts to organisms (pg 5.3-10). Provide an analysis to demonstrate how SMALL water quality impacts are. For example, if one performs a very simple calculation using the numbers provided in the ER, one can come up with crude dimensions needed to dilute the expected Total Dissolved Solids (TDS) concentrations to the Secondary Maximum Contaminant Level (SMCL). From Table 2.3.1-14 the average velocity in Chesapeake Bay is 1.7 knots (2.867 ft/s). From Figure 2.3.1-(12-13, 18-19), a lower but realistic constant temperature thickness is 5 ft. TDS release is 20,000 mg/L (pg 5.2-7) with a discharge rate of 23,227 gpm (pg 5.2-7). The U.S. EPA (SMCL for TDS is 500 mg/L. To dilute the TDS concentration to the SMCL, a width of water approximately equal to 144 ft would be required (23227 gpm / 7.48 gal/ft^3 / 60 s/min x (20,000/500) / 2.867 fps / 5 ft). (Cross reference with HI-1, HS-41[a])

Response:

The response to this item is provided in the response to RAI Item Number 85. No attempt was made to determine crude dimensions needed to dilute the expected TDS concentrations to the SMCL because the SMCL is a drinking water criterion and the CCNPP Unit 3 effluent will be directed to the saltwater of the Chesapeake Bay.

ER Impact:

No changes to the ER are required.

Item Number 87 **ER Section 5.3**

Request:

Clean Water Act Section 316(a) regulates the cooling water discharges to protect the health of the aquatic environment, yet this regulation is not referenced in Table 1.3-1. Explain. (Cross reference with HS-31[(a)])

Response:

The updated version of ER Table 1.3-1 attached to RAI Item Number 88 includes the addition of a listing for the applicable requirement of Section 316(a) under the Clean Water Act.

ER Impact:

ER Table 1.3-1 will be updated in a future ER revision.

Item Number 88 **ER Section 5.3**

Request:

Clean Water Act Section 316(b) regulates cooling water intake structures to minimize environmental impacts associated with location, design, construction, and capacity of those structures, yet this regulation is not referenced in Table 1.3-1. Explain. (Cross reference with HS-21[a])

Response:

The attached updated version of ER Table 1.3-1 includes the addition of a listing for the applicable requirement of Section 316(b) under the Clean Water Act.

ER Impact:

ER Table 1.3-1 will be updated in a future ER revision.

Table 1.3-1 Federal, State and Local Authorizations
(Page 1 of 7)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
U.S. Nuclear Regulatory Commission (USNRC)	10 Code of Federal Regulations (CFR) 40	Source Material License	--[a]	--[a]	Possession, use and transfer of source material	March 2008
USNRC	Atomic Energy Act of 1954 (AEA), 10 CFR 51; 10 CFR 52.89	Environmental Impact Statement (EIS)	--[a]	--[a]	Site approval for construction and operation of a nuclear power station as part of an application for a combined license (COL)	July 2007
USNRC	10 CFR 52, Subpart C	COL	--[a]	--[a]	Combined license for a nuclear power station	March 2008
USNRC	10 CFR 70	Special Nuclear Material License	--[a]	--[a]	Possession, delivery, receipt, use, transfer of fuel	March 2008
USNRC	10 CFR 30	By-Product Material License	--[a]	--[a]	Production, transfer, receipt, acquisition, ownership, possession of nuclear byproduct materials	March 2008
USNRC	10 CFR 52.80, 10 CFR 50.10	Limited Work Authorization (LWA) [b]	--[a]	--[a]	Safety-related construction prior to issuance of COL conditionally authorized by NRC	March 2008
Federal Aviation Administration (FAA)	49 United States Code (USC) 44718, 14 CFR 77.13	Construction Notice	--[a]	--[a]	Construction of structures (>200 feet) affecting air navigation	February 2010

Table 1.3-1 Federal, State and Local Authorizations
(Page 2 of 7)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
US Army Corps of Engineers (USACE)	Federal Water Pollution Act, Sec. 404; 33 CFR 322-323; Rivers and Harbors Act, 33 USC 403, Section 10	Individual Permit	--[a]	--[a]	Excavation, dredging, and/or disposal of dredged material in navigable waters; filling of waters of U.S. Needed for construction/modification of the discharge structure, barge slip upgrade, and any filling of waters of U.S.	August 2007
Maryland Department of the Environment (MDE)	Coastal Zone Management Act (CZMA), 15 CFR 930.57	CZMA Consistency Certification and Approval	--[a]	--[a]	Any activity that could affect the state's coastal zone resources.	March 2008
U.S. Fish and Wildlife Services (USFWS)	Endangered Species Act (ESA), Section 7 (16 USC 35); 50 CFR 402	Consultation regarding potential to adversely impact protected species (non-marine species) and critical habitats	--[a]	--[a]	Identification of protected species and critical habitats onsite and in the vicinity, assessment of project construction and/or operation impacts, and concurrence on appropriate mitigation.	Ongoing
National Marine Fisheries Service (NMFS)	ESA, Section 7 (16 USC 35); 50 CFR 402	Consultation regarding potential to adversely impact protected species (marine species) and critical habitats	--[a]	--[a]	Identification of protected species and critical habitats onsite and in the vicinity, assessment of project construction and/or operation impacts, and concurrence on appropriate mitigation.	Ongoing
NMFS	Magnuson-Stevens Fishery Conservation Management Act, Section 305(b) (2)-(4)	Consultation regarding potential impacts to Essential Fish Habitat (EFH)	--[a]	--[a]	Identification of EFH in the site vicinity, assessment of project operations impacts, and concurrence on appropriate mitigation.	Ongoing
USFWS	Migratory Bird Treaty Act, 50 CFR 21	Migratory Bird Permit	--[a]	--[a]	Adverse impacts on protected species and/or their eggs or nests due to site operations	2014

Table 1.3-1 Federal, State and Local Authorizations

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
State Historic Preservation Office (SHPO)/ Maryland Historic Trust	National Historic Preservation Act (NHPA); 36 CFR 800	Cultural Resources Review and Consultation	--[a]	--[a]	Identification, description, and evaluation of cultural resources on and in the site vicinity with the potential to be impacted by plant construction and/or operations. Concurrence on appropriate mitigation.	Ongoing
Maryland Public Service Commission (PSC)	Annotated Code of MD 7-207 and 7-208; Code of Maryland Regulations (COMAR) 20.79	Certification of Public Convenience and Necessity (CPCN)	--[a]	--[a]	Site preparation for construction and operation of electric generating station	August 2007
PSC	Annotated Code of MD 7-207 and 7-208; COMAR 20.79	CPCN	--[a]	--[a]	Construction or modification of transmission lines (Lines to be modified)	July 2008
MDE	Federal Water Pollution Control Act, 33 USC 1251 et seq., COMAR 26.08.02.10	Section 401 Water Quality Certification	--[a]	--[a]	Compliance with state water quality standards	No separate application, combined with review for Section 402 (NPDES) or 404 (Dredging) permits
Environmental Protection Agency (USEPA)/MDE	Federal Water Pollution Control Act, Section 316(a) COMAR 26.08.03.03	Water Quality Impact Assessment	--[a]	--[a]	Demonstrate thermal discharges to water comply with thermal discharge criteria and are protective of aquatic species	With NPDES permit Application
USEPA/MDE	Federal Water Pollution Control Act, Section 316(b) COMAR 26.08.03.05	Best Technology Available (BTA) Demonstration	--[a]	--[a]	Demonstrate cooling water intake structure represents BTA in minimizing potential for entrainment and impingement of aquatic species	With NPDES permit Application
MDE	Federal Water Pollution Control Act, Section 402; COMAR 26.08.04	National Pollution Discharge Elimination System (NPDES) Permit	--[a]	--[a]	Discharge of industrial wastewater and stormwater during operation	December 2013
MDE	COMAR 26.08.04.09	General NPDES Permit for Stormwater associated with Construction Activity	--[a]	--[a]	Discharge of stormwater during construction	August 2009

Table 1.3-1 Federal, State and Local Authorizations
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Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
PSC/MDE	COMAR 26.24 and 20.79.03.02.B (4)(g)	Maryland Tidal Wetlands License	--[a]	--[a]	Construction work in tidal wetlands	August 2007
PSC/MDE	COMAR 26.23 and 20.79.03.02.B (4)(g)	Maryland Non-Tidal Wetlands Permit	--[a]	--[a]	Construction work in non-tidal wetlands	August 2007
MDE	COMAR 26.17.04	Waterway and 100-Year Floodplain Permits	--[a]	--[a]	Any activity that changes the course, current, or cross-section of a non-tidal stream or body of water, including the 100-year floodplain	August 2007
MDE	COMAR 26.17.01	Erosion and Sediment Control Plan	--[a]	--[a]	Land clearing, grading, or other earth disturbance (construction)	January 2009
MDE	COMAR 26.17.02	Stormwater Management Plan	--[a]	--[a]	Land development activity (construction and operation)	January 2009
Chesapeake Bay Critical Area (CBCA) Commission	COMAR 27.02	CBCA Conformance	--[a]	--[a]	Construction and operation of an electric generating facility in the CBCA	August 2007
PSC/MDE	COMAR 26.17.06; 20.79.03.02.B (3)(e)	Water Appropriation Permit	--[a]	--[a]	Withdrawal of groundwater for construction and withdrawal of surface water during operation	August 2007
MDE	COMAR 26.03.12	Major Water Facilities Permit	--[a]	--[a]	Construction of potable water supply system	January 2011
MDE	COMAR 25.03.12	Major Sewerage System Permit	--[a]	--[a]	Construction of sanitary waste treatment system for operation	January 2011
MDE	COMAR 26.04.06	Sewage Sludge Utilization Permit	--[a]	--[a]	Disposal of sludge from sewage treatment plant	January 2011

Table 1.3-1 Federal, State and Local Authorizations
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Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
U.S. Environmental Protection Agency (USEPA)/MDE	40 CFR 262.12 COMAR 26.13.03	Hazardous Waste Generator Registration (USEPA Identification Number)	--[(a)]	--[(a)]	Generation and storage of hazardous waste for ≤90 days	January 2009
MDE	COMAR 26.12.01.01	State Radioactive Materials License	--[(a)]	--[(a)]	Possession, use, acquisition, ownership, transfer of radioactive materials not regulated by NRC	January 2015
MDE	COMAR 26.04.07	Solid Waste Disposal Facility Permit	--[(a)]	--[(a)]	On-site disposal of land-clearing and construction debris	July 2008
MDE	COMAR 26.10.01.07	Oil Operations Permit	--[(a)]	--[(a)]	Storage of oil in aboveground storage tanks ≥10,000 gal and/or >1,000 gal of used oil	January 2015
MDE	COMAR 26.11.02	State Air Permit to Construct - Construction Phase	--[(a)]	--[(a)]	Construction of construction phase air pollutant emission sources	July 2008
MDE	40 CFR 52.21; COMAR 26.11.01 and 26.11.02	Prevention of Significant Deterioration (PSD) – Construction Phase	--[(a)]	--[(a)]	Construction and operation of construction-phase major stationary sources of attainment pollutants.	July 2008
MDE	COMAR 26.11.01, 26.11.02; 26.11.17	New Source Review (NSR) – Construction Phase	--[(a)]	--[(a)]	Construction of construction-phase major stationary sources of nonattainment pollutants.	July 2008
MDE	COMAR 26.11.02.13	State Air Permit to Operate	--[(a)]	--[(a)]	Operation of construction phase air pollutant emission sources	State issues permit after start-up period as defined in permit to construct
MDE/PSC	COMAR 26.11.02; 20.79.03.02.B(2)(c)	State Air Permit to Construct – Operational Phase	--[(a)]	--[(a)]	Construction of operational phase air pollutant emission sources	August 2007

Table 1.3-1 Federal, State and Local Authorizations
(Page 6 of 7)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
MDE/PSC	40 CFR 52.21; COMAR 26.11.01, 26.11.02 and 20.79.03.02.B (2)(c)	Prevention of Significant Deterioration (PSD) – Operational Phase)	--[a]	--[a]	Construction of major stationary sources of attainment pollutants for operational phase facilities.	August 2007
MDE/PSC	COMAR 26.11.01, 26.11.02, 26.11.17, and 20.79.03.02.B (2)(c)	New Source Review (NSR) – Operational Phase)	--[a]	--[a]	Construction of major stationary sources of attainment pollutants for operational phase facilities.	August 2007
MDE	COMAR 26.11.03; 20.79.03.02.B (2)(c)	Title V Operating Permit	--[a]	--[a]	Operation of facility with major stationary sources of air emissions	2016
Maryland State Highway Administration (SHA)	Annotated Code of MD 8-625 and COMAR 11.04.05	Highway Access Permit	--[a]	--[a]	Construction of new or modified entrances on state highways	January 2009
Calvert County Department of Planning and Zoning	Calvert County Code, Ordinances and Resolutions Chapter 18, Building Code of Calvert County	County Grading Permit	--[a]	--[a]	Clearing and grading of land	January 2009
Calvert County Department of Planning and Zoning	Calvert County Code, Ordinances and Resolutions Chapter 18, Building Code of Calvert County	County Building Permit, and Related Site Development Plan	--[a]	--[a]	Construction of buildings and other structures	January 2009
Calvert County Department of Planning and Zoning	Calvert County Code, Ordinances and Resolutions Chapter 18, Building Code of Calvert County	County Permit for Structure Demolition or Move	--[a]	--[a]	Demolish certain structures and move certain structures at Camp Conoy	January 2009

Table 1.3-1 Federal, State and Local Authorizations
(Page 7 of 7)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Calvert County Department of Planning and Zoning; Inspections and Permits	Calvert County Zoning Ordinance' Article 4	County Use and Occupancy Permit	--[(a)]	--[(a)]	Use and occupancy of buildings	Certificate of Occupancy issued as defined by Building Permit
USEPA	40 CFR 82.162	Ozone-Depleting Substance (ODS) Compliance Certification	--[(a)]	--[(a)]	Recovery and recycling of ODS	2010
US Department of Transportation	49 CFR 107, Subpart G	Certificate of Registration	--[(a)]	--[(a)]	Transportation of hazardous materials	April 2011
Tennessee Department of Environment and Conservation – division of Radiological Health	TN Department of Environment and Conservation Rule 1200-2-10.32	Tennessee Radioactive License-for Delivery	--[(a)]	--[(a)]	Transportation of radioactive waste into the State of Tennessee (below regulatory limits material)	November 2015
State of Utah Department of environmental quality – Division of Radiological Control	Utah Radiation Control Rules R313-26	General Site Access Permit	--[(a)]	--[(a)]	Transportation of radioactive waste into the State of Utah	November 2015

Notes:

(a) Data not available. Applications for permits will be made before the beginning of construction or during construction, as required.

(b) As decided by management.

Item Number 89 **ER Section 5.3.1.1**

Request:

Discussion on the intake impacts is presented. Provide an analysis of the impacts associated with dredging and discharge. (Cross reference with HS-12, 41[(a)])

Response:

Because the intake velocities approaching the CCNPP Unit 3 intake structures are expected to be low, periodic dredging may be required to maintain intake channel elevation as discussed in Section 3.4.2.1. Excavation and dredging of the intake structure may result in increased turbidity in the immediate area for approximately two weeks. Dredging activities will be performed in accordance with U.S. Army Corps of Engineers and Maryland State requirements and dredging permit conditions including mitigation measures to minimize suspended sediment and other impacts. During operation of the dredge, sediment curtains will be deployed in strategic locations around the dredging activity to control transport of suspended solids and maintain acceptable water quality. Water quality monitoring will performed in accordance with dredge permit conditions during dredging activities to verify that operations are not exceeding allowable permit limits (Section 4.3.2.2.2).

The area near Calvert Cliffs does not provide critical spawning habitat for any federally managed marine fish species, thus CCNPP Unit 3 dredging is expected to have no significant effect on their eggs or larvae. Moreover, the dominant fish species in the area have no designated Habitat Areas of Particular Concern (HAPC). Studies demonstrate that the CNPP site area is not a major spawning area for invertebrates, such as the American Oyster, thus they will not be significantly affected. Neither the shortnose sturgeon nor the loggerhead turtle are commonly found in the CCNPP area. No threatened or endangered species are expected to be significantly affected by CCNPP Unit 3 dredging. Consequently, it can be concluded that small-scale dredging like that required to construct CCNPP Unit 3, will not result in a significant biological impact to the Chesapeake Bay.

This conclusion is further supported by a report by the NOAA Chesapeake Bay Office, developed by a Technical Advisory Panel comprised of top fisheries scientists from area universities and senior government fisheries scientists, presented a Fisheries Ecosystem Plan for the Chesapeake Bay. It is notable that the only mention of the effects of dredging in the 450 page report was the following two general statements: "Dredging and the displacement of dredge spoil to other parts of the Chesapeake Bay can affect fish and shellfish by removing or inundating slow-moving or sessile species and their prey. Dredge spoil can also reintroduce sedimentary inventories of nutrients and contaminants into the water" (NOAA, 2006). The report also acknowledged that the effects of even widely-used methods of harvest that disturb bottom sediments, such as trawling and crab dredging, remain unknown. Minimal effects of sedimentation or runoff into the Chesapeake Bay are expected.

Potential impacts that may occur as a result of dredging driving include sediment deposition, mortality due to crushing, noise pollution, and disturbances associated with intense vibrations. As previously discussed, these effects will be localized and temporary, and will therefore not result in significant biological impact to the Chesapeake Bay.

The potential for anchor scarring of the benthos is expected to be minimal during dredging activities. Existing benthos in the affected areas will have been impacted due to the dredging activities themselves.

The discharge point is near the southwest bank of the Chesapeake Bay approximately 1,200 feet (366 m) south of the intake structure for CCNPP Unit 3 and extends approximately 550 feet (168 m) into the bay through a buried nominal 30 inch (76 cm) discharge pipe with diffuser nozzles at the end of the line. The preliminary centerline elevation of the discharge nozzles of the diffuser is 3 feet (0.91 m) above the Chesapeake Bay bottom elevation. The three 16 inch (40.6 cm) diameter nozzles are spaced center-to-center at 9.375 feet (2.86 m) located 3 feet (0.91) above the bottom. The angle of discharge is 22.5 degrees to horizontal. Riprap will be placed around the discharge point to resist potential erosion due to discharge jet from the diffuser nozzles. Fish screens are not required on the diffuser nozzles since there will always be flow through the discharge piping, even during outages, to maintain discharge of treated liquid radioactive waste within the concentration limits to the applicable local, state, and federal requirements. The length of the diffuser flow after exiting the nozzles is approximately 26 feet (7.9 m).

Reference

NOAA, 2006. Fisheries Ecosystem Planning for Chesapeake Bay, American Fisheries Society, Trends in Fisheries Science and Management 3, Chesapeake Bay Fisheries Ecosystem Advisory Panel, National Oceanic and Atmospheric Administration Chesapeake Bay Office, 2006.

ER Impact:

No changes to the ER are required.

Item Number 90 **ER Section 5.3.1.2**

Request:

Provide quantitative data on characteristics of the water in the retention basin.

Response:

Quantitative data on water characteristics can be found in ER Sections 3.2, 3.3, 3.4 and 5.5.1.2. ER Section 3.3.2 provides a detailed description of the circulating water treatment and the likely constituents in the retention basis and ultimate discharge. Additional information is found in Section 3.4.2.2. The response to RAI Item Number 94 addresses the discharge to the Chesapeake Bay.

ER Impact:

No changes to the ER are required.

Item Number 91 **ER Section 5.3.1.2**

Request:

What are the references for the impingement survival studies mentioned on page 5.3-4?

Response:

The principal reference used was Ringger (Ringger, 2000) as cited in the text. Ringger cites several historical studies including:

- Breitburg, D.L., and T. A. Thoman. 1986. Calvert Cliffs Nuclear Power Plant Fish Survival Study for Baltimore Gas and Electric Company. Final Report No. 86-19, Academy of Sciences of Philadelphia, 25 pp.
- Burton, D.T. 1976. Impingement studies II. Qualitative and Quantitative Survival Estimates of Impinged Fish and Crabs. In: Semi-Annual Environmental Monitoring Report for the Calvert Cliffs Nuclear Power Plant, March 1976. Baltimore Gas and Electric Company, Pp II.2.1-II.2-49.
- Burton, D.T, and W.C. Graves 1979. Impingement Studies II. Survival Estimates of impinged Fish. In: Non-radiological Environmental Monitoring, Calvert Cliffs Nuclear Power Plant, January-December 1978. Baltimore Gas and Electric Company, Baltimore, MD. pp. II.2-1-II.2-23.
- Burton, D.T and S.L. Margrey 1980. Impingement Studies 2. Survival Estimates of Impinged Fish. In: Non-radiological Environmental Monitoring, Calvert Cliffs Nuclear Power Plant, January-December 1979. Baltimore Gas and Electric Company, Baltimore, MD. pp. 9.2-1-9.2-28.
- Gallagher, R.P., J.H. Hixson III and M.F. Hirshfield 1982. Impingement Studies 2. Survival Estimates of Impinged Fish. In: Non-radiological Environmental Monitoring, Calvert Cliffs Nuclear Power Plant, January-December 1981. Baltimore Gas and Electric Company, Baltimore, MD. pp. 8.2-1-8.2-17.
- Hirshfield, M. F. and J.H Hixson III, 1981. Impingement Studies 2. Survival Estimates of Impinged Fish. In: Non-radiological Environmental Monitoring, Calvert Cliffs Nuclear Power Plant, January-December 1980. Baltimore Gas and Electric Company, Baltimore, MD. pp. 9.2-1-9.2-9.
- Horwitz, R.J. 1987. Impingement studies. In: Heck, K.L. (Ed.). Ecological Studies in the Middle Reach of Chesapeake Bay. Spinger-Verlag, Berlin, pp.254-269.

These papers were also cited in the NRC GEIS for CCNPP Unit 1 and 2 license renewal.

References:

Ringger, 2000. Investigation of Impingement of Aquatic Organisms at the Calvert Cliffs Nuclear Power Plant, 1975-1995, Environmental Science and Policy 3 (2002) S261-S273, T. Ringger, 2000.

ER Impact:

No changes to the ER are required.

Item Number 92 **ER Section 5.3.1.2**

Request:

Provide detailed data on Impingement and entrainment and the results of any studies so that the amount attributable to Unit 3 can be estimated. Where the analysis is based on data from 1995 or earlier; justify applicability or provide new data in light of the changes that have occurred in the Chesapeake Bay ecosystem since those impingement and entrainment data were collected.

Response:

The potential impact of CCNPP Unit 3 from impingement of organisms on the intake traveling screens and the entrainment of organisms within the cooling water systems was assessed based on historical data collected at CCNPP Units 1 and 2 extrapolated to CCNPP Unit 3. Impingement sampling was conducted at CCNPP Units 1 and 2 from 1978 through 1995. Densities of plankton potentially entrained were sampled at various intervals in the 1970s. Numbers of organisms impinged and entrained were normalized to intake cooling water withdrawal flow at CCNPP Units 1 and 2 and scaled to the Unit 3 flow. Perspective was assessed by comparing projected impingement at CCNPP Unit 3 to catches of fish and invertebrates in routine trawl and seine sampling and to recreational commercial catches over time. Numbers of fish eggs and larvae entrainment were also converted to equivalent adults for comparative purposes (EPRI, 2004)

Impingement – Because the intake flow of CCNPP Unit 3 is a small fraction of that at CCNPP Units 1 and 2, projected impingement and entrainment at CCNPP Unit 3 are also correspondingly small. The combined flow of CCNPP Units 1 and 2 is approximately 151 m^3/sec (5,332 cfs). CCNPP Unit 3 is projected to have an intake flow of approximately 2.743 m^3/sec (96.8 cfs). Based on these flow ratios and the numbers of fish impinged at CCNPP Units 1 and 2, impingement mortality at CCNPP Unit 3 was estimated to be less than 6,400 individuals annually. This estimate reflects anticipated survival based on studies performed at CCNPP Units 1 and 2. The fish species most commonly impinged at CCNPP Units 1 and 2 were bay anchovy and hogchoker (Ringger, 2000).

An average of approximately 1,221 blue crab were estimated to be impinged at CCNPP Unit 3 annually, but because blue crab impingement survival is high (~95%) following impingement, only about 60 individuals are expected to experience mortality on a yearly basis. The impingement mortality estimates for fish and blue crab are considered to be conservative because the CCNPP Unit 3 intake will incorporate fish handling facilities and intake approach velocities less than 0.5 ft/sec (0.15 m/sec).

Entrainment – Entrainment of phytoplankton at CCNPP Unit 3 was estimated from data collected between 1978 through 1980 at CCNPP Units 1 and 2. Microzooplankton data were taken from sampling conducted from 1974 through 1980. Ichthyoplankton data were collected in 1978 and 1979 (ANSP, 1981)(EAI, 1979).

Entrainment of phytoplankton at CCNPP Unit 3 was estimated to range between 1.19E+16 and 4.25E+16 cells annually. The dominant groups included Bacillariophyta, Cyptophyta, Pyrrophyta and Cyanophyta. CCNPP Unit 3 annual entrainment for microzooplankton, based on data collected at CCNPP Units 1 and 2 between 1974 and 1980, was estimated to range between 1.33E+21 and 2.50E+22 organisms. Mortality of entrained microzooplankton was calculated to somewhat lower due to survival rates based on the earlier sampling. The dominant organisms included nauplii, copepodites and calanoid copepods. *Acartia tonsa* were the dominant nauplii. Other organisms commonly found included A. *clausi* and *Eurytemora affinis.*

The studies upon which these phytoplankton and zooplankton estimates were based indicated a localized reduction in the number of organisms in the discharge of CCNPP Units 1 and 2, but that there was no discernable impact on the ecology of Chesapeake Bay in the vicinity of the CCNPP site (McLean, 2002)(Heck, 1987)(ANSP, 1981)(MDNR, 2006). Since the relative number of planktonic organisms predicted to be entrained at CCNPP Unit 3 is small, impacts from the cumulative operation of CCNPP Units 1 and 2, and CCNPP Unit 3 is not expected to alter these conclusions.

The dominant fish eggs and larvae entrained included hogchoker eggs, anchovy eggs and larvae, naked goby larvae and spot larvae. Based on data from the period sampled, April-July 1979, the number of organisms potentially entrained at CCNPP Unit 3 is shown in Tables 1 and 2. The number of corresponding equivalent adults is shown in Table 3. These estimates, while they reflect only one year of sampling, suggest strongly that the impact on the dominant fish species observed in entrainment samples is insignificant.

That the potential impact of entrainment of fish eggs and larvae at CCNPP Unit 3 is estimated to be small is supported by corresponding data available for catches of fish in trawl and seine samples collected during these same periods. MMC (MMC, 1980) reported total annual catches of anchovy in monthly seine hauls at four stations in 1972-74 and in 1979. Catches ranged between 172 and 35,830 individuals. Heck (Heck, 1987) reported fish caught in trawl samples between 1969 and 1981. During that period the average annual catch of anchovy per 30 min trawl was 708 individuals. Hogchocker averaged between 518 and 15.6 per trawl.

Although there are no corresponding ongoing fish studies at Calvert Cliffs, the adequacy of historic data can also be judged by evaluating abundance in commercial and recreational catches for those species actively fished historically and today. Some of the dominant fish species impinged such as bay anchovy, are not represented in commercial catches but data are available for weakfish, summer flounder, spot and blue crab (ER Section 5.3.1). While effort varies from year to year, the commercial catches provide a relative comparison of abundance over time. In addition, these catches provide perspective compared to the relative impact expected from CCNPP Units 1 and 2, and CCNPP Unit 3 combined. Data provided by (NOAA, 2008) for both commercial and recreational species on a national and regional basis demonstrate that relative impact of CCNPP Unit 3 compared to commercial and recreational catches is small and that assessments based on historical data remain valid.

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Table 1. Summary of Estimated Egg Entrainment (April - July 1979).

Species	Numbers of Organisms	Estimated CCNPP Unit 1 and 2 Entrainment	Estimated CCNPP Unit 3 Entrainment
Hogchoker	1,157	2.89E+08	5.23E+06
Bay Anchovy	936	2.34E+08	4.23E+06
Rough silverside	3	7.49E+05	1.36E+04
Atlantic silverside	1	2.50E+05	4.52E+03
Naked goby	1	2.50E+05	4.52E+03
Winter flounder	1	2.50E+05	4.52E+03
TOTAL		5.24E+08	9.48E+06

Table 2. Summary of Estimated Larval Entrainment (April - July 1979).

Species	Numbers of Organisms	Estimated CCNPP Unit 1 and 2 Entrainment	Estimated CCNPP Unit 3 Entrainment
Naked goby	1,375	3.43E+08	6.21E+06
Blenny spp.	120	3.00E+07	5.42E+05
Spot	78	1.95E+07	3.52E+05
Atlantic silverside	66	1.65E+07	2.98E+05
Atlantic menhaden	26	6.49E+06	1.17E+05
American eel	25	6.24E+06	1.13E+05
Bay anchovy	25	6.24E+06	1.13E+05
Winter flounder	25	6.24E+06	1.13E+05
Silverside spp.	17	4.24E+06	7.68E+04
Tidewater silverside	14	3.50E+06	6.32E+04
Rough silverside	7	1.75E+06	3.16E+04
Skilletfish	6	1.50E+06	2.71E+04
Striped Blenny	5	1.25E+06	2.26E+04
Hogchoker	5	1.25E+06	2.26E+04
Northern pipefish	3	7.49E+05	1.36E+04
Oyster toadfish	1	2.50E+05	4.52E+03
ANNUAL TOTAL		4.49E+08	8.12E+06

Table 3. Estimated AEL Losses of Dominant Species Due to Entrainment at the CCNPP Site

Species	Estimated CCNPP Unit 1 and2 AEL Value	Estimated CCNPP Unit 3 AEL Value
Bay anchovy	910	16
Naked Goby	5,881	105
Spot	3,900	70
Hogchoker	65	1
TOTAL	10,756	192

ER Impact:

No changes to the ER are required.

Item Number 93 **ER Section 5.3.1.2**

Request:

Estimate actual aquatic losses expected from Unit 3. Justify applicability of old data or provide new data in light of the changes that have occurred in the Chesapeake Bay ecosystem since those data were collected.

Response:

The response to this RAI is provided in the response to in RAI Item Number 92.

ER Impact:

No changes to the ER are required.

Item Number 94 **ER Section 5.3.2.2**

Request:

Provide information about the expected concentrations to be discharged into Chesapeake Bay.

Response:

The chemicals used and potentially discharged into the Chesapeake Bay via the submerged offshore discharge are listed and discussed in ER Section 3.6. The discharge will receive inputs including cooling tower blowdown, desalination system waste water treatment and effluent from the sewage treatment system (ER Section 3.6.2). Reject waste waters from the desalination facility are given in Table 3.6.2. The desalination reject water is expected to have a salt concentration of 1 to 2 times that of seawater. This effluent will be mixed with cooling tower blowdown as it is discharged.

The following text will be incorporated into ER Section 5.3.2.2. in a future revision to the ER .

> The concentration of treatment chemicals in the various discharges that contribute to the offshore thermal discharge is provided in Table 3.6.1. Substances used include sodium bisulfate, sodium hypochlorite, soda ash, antifoam and dispersant agents, and sulfuric acid and sodium hydroxide for pH control. Within the circulating water system blowdown, total residual chlorine (TRC) is expected to be less than 0.1 mg/l, TSS at approximately 5 mg/l, total organic carbon at 1.4 mg/l. Within the waste water treatment plant discharge, TSS is expected to average 3.4 mg/l with a maximum of 45 mg/l. Concentration limits for the offshore thermal discharge that contains these various inputs will be determined by way of the NPDES discharge permit for CCNPP Unit 3.

ER Impact:

ER Section 5.3.2.2.2 will be updated to include the noted text in a future revision to the ER.

Item Number 95 **ER Section 5.3.2.2**

Request:

Provide the approximate size of the expected scour area. Also provide information about the soft-bottom community that will be lost and the hard-bottom one that will replace it. Justify applicability of old data (1979) or provide more recent data. Recalculate estimates of scour based on recent grain-size data and re-evaluate trophic impacts based on recent faunal data, or justify the applicability of the answers based on old data.

Response:

The area potentially scoured by the thermal plume was estimated based on discharge exit velocity and sediment composition. The amount of sediment potentially suspended as a result of the thermal discharge will be influenced by the sediment type. Benthic studies (MMC, 1980)(MMC, 1979) suggest that at the 10 ft (3.04 m) contour, the sediment is predominantly sand. Sand/clay ratios at 5 stations sampled in March and April 1979 along the 10 ft (3.04 m) contour offshore of CCNPP ranged from 82.55%/17.45% to 96.68%/3.32%, respectively. The percentage of organic content ranged from 0.24% to 0.68% along this same contour. The percentage of clay increased with increasing distance from shore. Since the discharge diffuser is located at the 10 ft (3.04 m) contour, the scour is expected to be largely limited to that area. More recent sampling at the area of potential CCNPP Unit 3 discharge (EA, 2006) indicates similar sand substrates composed of between 93.5% and 96% sand, between 1.55% and 5.1% gravel, and between 2.15% and 2.7% clay.

To calculate the potential area of scour analytically, a sand particle size of between 0.210 and 0.177 mm was assumed based on studies (MMC, 1979). Velocities necessary to move particles of this size were estimated to be approximately 1 ft/sec (0.3 m/s). The distance beyond which velocities from the discharge were expected to be below the 1 ft (0.3 m/s) threshold was estimated to be about 92 ft (28 m). The resulting area potentially scoured was estimated to be 13, 256 ft2 (1,232 m^2).

The area of scour was also determined using a computational fluid dynamics approach. Tidal flow was based on a slack-water case and a peak cross flow case. This method predicted an area of scour of approximately 10,500 ft^2 (975m^2).

The potential impact on the soft-bottom community is discussed in the response to RAI Item Number 96. Based on this analysis, it is likely that sand in the immediate area of scour will be mobilized and transported out of the scour zone and that the benthic community will become dominated by epifaunal and fouling organisms (MMC, 1979). During operation of CCNPP Units 1 and 2, macrobenthic biomass in the area of scour increased relative to unaffected mud and sand habitats.

References

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MMC, 1979. Results of Benthic Studies at Calvert Cliffs, Final 8 Report to the Maryland Power Plant Siting Program, Baltimore Maryland, Report PPSP-MP—28, Martin Marietta Corporation, 1979.

ER Impact:

No changes to the ER are required.

Item Number 96 **ER Section 5.3.2.2**

Request:

Provide impacts of scour based on more recent data; trophic impacts of community change.

Response:

The types of benthic infauna found in the CCNPP area were summarized by Heck (1987) and MMC (1980). Heck (1987) reported the results of sediment samples collected during 1977 through 1980 at the 3, 6 and 9 m contours with a 0.1 m2 grab sampler. Benthic communities were dominated by annelids, crustaceans and molluscs. Infauna were dominated by polychaetes (*Scolecolepides viridis, Heteromastus filiformis and Neanthes succinea), bivalves (Mya arenaria, Macoma balthica, Gemma gemma*) and nemerteans (Table 1). Meiofauna occurring along the 2-3 m contour consisted of juvenile bivalves, copepods, Foraminfera, nematodes oligochaetes, ostracods and Turbellaria. Densities generally decreased as depth increased (Tables 1 and 2).

Following operation of CCNPP Units 1 and 2, an area of approximately 42 acres (17 hectares) was scoured by the discharge. Surficial sands were transported to deeper waters (MMC 1980). Deposit-feeding benthic infauna abundance decreased in the scoured area and the benthic community became one dominated by epifaunal and fouling organisms, particularly those reliant on shell deposits (MMC 1979). Macrobenthic biomass increased relative to unaffected sand and mud habitats in the power plant vicinity (Table 3).

Additional benthic data were collected in 2006 at three locations, one located at the CCNPP Unit 3 proposed discharge and two other stations located within 500 feet of the discharge. The relative number of taxa and individuals is shown below (EA, 2006). At the discharge station, annelids were dominated by *Neanthes succinea* (14.7individuals/sample) and bivalves were dominated by *Gemma gemma* (29 individuals/sample). Gastropods and crustaceans were found a lower densities (Table 4).

Studies of ecosystem energy transfer and potential trophic impacts of community changes were previously summarized in a report (MMC, 1980). Various techniques were utilized to assess community metabolism and food transfer. Using respiration chambers and oxygen consumption in 1977 and 1978, benthic respiration was compared at stations near Calvert Cliffs and at control stations in shallow and deep waters. In the report was concluded that that "no consistent plant effect on benthic respiration was evident" (Table 5).

Stomach content analyses of benthic fish collected at a station in the vicinity of CCNPP Unit 1 and 2 discharge and at a control area upstream of the power plant (Kenwood Beach) were compared to assess fish species-specific food preferences, relative types of prey consumed at the two areas and any significant differences (MMC 1980). Copepods (52%) dominated diet at the control station but nematodes (27%) and polychaetes (13%) were also common. At the CCNPP site, nematodes (66%) dominated, followed by copepods (25%0 and polychaetes (7%). By weight, polychaetes dominated diets at both locations. "The mean number and mean weight values of prey items per individual were both higher for plant-site fish". More mollusks by weight were consumed at the power plant site and more Nereis at the control site yet the food web structure was similar at both locations (Tables 6 and 7).

These results suggest that food availability in the power plant discharge vicinity is consistent with that found elsewhere and that energy transfer following operation of all three units would be unaffected given the small incremental area of scour associated with CCNPP Unit 3.

References

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NRC, 1999. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Calvert Cliffs Nuclear Power Plant, NUREG-1437, Supplement 1, Nuclear Regulatory Commission, October 1999.

ER Impact:

No changes to the ER are required.

Table 1 Total Number of Infaunal Individuals m^2 for the 10 Most Abundant Species and for Species Combined by Year (Heck 1987)

Species	1977	1978	1979	1980
S. viridis	1061.33	1485.17	1176.56	1223.70
G. gemma	56.78	566.17	555.26	155.96
M. balthica	420.56	314.00	712.33	641.63
S. benedicti	343.89	377.28	443.30	34.85
N. succinea	73.11	360.61	187.33	118.93
T. agilis	231.11	177.93	230.26	121.22
H. filiformis	158.56	181.94	205.89	256.63
M. arenaria	206.39	648.94	86.44	698.85
P. ligni	1.00	36.72	37.81	24.96
M. leidyi	25.06	97.00	102.41	45.81
All Species combined	2379.33	4693.44	4290.67	4199.93

Table 2 Total Dry Weights ($g/m^{2)}$ of Infauna Groups Collected by Year (Heck, 1987)

Year	Annelida	Molluscs	Crustaceans	Other Taxa	All Taxa Combined
1978	1.61	12.89	0.06	0.48	15.06
1979	1.50	8.08	0.11	0.30	9.99
1980	1.56	15.53	0.10	0.29	17.47

Table 3 Summary of General Characteristics of Macrobenthic Communities Inhabiting the Scoured Area, a Preoperational-Period Shell Habitat, and an Operational-Period Shell Habitat during Spring (MMC, 1979)

	Scoured Area Macrobenthic Community		Preoperational Period Shell Habitat Macrobenthic Community	Operational Period Shell Habitat Macrobenthic Community
	(May 1977)	(May 1978)	(May 1972)	(May 1977)
Number of Species	24	26	28	21
Number of epifaunal species	8	8	6	4
Percent of fauna composed of species characteristic of shell habitats	74	77	4	1

Table 4 Mean Number of Taxa and Individuals Collected in the Vicinity of the CCNPP Unit 3 Discharge in 2006

	Discharge location	**Location1 Within 500'**	**Location 2 Within 500'**
Mean No. Taxa	11.7	11.3	10.3
Mean No. Individuals	69	61	45.7

Table 5 Summary of Benthic Community Respiration Measurements (g $O_2/m^2/day$) Taken at Dep (6-m) and Shallow (3-m) Stations in the Vicinity of Calvert Cliffs, Chesapeake Bay, 1977-1978.

	Calvert Cliffs				Kenwood Beach		
Date	Shallow		Deep		Shallow		Deep
June 14,1977	1.70 ± 0.42		3.66 ± 1.21		2.40 ± 0.13		3.11 ± 0.83
July 28, 1997	1.75 ± 0.58		1.54 ± 0.28		2.30 ± 0.60		1.63 ± 0.13
August 30, 1977	1.35 ± 0.45		1.63 ± 0.89		1.36 ± 0.20		1.98 ± 0.58
December 6, 1977	0.23 ± 0.01		0.26 ± 0.01		0.63 ± 0.07		0.65 ± 0.05
February 27, 1978	0.52 ± 0.32				0.10		0.18 ± 0.09
March 13, 1978			0.29 ± 0.31				
May 8, 1978	1.93 ± 0.08		3.02 ± 0.42		2.05 ± 0.65		1.41 ± 0.10

Data presented are the mean of three to four metabolic measurements. Confidence limits are ± 1 standard deviations (MMC, 1980).

Table 6 Community Diet of Bottom Fish Collected from Kenwood Beach and in the Vicinity of the Calvert Cliffs Power Plant. Data are March through December 1977, Combined Day/Night Diet.

	Kenwood Beach				Power Plant			
Total Number	121,770				111,151			
Total Number-empty	115,292				105,314			
Total Weight (g)	984,974.6				1,965,879.0			
Total Weight-empty (g)	926,221.6				1,875,543.6			
Food Item	**#**	**wgt., g**	**% of diet**	**% of body wgt.**	**#**	**wgt., g**	**% of diet**	**% of body wgt.**
Nereis	47,123	1,958.233	42.7	0.21	76,085	1,661.188	19.3	0.09
Polychaete sp.	689,891	1,711.515	37.4	0.18	1,488,857	3,558.058	41.2	0.19
Bay Anchovy	465	344.990	7.5	0.04	1,481	1,026.134	11.9	0.05
Spot	29	194.094	4.2	0.02	21	164.087	1.9	0.01
Molluscs	232,477	123.029	2.7	0.01	264,360	1,186.223	13.7	0.06
Copepods	3,260,433	79.609	1.7	0.01	5,390,321	122.823	1.4	0.01
Atlantic Menhaden	4	52.952	1.2	0.01	15	13.934	0.2	<0.01
Weakfish	13	41.956	0.9	<0.01	109	218.187	2.5	0.01
Nematodes	1,716,929	15.764	0.3	<0.01	14,257,678	132.995	1.5	0.01
Neomysis	2,414	14.864	0.3	<0.01	1,682	7.245	0.1	<0.01
Amphipods	26,228	14.218	0.3	<0.01	144,234	247.625	2.9	0.01
Naked Goby	111	5.548	0.1	<0.01	3	0.751	<0.1	<0.01
Detritus		5.409	0.1	<0.01		0.530	<0.1	<0.01
Crango	448	5.255	0.1	<0.01	538	11.856	0.1	<0.01

Ctenophores		5.124		0.1	<0.01		2.340		<0.1	<0.01
Ostracods	94,126	4.573		0.1	<0.01	34,204	1.514		<0.1	<0.01
Micrura	24	2.712		0.1	<0.01	425	28.751		0.3	<0.01
Winter Flounder	2	0.760		<0.1	<0.01					
Diatoms	51,436	0.630		<0.1	<0.01	5,827	0.075		<0.1	<0.01
Argulus	72	0.198		<0.1	<0.01	40	0.124		<0.1	<0.01
Isopods	9	0.089		<0.1	<0.01	460	0.400		<0.1	<0.01
Filamentous Algea		0.051		<0.1	<0.01					
Brachyurans	4	0.001		0.01	0.01	16	0.004		<0.1	<0.01
Molgula						14,399	152.283		1.8	0.01
Northern Searobin						119	83.361		1	<0.01
Diadumene						281	4.978		0.1	<0.01
Atlantic Croaker						7	1.701		<0.1	<0.01
Northern Pipefish						3	1.372		<0.1	<0.01
Atlantic Silverside						3	0.624		<0.1	<0.01
Palaemonetes						42	0.084		<0.1	<0.01
Mud Crab						2	0.040		<0.1	<0.01
Coleopterans						5	0.011		<0.1	<0.01
Total	6,273,238	4,581.574		100.0	0.49	21,681,220	8,629.298		100.0	0.46

Values given for numbers and weights are total values, all hauls.

Diets are adjusted by standardizing trawl data for unit effort (MMC, 1980).

Table 7 Monthly and Total Mean Numbers and Weights of Prey Items in the Combined Day/Night Diets of Kenwood Breach (KB) and Calvert Cliffs (CC) Demersal Fish Communities (MMC 1980)

	Prey items per individual predator						
Month	**X (number)**				**X (weight.g. wet wgt)**		
	KB		**CC**		**KB**		**CC**
May	16.3		28.5		0.027		0.039
June	60.8		168.9		0.040		0.074
August	16.0		35.6		0.021		0.062
September	53.2		285.0		0.051		0.095
All months	54.4		205.9		0.040		0.082

Values represent weighted means, adjusted to relative catches.

Item Number 97 **ER Section 5.3.2.2**

Request:

Provide relative abundance of important species in the discharge zone and provide the substrate at and in the vicinity of the discharge location.

Response:

The response to comment 96 provides relative abundance of the major groups and species of organisms found in the CCNPP Unit 1 and 2 discharge scour zone.

Other important recreational and/or commercial species found in the discharge zone include the soft-shell clam (*Mya arenaria*), American oyster (*Crassostrea virginica*), and blue crab (*Callinectes sapidus*). Each of these species has historically been the focus of special studies at Calvert Cliffs. Heck (Heck,1987) and (MMC 1980) reported relative densities of soft-shell clams during 1971 through 1979 at 17 sampling stations distributed above and below the CCNPP Unit 1 and 2 discharge zone, including one sampling station at the discharge area. Heck (Heck,1987) concluded that overall stocks based on these dredge samples were low compared to areas where commercial harvesting of soft-shell clams occurs. Within the CCNPP area, highest densities occurred in the 12 ft (6 m) zone where sediments contained a higher percent of muddy sand. During the study period, densities were highly variable and mean total density ranged from less than 1/m2 to approximately 4/m2 with no apparent impact of CCNPP Units 1 and 2. MMC (1980) reported that soft-shell densities were generally higher in the plant's near-field region before and during operations.

The potential impact of station operation on the blue crab was examined during 1968 through 1983, encompassing pre-operational and operational plant conditions (Heck 1987). Crabs were sampled at three stations, one being about 200 m out from the point of thermal discharge, using commercial crab pots of 25-mm mesh. Up to 20 pots were sampled at each station per week. Information collected included abundance, size, weight, and sex. Between 1968 and 1974, blue crab catch averaged 2, 775 individuals annually (range of 239-4,792). During 1975 through 1983, annual blue crab catch averaged 5,206 individuals (range between 2,089 and 15,106). Heck (Heck,1987) reported that" the percentage of catch at each station during the preoperational and operational periods was nearly identical". The only significant was the larger size of males at the upstream station compared to the other two.

Studies examining the potential impact of CCNPP Unit 3 on American oyster (*Crassostrea virginica*) were conducted using several different methods during the period 1968 through 1983 (MMC,1980)(Heck,1987). Results of oysters held in trays at various locations showed that growth was generally higher at the plant site. The increased growth was most pronounced in age 3 and 4 oysters.

Annual mortality rates during the preoperational period (1970-75) were similar to that during the operational period studied (1975-81). Studies of naturally occurring oysters near the plant site in 1968, 1979 and 1983 provided variable results due to annual variations in settlement. Average densities of oysters on a sand bar immediately upstream of CCNPP Units 1 and 2 in May and October of 1979 ranged between 0.32 and 2.64 /m^2 for oysters ≤ 3 inches and 0.14 and 0.70/m^2 for oysters > 3 inches. The number of oyster spat in October 1979 ranged between 0.00 and 0.29/m^2. No oyster larvae were collected from intake waters suggesting low reproductive success in the general area. MMC (MMC,1980) concluded, however, that even though the CCNPP site area of Chesapeake Bay had a limited amount of suitable substrate for oyster settlement growth and that abundances would not support commercial harvest, survival of those that settled was not atypical.

Demersal fish were sampled in two separate surveys covering the period 1968 through 1978 (MMC,1980) (Heck,1987). One survey included monthly samples at three stations (one station at the plant site) using a 3.17 cm mesh semi-balloon trawl. A second survey at the same stations was performed with a 25 ft otter trawl at selected depths on a monthly basis. Bay anchovy (*Anchoa mitchilli*) and juvenile spot (*Leiostomus xanthurus*) dominated the catches. Other species commonly caught included hogchoker (*Trinectes maculatus*) , Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*) and winter flounder (*Pseudopleuronectes americanus*) (Tables 1 and 2). Catches during the operational period were similar at all three stations (Table 3). An additional survey using acoustics provided similar conclusions (MMC,1980).

A survey of shore-zone fish was also performed during 1971 through 1974 and 1979 MMC 1980). Monthly sampling occurred at 4 stations including the plant site and the addition of a discharge site in 1975. Collections were made with a 50 ft bag seine. The most abundant species at each of the four stations included bay anchovy, Atlantic menhaden and Atlantic silverside (*Menidia menidia*). Collections by station are provided in Table 4 for 1979.

<u>References</u>

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ER Impact:

No changes to the ER are required.

Table 1 Rank Abundance of Dominant Species in Trawl Samples, Average Over 1968-1981, at Four stations in the Vicinity of Calvert Cliffs, MD. (= rank greater than 10. Sum Computed with All Ranks Greater than 10 Counts as 11.) (ANSP 1981)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Sum
Anchoa mitchilli	3	1	1	1	1	2	2	2	1	1	1	1		17
Leiostomus xanthurus	1	6			2	1	1	1	2	2	2	3		43
Micropogonias undulates	5	4	3	3	3	6	5	5	3	3	3	2		45
Brevoortia tyrannus	2	7	6	2		9	4	7	8*	10*	6	7		79
Norone Americana	7	2	4	5	6	5	7				4	6		79
Pseudopleuronectes americanus	9*	10*	7	7	4	3	3	6	7*	8*				86
Trinectas maculates					7	4	4	4	6	5	10			95
Nenidia menidia	4	3	2	10*								4		100
Alosa aestivalis	8	5	5	4								5		104
Paralichthys dentatus							6	8		7	9			109
Alosa pseudoharengus	6	9	8*	9			10*				8	8		113
Cynoscion regalis								3	4	4	5			118
Urophycis regius				6	5	10								120
Peprilus alepidotus									5	6				121
Anguilla rostrata					8	7	8							122
Norone saxatilis			9*		9			9*				9		124
Bairdiella chrysoura										9	7			126
Prionotus carolinae					10		9*							129

Apeltes quadracus		8												129
Opsanus tau								10*	9*					129
Gobiesox strumosus	10*											10		130
Syngnathus fuscus				9*										130
Peprilus triacanthus									10*					131
Dorosoma cepedanus			10*											131
% CPUE in 3 most aboundant species	78	69	82	93	73	95	93	94	99	97	98	83		
*CPUE <1.00 fish/30 minutes.														

Table 2 Rank Abundance of the Ten Most Common Species in Trawl Samples at Four Stations in the Vicinity of Calvert Cliffs, MD. Ranks are based on the Average Monthly CPUE. (- = rank greater than 10. Total of Ranks Computed with Rank >10 counted as 11.) (ANSP 1981)

Species	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Total
Anchoa mitchilli	1	1	1	1	1	1	1	1	1	1	1	1	1	16
Leiostomus xanthurus	2	2	2	2	2	2	1	1	1	2	2	2	2	23
Micropogonias undulatus	3	8	4	7	5	3	3	3	8	3	8	3	5	63
Norone americana		6	3	4	3	5	7	5	7		6	7		86
Pseudopleuronectes americanus	10		10	5		9	6	4	4	5	3	6	3	87
Trinectas maculatus	4	5	6	3	4	7	5		9	10	4		8	87
Brevoortia tyrannus					8	9	4	7	5	4	5	3	4	93
Cynoscion regalis	6	9	7	6		6		9	3	7	7		6	99
Nenidia menidia	5	7	5	10	7			6						117
Alosa aestivalis		10			6			6				5	7	122
Alosa pseudoharengus	7	4			10					6		9		124
Paralichthys dentatus						8	8	10	10	8	9	8	10	126
Norone saxatilis		3	8	9	5									128
Urophycis regius						10	9	8		9				135
Peprilus alepidotus			9								10	10		139
Bairdiella chrysoura	8													140

Anguilla rostrata				8										140
Apeltes quadracus	9													141
Acnchoa hepsetus													9	141
Proportion of total CPUE in 3 most abundant species	89	94	88	88	98	96	99	93	95	96	97	97	97	

Table 3 Mean Log Fish Abundance (±95% Confidence Intervals) of Monthly Bottom Trawls (All Depths Combined) at Kenwood Beach Plant Site and Rocky Point in the Chesapeake Bay near the Calvert Cliffs Nuclear Power Plant, January 1974 through June 1978, Grouped by Operational Stage and Season (MMC 1980)

PREOPERATIONAL*	WINTER+	SUMMER++
Kenwood Beach	1.55 + 0.58	2.38 + 0.48
Plant Site	1.55 + 0.44	2.44 + 0.36
Rocky Point	2.00 + 0.52	2.43 + 0.44
OPERATIONAL**	**WINTER+**	**SUMMER++**
Kenwood Beach	1.83 + 0.47	2.85 + 0.30
Plant Site	1.28 + 0.35	2.87 + 0.22
Rocky Point	1.52 + 0.42	3.08 + 0.28
* Preoperational = January 1974 - May 1975		
** Operational = June 1975 - June 1978		
+ Winter = December - March		
++ Summer = April - November		

Table 4 Collections, by Species and Station, during 1979 Seining Studies in the Shore Zone of the Chesapeake Bay in the Vicinity of Calvert Cliffs Nuclear Power Plant (MMC 1980). PS is the Plant Site

Species	KB	LB	PS	RP	PD	Total
Alosa aaestivalis		1	8			9
A. pseudoharengus			1			1
Anchoa hepsetus		4		1		5
A. mitchilli	2	21	47	94	8	172
Anguilla rostrata	2	5	3	4	1	15
Brevoortia tyrannus	1	311	173	16	16 6	667
Cynoscion variegatus		4	40	2		46
Cyprinodon variegatus	1				5	6
Dorosoma cepedianum			3			3
Fundulus heteroclitus	1	2				3
Fundulus majalis	11	1				12
Gobiesox strumosus		1				1
Leiostomus xanthurus	31 0	461	108	482	66	142 7
Membras martinica	4		1		2	7
Menidia beryllina		3			28	31
M. menidia	14 8	96	221	88	41 0	963
Paralichthys dentatus			3	1		4
Pomatomus saltatrix			1	1		2
Pseudopleuronectes americanus	2		4		3	9
Stronglura marina	1	1			3	5
Syngnathus fuscus			2	1	1	4
Trinectes maculatus		1	2		6	9
Total Species	11 1	14	15	10	12	22
Total Fish	48 3	912	617	690	69 9	340 1

Item Number 98 **ER Section 5.3.2.2**

Request:

Provide potential impacts to plankton, listed as an important "species."

Response:

This information is provided as part of the additional discussion of entrainment impacts at CCNPP Unit 3 in RAI Item Number 92. The discussion will include, phyto-, zoo-, mero- and ichthyo- plankton.

ER Impact:

No changes to the ER are required.

Item Number 99 **ER Section 5.3.3.1.1**

Request:

Provide additional justification for dismissing ESWS cooling tower impacts. Are the impacts important on site?

Response:

The EPRI Seasonal/Annual Cooling Tower Impact (SACTI) model was used to assess the potential for fogging and icing impacts from the Essential Service Water System (ESWS) cooling towers. The SACTI model was specifically developed to simulate cooling tower plumes and is designed to estimate probability of occurrence of various impacts due to wet cooling tower plumes, including fogging and icing. The model was applied for the "Normal Operation" described in Table 3.4-1 of the ER, i.e., the scenario consisting of two ESWS towers operating.

The model results for this scenario indicate that there is essentially no probability of fogging or icing events occurring either in the on-site areas or the off-site areas surrounding the plant location. The SACTI model also estimates frequency of occurrence of visible plumes at various distances downwind from the cooling tower. The SACTI results indicate a low probability of occurrence of visible plumes from the ESWS, with the highest frequency of occurrence limited to a distance of 100 meters from the ESWS location. Beyond a distance of 100 meters, the plume dissipates rapidly and the plume frequency drops to a range of 0% to 2.1% depending on distance and direction.

In summary, the wet plumes from the ESWS are not expected to cause adverse on-site or off-site environmental impacts.

ER Impact:

No changes to the ER are required.

Item Number 100 **ER Section 5.3.3.1.2**

Request:

Provide information on the distribution of plume lengths and heights.

Response:

The addition of the hybrid cooling tower will essentially eliminate any visible plumes from the CWS cooling tower. The discussion of plume lengths and heights is no longer relevant.

ER Impact:

Plume length and height discussions will be updated in a future revision of the ER.

Item Number 101 **ER Section 5.3.3.1.4**

Request:

Justify using BWI meteorological data to represent Calvert Cliffs rather than data from Patuxent River Naval Air Station.

Response:

The use of BWI meteorological data in this Section of the ER was to compare the additional precipitation caused by the cooling tower to normal rainfall in the area. With the inclusion of the hybrid cooling tower design for the CWS cooling tower and the additional analysis conducted for the ESWS cooling towers, Section 5.3.3.1.4 "Cloud Shadowing and Additional Precipitation" is no longer relevant and will be updated accordingly in a future revision to the ER.

ER Impact:

Cloud shadowing and additional precipitation discussions will be updated in Section 5.3.3.1.4 in a future revision of the ER.

Item Number 102 **ER Section 5.3.3.1.6**

Request:

The section does not include sufficient information on land use in the vicinity of the plant to draw the conclusion in the last sentence. Complete the logic chain.

Response:

The estimated noise generated from the CCNPP Unit 3 cooling tower operation has been modeled to assess the impact to the nearby community (Hessler, 2007). As discussed in ER Section 5.8.1.3, sound contours were estimated from the anticipated cooling tower noise during the summer leaf-on season and the winter leaf-off season. The sound levels beyond the CCNPP Unit 3 site boundary are below both the daytime and nighttime maximum allowable levels of 65 dBA and 55 dBA, respectively, as well as the day-night environmental noise standard of 55 dBA (Ldn), for all seasons.

Since the estimated noise levels generated from the CCNPP Unit 3 cooling tower operation are much less than the ambient measured noise levels previously shown in ER Table 2.7-116, noise from the cooling tower operation will not add to the baseline noise levels. Thus, the impact from noise from operation of CCNPP Unit 3 to nearby residences and recreational areas is anticipated to be SMALL.

Hessler, 2007. Estimated Cooling Tower Sound Emissions for the Calvert Cliffs Nuclear Power Plant (CCNPP) Expansion Project, Report Number 051007-1, Hessler Associates, Inc., May 2007.

ER Impact:

No changes to the ER are required.

Item Number 103 **ER Section 5.3.3.1.7**

Request:

What is the rationale for suggesting that the impacts of cooling tower impacts at Calvert Cliffs would be similar to those at Chalk Point and Hope Creek, given the differences in release heights. Does the statement that there have been no impacts at the two sites mean that there have been monitoring programs and no impacts observed, or that no impacts have been observed because there have been no monitoring programs?.

Response:

Salt deposition from cooling towers is affected by a number of operating parameters, including the tower size (i.e., water recirculation rate), tower type (i.e., natural draft versus mechanical draft – insofar as it dictates the height of the tower), drift elimination efficiency, influent total dissolved solids (TDS) content, and operating cycles of concentration. The variability in these parameters among the operating cooling towers located in the vicinity of CCNPP Unit 3 prevents simple, direct comparisons.

Statements made in the ER Section 5.3.3.1.7 do not refer to any monitoring programs for the Chalk Point and Hope Creek cooling towers. Instead, they provide a qualitative evaluation of effects of the cooling tower proposed for CCNPP Unit 3 that is based on the fact that no adverse affects have been observed related to salt deposition resulting from the operation of the cooling towers at these other locations.

This qualitative assessment is supported by conclusions expressed in NUREG-1437, Section 4.3.5.1.3, where it states "Monitoring results from the sample of nuclear plants and from the Chalk Point plant, in conjunction with the literature review and information provided by the natural resource agency and agricultural agencies in all states with nuclear power plants, have revealed no instances where cooling tower operation has resulted in measurable degradation of the health of natural plant communities."

As stated in ER Section, 5.3.3.1.3, the expected salt deposition rate associated with operation of the CCNPP Unit 3 cooling tower will not exceed significance level identified in NUREG-1555, Section 5.3.3.2. As a result, we do not expect any impacts from the salt deposition levels that will result from the operation of CCNPP Unit 3.

ER Impact:

No changes to the ER are required.

Item Number 104 **ER Section 5.4**

Request:

Provide input and output files for LADTAP, GASPAR-II.

Response:

Inputs for the LADTAP II and GASPAR II runs are given in the following tables. Resulting doses are given in ER Tables 5.4-7 through 5.4-13 and Table 5.4-19.

ER Impact:

No changes to the ER are required.

Table 1–LADTAP II Input for Offsite Dose to Maximum Exposed Individual and Population from Liquid Effluents

Record Type and Description	Parameter Description	Parameter Value
1 – Case Title	Descriptive case title	CCNPP MEI and Population Dose, PSAT 4023CF.16, Rev. 1
2 – Site Characteristics	Water type selection; if =1, saltwater	1
	Reactor effluent discharge rate in ft^3/sec	39.3 (revised ER Table 5.4-1)
	Source term multiplier	1
	Integer to control calculation and printing of % contribution to doses by radionuclide	0
	Integer to control changing and printing of block data parameters and printing of dose conversion factors	0
3 – Site population	Population within 50 miles	8124000
	Control parameter for reading record 3a	0
4 – Source term title	Source term title	GALE Liquid
5 - Radionuclide release information	Radionuclide element symbol	See ER Table 3.5-7
	Radionuclide mass number	See ER Table 3.5-7
	Radionuclide release rate (Ci/yr)	See ER Table 3.5-7
	Radionuclide reconcentration factor	0
6 – Impoundment reconcentration model data	Reconcentration model index; if =0, no model	0
	Discharge rate to receiving water	0
	Radionuclide concentration factor	0
7 – ALARA analysis usage location data	Index for reading records 7a-7d	1
	Shore-width factor	1
	Dilution factor – aquatic food and boating	13.3
	Dilution factor – shoreline and swimming	69
	Dilution factor – drinking water	[Special Case: See ER Sections 5.4.2.1 & 5.4.3.1]
	Transit time – all pathways except drinking water	0
	Transit time – drinking water	0
7a – Usage and Consumption Data for ALARA Location	Usage and consumption data for adult	See Table 5
7b – Usage and Consumption Data for ALARA Location	Usage and consumption data for teenagers	See Table 5
7c – Usage and Consumption Data for ALARA Location	Usage and consumption data for children	See Table 5
7d – Usage and Consumption Data for ALARA Location	Usage and consumption data for infants	See Table 5
8 – Selected usage location data	Additional selected usage location data	<Not used>
9 –Sport-harvest fishing usage location data	Annual harvest of sport fish for current location	1.29E+06 kg/yr
	Dilution factor for current sport fishing location	365
	Transit time from discharge point to location of sport fishing harvest (hr)	0

Table 1 – LADTAP II Input for Offsite Dose to Individuals and Populations from Liquid Effluents (Cont'd)

Record Type and Description	Parameter Description	Parameter Value
	Title for current location	Sport Fishing Total
10 – Commercial-harvest fishing location data	Annual harvest of commercial fish for current location	1.522E+08 kg/yr
	Dilution factor for current commercial fishing location	365
	Transit time from discharge point to location of commercial fishing harvest (hr)	0
	Title for current location	Commercial Fishing Total
11 – Sport Invertebrate harvest location data	Annual harvest of sport invertebrate for current location	1.58E+06 kg/yr
	Dilution factor for current sport invertebrate harvest location	365
	Transit time from discharge point to location of sport invertebrate harvest location (hr)	0
	Title for current location	Sport Invert Total
12 – Commercial Invertebrate harvest location data	Annual harvest of commercial invertebrate for current location	2.64E+07 kg/yr
	Dilution factor for current commercial invertebrate harvest location	365
	Transit time from discharge point to location of commercial invertebrate harvest location (hr)	0
	Title for current location	Commercial Invert Total
13 – Population drinking-water usage location	Population drinking water usage location data	<Not used>
14 – Population shoreline usage data	Total shoreline usage time	37,843,909 person-hrs/yr
	Dilution factor for shoreline exposure	365
	Transit time from release point to usage location	0
	Shore-width factor for shoreline usage location	1
	Title	Shoreline
15 – Population swimming usage data	Total exposure time for swimming for the current usage location	30,133,372 person-hrs/yr
	Dilution factor for the current swimming usage location	365
	Transit time from release point to usage location	0
	Title	Swimming
16 – Population boating usage data	Total exposure time for boating activities for the current usage location	44,285,377
	Dilution factor for the current boating usage location	365
	Transit time from release point to usage location	0
	Title	Boating
17 – Irrigation food pathway data	Irrigated food pathway data	<Not used>
18 – Food product irrigation-water usage location data	Food product water usage location data	<Not used>

Table 1 – LADTAP II Input for Offsite Dose to Individuals and Populations from Liquid Effluents (Cont'd)

Record Type and Description	Parameter Description	Parameter Value
19 – Biota exposure location data	Dilution factor	<Not used>
	Transit time	<Not used>
	Usage location title	<Not used>

Table 2 – LADTAP II Input for Calculation of Dose to Biota

Record Type and Description	Parameter Description	Parameter Value
1 - Case Title	Descriptive case title	CCNPP Unit 3, US EPR Dose to Biota with Low Dilution Factor
2 - Site Characteristics	Water type selection; if =1, saltwater	1
	Reactor effluent discharge rate in ft^3/sec	39.3
	Source term multiplier	1
	Integer to control calculation and printing of % contribution to doses by radionuclide	0
	Integer to control changing and printing of block data parameters and printing of dose conversion factors	0
3 - Site population	Population within 50 miles	100 (dummy variable, not used to calculate dose to biota)
	Control parameter for reading record 3a	0
4 - Source term title	Source term title	From PWR GALE (Liquid)
5 - Radionuclide release information	Radionuclide element symbol	See ER Table 3.5-7
	Radionuclide mass number	See ER Table 3.5-7
	Radionuclide release rate (Ci/yr)	See ER Table 3.5-7
	Radionuclide reconcentration factor	0
6 - Impoundment reconcentration model data	Reconcentration model index; if =0, no model	0
	Discharge rate to receiving water	0
	Radionuclide concentration factor	0
7 - ALARA analysis usage location data	Index for reading records 7a-7d	0
	Shore-width factor	1
	Dilution factor – aquatic food and boating	1 (dummy variable, not used to calculate dose to biota)
	Dilution factor – shoreline and swimming	1 (dummy variable, not used to calculate dose to biota)
	Dilution factor – drinking water	1 (dummy variable, not used to calculate dose to biota)
	Transit time – all pathways except drinking water	0
	Transit time – drinking water	0
8 – Selected usage location data	Additional selected usage location data	<Not used>
9 –Sport-harvest fishing usage location data	Sport fishing usage location data	<Not used>
10 – Commercial-harvest fishing location data	Commercial fishing usage location data	<Not used>
11 – Invertebrate sport harvest usage location data	Sport invertebrate harvest location data	<Not used>
12 – Invertebrate commercial harvest usage location data	Commercial invertebrate harvest location data	<Not used>
13 – Population drinking-water usage location	Population drinking water usage location data	<Not used>
14 – Population shoreline usage data	Population shoreline usage data	<Not used>
15 – Population swimming usage data	Population swimming usage data	<Not used>

Table 2- LADTAP II Input for Calculation of Dose to Biota (Cont'd)

Record Type and Description	Parameter Description	Parameter Value
16 – Population boating usage data	Population boating usage data	<Not used>
17 – Irrigation food pathway data	Irrigated food pathway data	<Not used>
18 – Food product irrigation-water usage location data	Food product water usage location data	<Not used>
19 – Biota exposure location data	Dilution factor	13.3
	Transit time	0
	Usage location title	EPR

Table 3 – LADTAP II Input for Cost-Benefit Analysis - Reference Configuration

Record Type and Description	Parameter Description	Parameter Value
1 - Case Title	Descriptive case title	PSAT 4023CF.07, Rev 1, Cost-Benefit, Liquid
2 - Site Characteristics	Water type selection; if =1, saltwater	1
	Reactor effluent discharge rate in ft^3/sec	39.3
	Source term multiplier	1
	Integer to control calculation and printing of % contribution to doses by radionuclide	0
	Integer to control changing and printing of block data parameters and printing of dose conversion factors	0
3 - Site population	Population within 50 miles	8.12E+06
	Control parameter for reading record 3a	0
4 - Source term title	Source term title	GALE Liquid (Unadjusted)
5 - Radionuclide release information	Radionuclide element symbol	See Table 6
	Radionuclide mass number	See Table 6
	Radionuclide release rate (Ci/yr)	See Table 6
	Radionuclide reconcentration factor	0
6 - Impoundment reconcentration model data	Reconcentration model index; if =0, no model	0
	Discharge rate to receiving water	0
	Radionuclide concentration factor	0
7 - ALARA analysis usage location data	Index for reading records 7a-7d	1
	Shore-width factor	1
	Dilution factor – aquatic food and boating	13.3
	Dilution factor – shoreline and swimming	69
	Dilution factor – drinking water	1
	Transit time – all pathways except drinking water	0
	Transit time – drinking water	0
8 – Selected usage location data	Additional selected usage location data	<Not Used>
9 –Sport-harvest fishing usage location data	Annual harvest of sport fish for current location	1.29E+06 kg/yr
	Dilution factor for current sport fishing location	365
	Transit time from discharge point to location of sport fishing harvest (hr)	168
	Title for current location	Sport Fishing Total
10 – Commercial-harvest fishing location data	Annual harvest of commercial fish for current location	1.522E+08 kg/yr
	Dilution factor for current commercial fishing location	365

Table 3– LADTAP II Input for Cost-Benefit Analysis - Reference Configuration (Cont'd)

Record Type and Description	Parameter Description	Parameter Value
	Transit time from discharge point to location of commercial fishing harvest (hr)	240
	Title for current location	Commercial Fishing Total
11 – Sport Invertebrate harvest location data	Annual harvest of sport invertebrate for current location	1.58E+06 kg/yr
	Dilution factor for current sport invertebrate harvest location	365
	Transit time from discharge point to location of sport invertebrate harvest location (hr)	168
	Title for current location	Sport Invert Total
12 – Commercial Invertebrate harvest location data	Annual harvest of commercial invertebrate for current location	2.64E+07 kg/yr
	Dilution factor for current commercial invertebrate harvest location	365
	Transit time from discharge point to location of commercial invertebrate harvest location (hr)	240
	Title for current location	Commercial Invert Total
13 – Population drinking-water usage location	Population drinking water usage location data	<Not used>
14 – Population shoreline usage data	Total shoreline usage time	37,843,909 person-hrs/yr
	Dilution factor for shoreline exposure	365
	Transit time from release point to usage location	0
	Shore-width factor for shoreline usage location	1
	Title	Shoreline
15 – Population swimming usage data	Total exposure time for swimming for the current usage location	30,133,372 person-hrs/yr
	Dilution factor for the current swimming usage location	365
	Transit time from release point to usage location	0
	Title	Swimming
16 – Population boating usage data	Total exposure time for boating activities for the current usage location	44,285,377
	Dilution factor for the current boating usage location	365
	Transit time from release point to usage location	0
	Title	Boating
17 – Irrigation food pathway data	Irrigated food pathway data	<Not used>
18 – Food product irrigation-water usage location data	Food product water usage location data	<Not used>
19 – Biota exposure location data	Dilution factor	<Not used>
	Transit time	<Not used>
	Usage location title	<Not used>

Table 4 – LADTAP II Input for Cost-Benefit Analysis -Alternate Configuration

Record Type and Description	Parameter Description	Parameter Value
1 - Case Title	Descriptive case title	PSAT 4023CF.07, Rev 1, Cost-Benefit, Liquid
2 - Site Characteristics	Water type selection; if =1, saltwater	1
	Reactor effluent discharge rate in ft^3/sec	39.3
	Source term multiplier	1
	Integer to control calculation and printing of % contribution to doses by radionuclide	0
	Integer to control changing and printing of block data parameters and printing of dose conversion factors	0
3 - Site population	Population within 50 miles	8.12E+06
	Control parameter for reading record 3a	0
4 - Source term title	Source term title	GALE Liquid, Alternate Configuration (Unadjusted)
5 - Radionuclide release information	Radionuclide element symbol	See Table 7
	Radionuclide mass number	See Table 7
	Radionuclide release rate (Ci/yr)	See Table 7
	Radionuclide reconcentration factor	0
6 - Impoundment reconcentration model data	Reconcentration model index; if =0, no model	0
	Discharge rate to receiving water	0
	Radionuclide concentration factor	0
7 - ALARA analysis usage location data	Index for reading records 7a-7d	1
	Shore-width factor	1
	Dilution factor – aquatic food and boating	13.3
	Dilution factor – shoreline and swimming	69
	Dilution factor – drinking water	1
	Transit time – all pathways except drinking water	0
	Transit time – drinking water	0
8 – Selected usage location data	Additional selected usage location data	See Table 5.4-2 for shoreline, swimming, and boating pathways. Other values use RG 1.109 default values
9 –Sport-harvest fishing usage location data	Annual harvest of sport fish for current location	1.29E+06 kg/yr
	Dilution factor for current sport fishing location	365
	Transit time from discharge point to location of sport fishing harvest (hr)	168
	Title for current location	Sport Fishing Total
10 – Commercial-harvest fishing location data	Annual harvest of commercial fish for current location	1.522E+08 kg/yr
	Dilution factor for current commercial fishing location	365

Table 4– LADTAP II Input for Cost-Benefit Analysis -Alternate Configuration (Cont'd)

Record Type and Description	Parameter Description	Parameter Value
	Transit time from discharge point to location of commercial fishing harvest (hr)	240
	Title for current location	Commercial Fishing Total
11 – Sport Invertebrate harvest location data	Annual harvest of sport invertebrate for current location	1.58E+06 kg/yr
	Dilution factor for current sport invertebrate harvest location	365
	Transit time from discharge point to location of sport invertebrate harvest location (hr)	168
	Title for current location	Sport Invert Total
12 – Commercial Invertebrate harvest location data	Annual harvest of commercial invertebrate for current location	2.64E+07 kg/yr
	Dilution factor for current commercial invertebrate harvest location	365
	Transit time from discharge point to location of commercial invertebrate harvest location (hr)	240
	Title for current location	Commercial Invert Total
13 – Population drinking-water usage location	Population drinking water usage location data	<Not used>
14 – Population shoreline usage data	Total shoreline usage time	37,843,909 person-hrs/yr
	Dilution factor for shoreline exposure	365
	Transit time from release point to usage location	0
	Shore-width factor for shoreline usage location	1
	Title	Shoreline
15 – Population swimming usage data	Total exposure time for swimming for the current usage location	30,133,372 person-hrs/yr
	Dilution factor for the current swimming usage location	365
	Transit time from release point to usage location	0
	Title	Swimming
16 – Population boating usage data	Total exposure time for boating activities for the current usage location	44,285,377
	Dilution factor for the current boating usage location	365
	Transit time from release point to usage location	0
	Title	Boating
17 – Irrigation food pathway data	Irrigated food pathway data	<Not used>
18 – Food product irrigation-water usage location data	Food product water usage location data	<Not used>
19 – Biota exposure location data	Dilution factor	<Not used>
	Transit time	<Not used>
	Usage location title	<Not used>

Table 5: Usage Factors for Liquid Effluent Pathway

	Fish[1] (kg/yr)	Invertebrate[1] (kg/yr)	Potable Water[1] (l/yr)	Shoreline[2] (hr/yr)	Swimming[2] (hr/yr)	Boating[2] (hrs/yr)
Adult	21	5.0	730	200	100	200
Teen	16	3.8	510	200	100	200
Child	6.9	1.7	510	200	100	200
Infant	0.0	0.0	330	200	100	200

[1] Values from Reg. Guide 1.109, Table E-5.
[2] Values from ER Table 5.4-2.

Table 6: Reference Configuration GALE Liquid Effluent Releases (unadjusted)

Nuclide	Release Rate Ci/yr
Na 24	0.00105
Cr 51	0.00018
Mn 54	0.00009
Fe 55	0.00007
Fe 59	0.00002
Co 58	0.00027
Co 60	0.00003
Zn 65	0.00003
Sr 89	0.00001
Sr 91	0.00001
Y 91M	0.00001
Y 93	0.00006
Zr 95	0.00002
Nb 95	0.00002
Mo 99	0.00030
Tc 99m	0.00029
Ru 103	0.00043
Ru 106	0.00522
Ag 110m	0.00008
Te 129m	0.00001
Te 129	0.00001
Te 131m	0.00005
Te 131	0.00001
I 131	0.00586
Te 132	0.00008
I 132	0.00020
I 133	0.00597
Cs 134	0.00045
I 135	0.00256
Cs 136	0.00005
Cs 137	0.00060
Ba 140	0.00072
La 140	0.00131
Ce 141	0.00001
Ce 143	0.00010
Pr 143	0.00001
Ce 144	0.00023
Pr144	0.00023
W 187	0.00008
Np 239	0.00010
H 3	1660

Table 7: Alternate Configuration GALE Liquid Effluent Releases (unadjusted)

Nuclide	Release Rate Ci/yr
Na 24	0.00523
Cr 51	0.00091
Mn 54	0.00048
Fe 55	0.00036
Fe 59	0.00009
Co 58	0.00136
Co 60	0.00016
Zn 65	0.00015
Sr 89	0.00004
Sr 91	0.00006
Y 91m	0.00004
Y 93	0.00030
Zr 95	0.00012
Nb 95	0.00009
Mo 99	0.00152
Tc 99m	0.00147
Ru 103	0.00221
Ru 106	0.02689
Ag 110m	0.00039
Te 129m	0.00006
Te 129	0.00004
Te 131m	0.00027
Te 131	0.00005
I 131	0.02921
Te 132	0.00042
I 132	0.00091
I 133	0.02956
Cs 134	0.00234
I 135	0.01241
Cs 136	0.00028
Cs 137	0.00309
Ba 140	0.00369
La 140	0.00665
Ce 141	0.00004
Ce 143	0.00053
Pr 143	0.00004
Ce 144	0.00116
Pr144	0.00116
W 187	0.00040
Np 239	0.00050
H 3	1660

Table 8: GASPAR II Input Variables for Calculation of Maximum Exposed Individual and Biota Dose

Record Type	Parameter Description	Parameter Value
1	Case title	Dose to MEI from Gaseous Effluents – CC (Rev2)
2	Type of calculation, 0 = population dose, non zero for individual doses only	1
	Number of source terms	1
	Print Control, 0= print cumulative dose for each term, 1 = total dose printed only	1
	Block Data Change, if >0 then read changes	0
	Print dose factor library, if > 0 print	0
	PARTS calculation, if >0 then perform	0
	Meteorological data entry, if 0 read with rest of data	0
3	Distance from the facility to NE Corner of U.S.[1]	740 miles
	Fraction of the year leafy vegetables are grown	0.58
	Fraction of the year milk cows are on pasture	0.58
	Fraction of the year MEI's vegetables are from own garden	0.76
	Fraction of the milk-cow feed is from pasture while on pasture	1.0
	Average absolute humidity over growing season	8.4 g/m^3
	Average temperature over growing season[2]	0
	Fraction of the year goats are on pasture	0.58
	Fraction of the goat feed is from pasture while on pasture	1
	Fraction of the year beef cattle are on pasture	0.58
	Fraction of the beef cattle feed from pasture while on pasture	1
4	Population Data	Not used
5	Milk Production Data	Not used
6	Meat Production Data	Not used
7	Vegetable Production Data	Not used
8	Source term multiplier	1
	Source term	See ER Table 3.5-8
9	Meteorological Data (Undecayed/Undepleted)	Not used
10	Meteorological Data (Decayed/Undepleted)	Not used
11	Meteorological Data (Decayed/Depleted)	Not used
12	Meteorological Data (Deposited)	Not used
13	Special Meteorological Data [Receptor Data]	See Table 10

(1) This is a dummy variable and is not used in this calculation
(2) This value is set to zero when an absolute humidity is input

Table 9: GASPAR II Input Variables for Calculation of Population Dose

Record Type	Parameter Description	Parameter Value
1	Case title	PSAT 4023CF.18 (Rev 0)
2	Type of calculation, 0 = population dose, non zero for individual doses only	0
	Number of source terms	1
	Print Control, 0= print cumulative dose for each term, 1 = total dose printed only	1
	Block Data Change, if >0 then read changes	0
	Print dose factor library, if > 0 print	0
	PARTS calculation, if >0 then perform	0
	Meteorological data entry, if 0 read with rest of data	0
3	Distance from the facility to NE Corner of U.S.[1]	740 miles
	Fraction of the year leafy vegetables are grown	0.58
	Fraction of the year milk cows are on pasture	0.58
	Fraction of the year that vegetables are from own garden	0.76
	Fraction of the milk-cow feed is from pasture while on pasture	1.0
	Average absolute humidity over growing season	8.4 g/m^3
	Average temperature over growing season[2]	0
	Fraction of the year goats are on pasture	0.58
	Fraction of the goat feed is from pasture while on pasture	1.0
	Fraction of the year beef cattle are on pasture	0.58
	Fraction of the beef cattle feed from pasture while on pasture	1.0
4	Population Data	See Table 11
5	Milk Production Data	See Table 12
6	Meat Production Data	See ER Tables 5.4-26 and 5.4-27
7	Vegetable Production Data	See ER Tables 5.4-28
8	Source term multiplier	1
	Source term	See ER Table 3.5-8
9	Meteorological Data (Undecayed/Undepleted)	See Table 13
10	Meteorological Data (Decayed/Undepleted)	See Table 13
11	Meteorological Data (Decayed/Depleted)	See Table 14
12	Meteorological Data (Deposited)	See Table 15
13	Special Meteorological Data [Receptor Data]	Not used

(3) This is a dummy variable and is not used in this calculation
(4) This value is set to zero when an absolute humidity is input

Table 10: GASPAR II Special-Location Data

Receptor	Direction	Distance (miles)	X/Q (sec/m^3)	Dep. X/Q (sec/m^3)	D/Q (1/m^2)
Site Boundary 1	SE	0.88	1.076E-06	9.733E-07	1.060E-08
Site Boundary 2	S	0.86	8.681E-07	7.939E-07	1.186E-08
Nearest Garden	SW	1.1	4.899E-07	4.516E-07	5.415E-09

Table 11: CCNPP Unit 3 Site Area Population Data within 50 miles for Year 2080 (Projected)

	Distance (miles)										
	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	Sector Totals
N	0							15,248	198,666	229,286	443,200
NNE	0						761	12,217	46,412	37,244	96,634
NE	0					2	2,285	16,825	56,137	65,256	140,505
ENE	0					1,357	3,736	37,475	24,945	73,387	140,900
E	0					78	529	1,048	12,247	180,306	194,208
ESE	0					0	1,588	1,331	8,460	30,493	41,872
SE	0	0	877	0	583		410	0	1,885	13,099	16,854
SSE	0	0	102	3,019	10,050	19,851	3,764	6,273	3,627	5,347	52,033
S	0	208	760	586	4,662	36,849	161,461	15,423	17,607	14,300	251,856
SSW	0	133	642	443	632	46,744	127,297	7,449	20,209	12,820	216,369
SW	0	1,020	0	512	177	22,605	66,962	6,987	6,540	9,159	113,962
WSW	0	2,657	2,176	202	1,380	17,573	59,633	30,712	47,148	28,877	190,358
W	93	1,339	896	543	1,107	5,214	90,987	61,796	52,610	203,614	418,199
WNW	0	171	183	264	1,569	8,441	68,358	368,479	366,222	1,527,435	2,341,122
NW	0	2,154	3,587	3,215	989	7,490	32,522	45,700	521,566	2,081,727	2,698,950
NNW	0	0				2,226	63,612	45,177	165,248	490,640	766,903
Ring totals	93	7,682	9,223	8,784	21,149	168,430	683,905	672,140	1,549,529	5,002,990	8,123,925
Cum Totals	93	7,775	16,998	25,782	46,931	215,361	899,266	1,571,406	3,120,935	8,123,925	

Table 12: CCNPP Unit 3 Milk Production (liters/year) within 50 miles

	Distance (miles)										
Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	Total
N	0	0	0	0	0	0	0	1,027,114	2,875,917	5,731,291	9.634E+06
NNE	0	0	0	0	0	0	57,860	578,600	3,067,078	3,761,383	7.465E+06
NE	0	0	0	0	0	77,033	1,140,096	819,683	6,998,552	8,998,138	1.803E+07
ENE	0	0	0	0	0	385,167	3,019,713	4,108,453	6,998,552	8,998,138	2.351E+07
E	0	0	0	0	0	385,167	3,081,340	5,135,566	7,189,792	9,244,018	2.504E+07
ESE	0	0	0	0	0	77,033	2,773,206	2,567,783	5,032,854	8,781,817	1.923E+07
SE	0	0	0	0	0	38,517	616,268	1,027,114	1,797,448	3,697,608	7.177E+06
SSE	0	0	0	0	0	500,717	616,268	1,027,114	718,980	350,644	3.214E+06
S	0	0	0	0	0	654,784	2,773,206	2,567,783	2,181,784	3,155,796	1.133E+07
SSW	0	0	0	0	0	616,268	2,311,005	1,207,774	2,727,231	2,805,152	9.667E+06
SW	0	0	0	0	0	654,784	2,619,139	779,209	2,727,231	3,506,440	1.029E+07
WSW	0	0	0	0	0	539,234	3,081,340	2,567,783	2,318,146	3,506,440	1.201E+07
W	0	0	0	0	0	616,268	2,773,206	4,622,009	5,751,834	7,395,215	2.116E+07
WNW	0	0	0	0	0	770,335	2,619,139	5,135,566	6,470,813	7,857,416	2.285E+07
NW	0	0	0	0	0	693,301	2,773,206	5,135,566	7,189,792	0	1.579E+07
NNW	0	0	0	0	0	231,100	2,619,139	4,878,787	7,189,792	9,244,018	2.416E+07
Totals	0	0	0	0	0	6.240E+06	3.287E+07	4.319E+07	7.124E+07	8.703E+07	2.406E+08

Table 13: CCNPP Unit 3 Annual Average Undecayed, Undepleted X/Q (sec/m^3)

Downwind Sector	Downwind Distance (miles)										
	0.5	0.75	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
N	1.923E-06	1.065E-06	5.811E-07	2.571E-07	1.538E-07	1.055E-07	8.046E-08	6.401E-08	5.261E-08	4.482E-08	3.881E-08
NNE	3.287E-06	1.754E-06	9.348E-07	3.980E-07	2.333E-07	1.584E-07	1.201E-07	9.528E-08	7.821E-08	6.663E-08	5.773E-08
NE	5.039E-06	2.711E-06	1.443E-06	6.059E-07	3.491E-07	2.334E-07	1.748E-07	1.372E-07	1.117E-07	9.446E-08	8.134E-08
ENE	2.038E-06	1.090E-06	5.855E-07	2.525E-07	1.491E-07	1.017E-07	7.731E-08	6.142E-08	5.048E-08	4.303E-08	3.731E-08
E	1.516E-06	8.448E-07	4.715E-07	2.135E-07	1.287E-07	8.848E-08	6.751E-08	5.374E-08	4.421E-08	3.773E-08	3.273E-08
ESE	1.987E-06	1.123E-06	6.238E-07	2.761E-07	1.627E-07	1.099E-07	8.269E-08	6.509E-08	5.305E-08	4.489E-08	3.866E-08
SE	2.416E-06	1.464E-06	8.347E-07	3.833E-07	2.214E-07	1.458E-07	1.072E-07	8.261E-08	6.606E-08	5.495E-08	4.660E-08
SSE	1.381E-06	8.911E-07	5.240E-07	2.393E-07	1.396E-07	9.489E-08	6.969E-08	5.363E-08	4.280E-08	3.554E-08	3.008E-08
S	1.815E-06	1.127E-06	6.501E-07	3.095E-07	1.771E-07	1.155E-07	8.420E-08	6.481E-08	5.148E-08	4.256E-08	3.589E-08
SSW	1.599E-06	1.050E-06	6.224E-07	2.824E-07	1.628E-07	1.066E-07	7.786E-08	5.963E-08	4.741E-08	3.922E-08	3.308E-08
SW	1.557E-06	1.013E-06	5.897E-07	2.619E-07	1.496E-07	9.750E-08	7.102E-08	5.432E-08	4.314E-08	3.568E-08	3.009E-08
WSW	1.053E-06	7.219E-07	4.396E-07	2.056E-07	1.204E-07	7.956E-08	5.843E-08	4.492E-08	3.580E-08	2.968E-08	2.508E-08
W	6.742E-07	5.085E-07	3.282E-07	1.627E-07	9.803E-08	6.584E-08	4.888E-08	3.787E-08	3.036E-08	2.528E-08	2.143E-08
WNW	4.529E-07	3.122E-07	2.012E-07	1.108E-07	6.956E-08	4.823E-08	3.671E-08	2.902E-08	2.365E-08	2.079E-08	1.781E-08
NW	6.608E-07	4.337E-07	2.685E-07	1.399E-07	8.563E-08	5.846E-08	4.403E-08	3.454E-08	2.799E-08	2.353E-08	2.012E-08
NNW	1.586E-06	9.808E-07	5.737E-07	2.658E-07	1.580E-07	1.062E-07	7.933E-08	6.190E-08	4.999E-08	4.193E-08	3.580E-08

Table 13: CCNPP Unit 3 Annual Average Undecayed, Undepleted X/Q (sec/m^3) (cont'd)

	Downwind Distance (miles)									
Downwind Sector	7.5	10	15	20	25	30	35	40	45	50
N	2.217E-08	1.608E-08	1.013E-08	7.265E-09	5.602E-09	4.526E-09	3.937E-09	3.363E-09	2.926E-09	2.584E-09
NNE	3.321E-08	2.429E-08	1.555E-08	1.129E-08	8.797E-09	7.170E-09	6.090E-09	5.239E-09	4.773E-09	4.236E-09
NE	4.586E-08	3.318E-08	2.099E-08	1.515E-08	1.236E-08	1.005E-08	8.434E-09	7.247E-09	6.340E-09	5.625E-09
ENE	2.152E-08	1.580E-08	1.018E-08	7.445E-09	6.198E-09	5.078E-09	4.290E-09	3.706E-09	3.258E-09	2.903E-09
E	1.892E-08	1.390E-08	8.963E-09	6.547E-09	5.263E-09	4.304E-09	3.629E-09	3.129E-09	2.746E-09	2.443E-09
ESE	2.176E-08	1.570E-08	9.870E-09	7.089E-09	5.615E-09	4.546E-09	3.802E-09	3.257E-09	2.841E-09	2.514E-09
SE	2.468E-08	1.706E-08	1.011E-08	6.975E-09	5.294E-09	4.183E-09	3.429E-09	2.888E-09	2.482E-09	2.169E-09
SSE	1.578E-08	1.081E-08	6.328E-09	4.322E-09	3.249E-09	2.550E-09	2.079E-09	1.743E-09	1.492E-09	1.299E-09
S	1.862E-08	1.270E-08	7.407E-09	5.053E-09	3.791E-09	2.977E-09	2.429E-09	2.037E-09	1.746E-09	1.522E-09
SSW	1.716E-08	1.170E-08	6.808E-09	4.636E-09	3.470E-09	2.721E-09	2.217E-09	1.857E-09	1.590E-09	1.385E-09
SW	1.562E-08	1.065E-08	6.206E-09	4.230E-09	3.169E-09	2.487E-09	2.078E-09	1.741E-09	1.519E-09	1.322E-09
WSW	1.306E-08	8.908E-09	5.187E-09	3.526E-09	2.614E-09	2.048E-09	1.779E-09	1.486E-09	1.290E-09	1.120E-09
W	1.128E-08	7.736E-09	4.767E-09	3.231E-09	2.399E-09	1.876E-09	1.525E-09	1.275E-09	1.089E-09	9.469E-10
WNW	9.934E-09	6.957E-09	4.180E-09	2.903E-09	2.411E-09	1.901E-09	1.571E-09	1.321E-09	1.234E-09	1.074E-09
NW	1.095E-08	7.658E-09	4.619E-09	3.201E-09	2.677E-09	2.106E-09	1.789E-09	1.499E-09	1.309E-09	1.139E-09
NNW	2.036E-08	1.421E-08	9.444E-09	6.507E-09	5.273E-09	4.148E-09	3.389E-09	2.847E-09	2.442E-09	2.130E-09

Table 14: CCNPP Unit 3 Annual Average Depleted X/Q (sec/m^3)

	Downwind Distance (miles)										
Downwind Sector	0.5	0.75	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
N	1.760E-06	9.545E-07	5.149E-07	2.253E-07	1.340E-07	9.153E-08	6.951E-08	5.510E-08	4.513E-08	3.833E-08	3.308E-08
NNE	3.008E-06	1.570E-06	8.255E-07	3.458E-07	2.007E-07	1.353E-07	1.020E-07	8.050E-08	6.579E-08	5.582E-08	4.818E-08
NE	4.614E-06	2.427E-06	1.274E-06	5.254E-07	2.990E-07	1.980E-07	1.470E-07	1.146E-07	9.272E-08	7.798E-08	6.680E-08
ENE	1.870E-06	9.791E-07	5.199E-07	2.212E-07	1.295E-07	8.772E-08	6.629E-08	5.240E-08	4.287E-08	3.639E-08	3.142E-08
E	1.392E-06	7.627E-07	4.229E-07	1.902E-07	1.141E-07	7.811E-08	5.935E-08	4.707E-08	3.860E-08	3.283E-08	2.839E-08
ESE	1.823E-06	1.013E-06	5.585E-07	2.449E-07	1.433E-07	9.622E-08	7.202E-08	5.641E-08	4.578E-08	3.859E-08	3.311E-08
SE	2.220E-06	1.328E-06	7.531E-07	3.439E-07	1.970E-07	1.287E-07	9.395E-08	7.192E-08	5.715E-08	4.727E-08	3.986E-08
SSE	1.272E-06	8.145E-07	4.778E-07	2.168E-07	1.255E-07	8.487E-08	6.189E-08	4.730E-08	3.752E-08	3.097E-08	2.606E-08
S	1.680E-06	1.033E-06	5.933E-07	2.816E-07	1.596E-07	1.032E-07	7.458E-08	5.698E-08	4.493E-08	3.689E-08	3.091E-08
SSW	1.491E-06	9.745E-07	5.766E-07	2.596E-07	1.484E-07	9.633E-08	6.978E-08	5.303E-08	4.186E-08	3.439E-08	2.883E-08
SW	1.449E-06	9.378E-07	5.444E-07	2.396E-07	1.356E-07	8.756E-08	6.325E-08	4.799E-08	3.784E-08	3.108E-08	2.604E-08
WSW	9.797E-07	6.711E-07	4.089E-07	1.901E-07	1.104E-07	7.237E-08	5.272E-08	4.022E-08	3.183E-08	2.621E-08	2.201E-08
W	6.324E-07	4.789E-07	3.101E-07	1.533E-07	9.180E-08	6.126E-08	4.520E-08	3.480E-08	2.774E-08	2.297E-08	1.938E-08
WNW	4.205E-07	2.897E-07	1.876E-07	1.039E-07	6.502E-08	4.490E-08	3.403E-08	2.678E-08	2.174E-08	1.909E-08	1.629E-08
NW	6.130E-07	4.005E-07	2.485E-07	1.299E-07	7.919E-08	5.382E-08	4.035E-08	3.151E-08	2.542E-08	2.128E-08	1.812E-08
NNW	1.462E-06	8.954E-07	5.225E-07	2.408E-07	1.423E-07	9.513E-08	7.063E-08	5.481E-08	4.404E-08	3.676E-08	3.125E-08

Table 14: CCNPP Unit 3 Annual Average Depleted X/Q (sec/m^3) (cont'd)

	Downwind Distance (miles)									
Downwind Sector	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	1.868E-08	1.340E-08	8.305E-09	5.878E-09	4.485E-09	3.591E-09	3.132E-09	2.657E-09	2.298E-09	2.017E-09
NNE	2.736E-08	1.978E-08	1.244E-08	8.912E-09	6.869E-09	5.547E-09	4.687E-09	4.003E-09	3.668E-09	3.235E-09
NE	3.698E-08	2.634E-08	1.628E-08	1.156E-08	9.443E-09	7.597E-09	6.315E-09	5.381E-09	4.672E-09	4.115E-09
ENE	1.788E-08	1.297E-08	8.214E-09	5.928E-09	4.961E-09	4.034E-09	3.383E-09	2.904E-09	2.539E-09	2.250E-09
E	1.625E-08	1.183E-08	7.532E-09	5.449E-09	4.371E-09	3.552E-09	2.977E-09	2.554E-09	2.231E-09	1.975E-09
ESE	1.839E-08	1.311E-08	8.101E-09	5.743E-09	4.529E-09	3.635E-09	3.016E-09	2.565E-09	2.224E-09	1.957E-09
SE	2.067E-08	1.403E-08	8.084E-09	5.456E-09	4.081E-09	3.176E-09	2.567E-09	2.135E-09	1.815E-09	1.569E-09
SSE	1.337E-08	8.997E-09	5.116E-09	3.418E-09	2.529E-09	1.956E-09	1.572E-09	1.302E-09	1.102E-09	9.494E-10
S	1.562E-08	1.041E-08	5.855E-09	3.883E-09	2.851E-09	2.195E-09	1.755E-09	1.446E-09	1.219E-09	1.046E-09
SSW	1.457E-08	9.706E-09	5.448E-09	3.606E-09	2.639E-09	2.027E-09	1.617E-09	1.330E-09	1.120E-09	9.590E-10
SW	1.317E-08	8.790E-09	4.952E-09	3.289E-09	2.415E-09	1.861E-09	1.537E-09	1.268E-09	1.093E-09	9.369E-10
WSW	1.117E-08	7.458E-09	4.203E-09	2.785E-09	2.022E-09	1.556E-09	1.345E-09	1.106E-09	9.432E-10	8.070E-10
W	9.991E-09	6.734E-09	4.058E-09	2.695E-09	1.968E-09	1.517E-09	1.216E-09	1.004E-09	8.487E-10	7.291E-10
WNW	8.964E-09	6.202E-09	3.658E-09	2.505E-09	2.078E-09	1.624E-09	1.329E-09	1.107E-09	9.486E-10	8.114E-10
NW	9.709E-09	6.696E-09	3.954E-09	2.695E-09	2.244E-09	1.742E-09	1.426E-09	1.175E-09	9.615E-10	8.199E-10
NNW	1.757E-08	1.208E-08	7.968E-09	5.395E-09	4.271E-09	3.304E-09	2.657E-09	2.194E-09	1.853E-09	1.592E-09

Table 15: CCNPP Unit 3 Annual Average Depleted D/Q ($1/m^2$)

	Downwind Distance (miles)										
Downwind Sector	0.5	0.75	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
N	1.322E-08	7.391E-09	3.875E-09	1.472E-09	7.661E-10	4.653E-10	3.197E-10	2.322E-10	1.759E-10	1.390E-10	1.123E-10
NNE	2.145E-08	1.177E-08	6.016E-09	2.219E-09	1.135E-09	6.822E-10	4.657E-10	3.368E-10	2.545E-10	2.008E-10	1.622E-10
NE	3.792E-08	2.075E-08	1.057E-08	3.879E-09	1.977E-09	1.184E-09	8.068E-10	5.829E-10	4.402E-10	3.472E-10	2.804E-10
ENE	1.588E-08	8.994E-09	4.695E-09	1.763E-09	9.143E-10	5.545E-10	3.812E-10	2.773E-10	2.105E-10	1.666E-10	1.349E-10
E	1.203E-08	6.702E-09	3.472E-09	1.305E-09	6.721E-10	4.053E-10	2.774E-10	2.010E-10	1.522E-10	1.202E-10	9.720E-11
ESE	1.987E-08	1.081E-08	5.498E-09	2.033E-09	1.032E-09	6.158E-10	4.181E-10	3.012E-10	2.270E-10	1.787E-10	1.441E-10
SE	2.758E-08	1.520E-08	7.823E-09	2.943E-09	1.496E-09	8.920E-10	6.051E-10	4.355E-10	3.280E-10	2.582E-10	2.081E-10
SSE	1.508E-08	8.770E-09	4.717E-09	1.846E-09	9.593E-10	5.823E-10	3.982E-10	2.882E-10	2.179E-10	1.721E-10	1.390E-10
S	2.818E-08	1.604E-08	8.446E-09	3.275E-09	1.690E-09	1.018E-09	6.966E-10	5.050E-10	3.822E-10	3.021E-10	2.443E-10
SSW	2.181E-08	1.271E-08	6.802E-09	2.649E-09	1.380E-09	8.371E-10	5.751E-10	4.180E-10	3.172E-10	2.511E-10	2.033E-10
SW	2.151E-08	1.255E-08	6.719E-09	2.616E-09	1.357E-09	8.192E-10	5.607E-10	4.063E-10	3.075E-10	2.431E-10	1.966E-10
WSW	1.199E-08	7.502E-09	4.250E-09	1.740E-09	9.261E-10	5.680E-10	3.929E-10	2.867E-10	2.179E-10	1.729E-10	1.400E-10
W	6.673E-09	4.317E-09	2.510E-09	1.053E-09	5.700E-10	3.537E-10	2.466E-10	1.810E-10	1.382E-10	1.098E-10	8.910E-11
WNW	4.775E-09	3.015E-09	1.737E-09	7.306E-10	3.965E-10	2.468E-10	1.724E-10	1.267E-10	9.681E-11	7.725E-11	6.266E-11
NW	8.120E-09	4.833E-09	2.646E-09	1.061E-09	5.619E-10	3.445E-10	2.384E-10	1.741E-10	1.326E-10	1.052E-10	8.525E-11
NNW	1.920E-08	1.103E-08	5.871E-09	2.275E-09	1.184E-09	7.177E-10	4.927E-10	3.578E-10	2.712E-10	2.145E-10	1.735E-10

Table 15: CCNPP Unit 3 Annual Average Depleted D/Q ($1/m^2$) (cont'd)

	Downwind Distance (miles)									
Downwind Sector	7.5	10	15	20	25	30	35	40	45	50
N	5.031E-11	3.161E-11	1.627E-11	1.009E-11	7.011E-12	5.187E-12	3.990E-12	3.183E-12	2.596E-12	2.156E-12
NNE	7.259E-11	4.579E-11	2.373E-11	1.478E-11	1.034E-11	7.696E-12	5.956E-12	4.767E-12	3.888E-12	3.234E-12
NE	1.254E-10	7.906E-11	4.100E-11	2.555E-11	1.786E-11	1.329E-11	1.030E-11	8.249E-12	6.744E-12	5.611E-12
ENE	6.088E-11	3.847E-11	2.012E-11	1.265E-11	8.954E-12	6.734E-12	5.259E-12	4.245E-12	3.491E-12	2.917E-12
E	4.350E-11	2.735E-11	1.418E-11	8.878E-12	6.223E-12	4.649E-12	3.614E-12	2.909E-12	2.388E-12	1.994E-12
ESE	6.385E-11	4.000E-11	2.053E-11	1.272E-11	8.795E-12	6.499E-12	5.015E-12	4.011E-12	3.279E-12	2.733E-12
SE	9.188E-11	5.720E-11	2.906E-11	1.793E-11	1.243E-11	9.273E-12	7.278E-12	5.937E-12	4.959E-12	4.244E-12
SSE	6.157E-11	3.806E-11	1.920E-11	1.183E-11	8.188E-12	6.096E-12	4.774E-12	3.884E-12	3.236E-12	2.763E-12
S	1.089E-10	6.795E-11	3.500E-11	2.193E-11	1.539E-11	1.158E-11	9.095E-12	7.412E-12	6.162E-12	5.223E-12
SSW	9.094E-11	5.673E-11	2.926E-11	1.839E-11	1.298E-11	9.821E-12	7.758E-12	6.356E-12	5.308E-12	4.519E-12
SW	8.744E-11	5.427E-11	2.766E-11	1.720E-11	1.198E-11	8.950E-12	7.656E-12	6.425E-12	6.883E-12	6.214E-12
WSW	6.255E-11	3.862E-11	1.952E-11	1.208E-11	8.370E-12	6.195E-12	5.790E-12	4.968E-12	5.869E-12	5.485E-12
W	4.009E-11	2.485E-11	1.266E-11	7.985E-12	5.745E-12	4.473E-12	3.663E-12	3.106E-12	2.678E-12	2.365E-12
WNW	2.827E-11	1.757E-11	9.012E-12	5.644E-12	4.309E-12	3.511E-12	3.334E-12	3.048E-12	4.026E-11	3.979E-11
NW	3.833E-11	2.395E-11	1.238E-11	7.785E-12	6.691E-12	5.943E-12	2.517E-11	2.703E-11	5.502E-11	5.402E-11
NNW	7.758E-11	4.832E-11	2.489E-11	1.618E-11	2.645E-11	3.090E-11	3.475E-11	3.701E-11	3.749E-11	3.831E-11

Table 16: CCNPP Unit 3 Beef Production (kg/year) within 50 miles

	Distance (miles)										
Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	Total
N	0	0	0	0	0	0	0	6,557	18,360	36,589	61,507
NNE	0	0	0	0	0	0	721	7,205	30,815	37,791	76,532
NE	0	0	0	0	0	991	14,662	10,207	24,871	31,977	82,709
ENE	0	0	0	0	0	4,953	38,835	9,607	24,871	31,977	110,244
E	0	0	0	0	0	4,953	39,627	12,009	92,464	118,882	267,935
ESE	0	0	0	0	0	991	35,665	6,004	64,725	112,938	220,322
SE	0	198	198	231	297	495	7,925	2,402	23,116	30,490	65,353
SSE	0	396	660	925	1,189	6,439	6,631	11,052	1,824	2,345	31,461
S	0	396	660	925	1,189	8,421	29,841	6,513	14,588	322,421	384,954
SSW	0	396	660	925	951	6,631	24,867	123,396	278,635	286,596	723,058
SW	0	396	614	601	476	7,046	28,183	79,610	278,635	358,245	753,806
WSW	0	396	495	925	713	5,802	33,156	27,630	236,840	358,245	664,204
W	0	396	528	925	1,189	6,631	29,841	30,515	37,974	286,596	394,596
WNW	0	396	660	925	1,189	9,907	28,183	55,261	100,177	121,643	318,341
NW	0	258	429	647	892	8,916	29,841	33,906	42,813	0	117,701
NNW	0	0	0	0	0	2,972	33,683	31,147	45,901	59,015	172,718
Totals	0	3,230	4,907	7,027	8,084	75,149	381,661	453,020	1,316,609	2,195,751	4,445,440

Table 17: CCNPP Unit 3 Poultry Production (kg/year) within 50 miles

	Distance (miles)										
Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	Total
N	0	0	0	0	0	0	0	1,631	4,567	9,101	15,298
NNE	0	0	0	0	0	0	202,571	2,025,710	3,072,327	2,470,110	7,770,718
NE	0	0	0	0	0	59,337	878,182	2,869,756	16,502,080	21,216,960	41,526,314
ENE	0	0	0	0	0	296,683	2,325,996	3,164,621	16,502,080	57,610,866	79,900,246
E	0	0	0	0	0	296,683	2,373,465	3,955,776	20,957,134	57,610,866	85,193,925
ESE	0	0	0	0	0	59,337	2,136,119	1,977,888	14,669,994	25,587,643	44,440,980
SE	0	47	47	55	71	118	474,693	791,155	4,569,955	9,401,049	15,237,191
SSE	0	95	158	221	284	1,538	110	183	185,492	238,489	426,569
S	0	95	158	221	284	2,012	493	662,471	1,483,934	2,146,405	4,296,072
SSW	0	95	158	221	227	110	411	821,464	1,854,918	1,907,916	4,585,518
SW	0	95	147	144	114	116	466	529,977	1,854,918	2,384,894	4,770,870
WSW	0	95	118	221	170	96	548	457	1,576,680	2,384,894	3,963,279
W	0	95	126	221	284	1,893	493	145	181	1,907,916	1,911,354
WNW	0	95	158	221	284	2,367	466	913	1,669,426	2,027,160	3,701,090
NW	0	62	103	155	213	2,130	493	260	364	0	3,779
NNW	0	0	0	0	0	710	8,047	7,747	364	468	17,336
Totals	0	772	1,172	1,679	1,931	723,130	8,402,553	16,810,151	84,904,413	186,914,738	297,760,540

Table 18: CCNPP Unit 3 Grains* (kg/year) within 50 miles

	Distance (miles)										
Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	Total
N	0	0	0	0	0	0	0	852,203	2,386,170	4,755,296	7,993,671
NNE	0	0	0	0	0	0	1,915,751	19,157,508	37,020,433	45,400,883	103,494,575
NE	0	0	0	0	0	230,809	3,415,980	27,139,803	56,954,513	73,227,230	160,968,335
ENE	0	0	0	0	0	1,154,047	9,047,731	25,543,344	44,700,852	55,589,006	136,034,979
E	0	0	0	0	0	1,154,047	9,232,378	31,929,180	21,542,216	55,589,006	119,446,827
ESE	0	0	0	0	0	230,809	8,309,140	15,964,590	15,079,551	21,193,035	60,777,127
SE	0	13,407	13,407	15,641	20,110	33,516	1,846,476	6,385,836	5,385,554	7,232,354	20,946,299
SSE	0	26,813	44,688	62,564	80,439	435,713	789,229	1,315,382	3,240,262	4,166,051	10,161,141
S	0	26,813	44,688	62,564	80,439	569,778	3,551,531	11,572,363	25,922,093	37,494,456	79,324,725
SSW	0	26,813	44,688	62,564	64,351	789,229	2,959,609	12,489,743	28,202,646	26,952,086	71,591,731
SW	0	26,813	44,560	40,667	32,176	838,556	3,354,224	8,057,899	28,202,646	33,690,108	74,284,648
WSW	0	26,813	33,516	62,564	48,264	690,576	3,946,146	3,288,455	23,972,249	8,427,616	40,496,198
W	0	26,813	35,751	62,564	80,439	789,229	3,551,531	2,093,125	2,604,778	3,349,000	12,593,230
WNW	0	26,813	44,688	62,564	80,439	670,327	3,354,224	6,576,909	2,930,375	3,558,312	17,304,653
NW	0	17,429	29,048	43,795	60,329	603,295	3,551,531	2,325,694	2,669,361	0	9,300,481
NNW	0	0	0	0	0	201,098	2,279,113	4,047,968	5,965,426	7,669,833	20,163,438
Totals	0	218,527	332,035	475,486	546,987	8,391,031	61,104,594	178,740,002	306,779,124	388,294,272	944,882,058

* Grains include corn, sorghum, wheat and barley and make up the significant proportion of the food production around CCNPP. Leafy vegetable production is provided in ER Table 5.4-29, but was not included in the population dose assessment as the mass of grains dominate the food production.

Item Number 105 **ER Section 5.4.1**

Request:

Provide data on transit time of liquid effluent to receptors.

Response:

Estimated transit times of liquid effluents to different receptor locations are provided in ER Table 5.4-23. In addition, ER Section 5.4.1.1 and Table 5.4-1, indicate that transit times are conservatively assumed to be zero (no credit for radioactive decay) for the liquid dose calculations presented in ER Section 5.4.

ER Impact:

No changes to the ER are required.

Item Number 106 **ER Section 5.4.1.1**

Request:

Provide data on mixing ratio/Dilution factors for liquid effluent.

Response:

ER Section 5.4.1.1 describes that a near-field dilution factor of 13.3 (a mixing ratio of 0.075) was utilized for calculating the maximum individual dose to man for exposures associated with fish and invertebrate ingestion and boating pathways. For swimming and shoreline exposure pathways, an environmental dilution factor of 69 (a mixing ratio of 0.014) was applied for the nearest shore with the minimum tidal average mixing.

These dilution factors are based on a submerged, multi-port diffuser (with three nozzles), a discharge line situated approximately 550 ft (168 m) off the near shoreline with the nozzles directed out into the Chesapeake Bay and into the overhead water column. Near-field and far-field dilution factors are also provided in Table 5.4-22 and Table 5.4-23, respectively.

ER Impact:

No changes to the ER are required.

Item Number 107 **ER Section 5.4.1.3**

Request:

Provide process used to determine occupational doses would be minimal.

Response:

Occupational doses were estimated using data from French and German reactors because of the similarity in design. Doses were adjusted for the difference in power levels. Additional detail regarding the calculation of occupational doses and the US EPR design features that have been incorporated to minimize occupational dose are given in Section 12.3.5 of the U.S. EPR FSAR. The estimated occupational dose for the US EPR of 50 person-rem is minimal compared to the average occupational dose reported in NUREG-0713 for US PWRs which totals approximately 200 person-rem.

ER Impact:

No changes to the ER are required.

Item Number 108 **ER Section 5.4.2**

Request:

The data on collective population doses, population distribution and meteorological dispersion (X/Q or D/Q) are currently insufficient to reconstruct calculations. Provide remaining data.

Response:

Population doses were calculated using a conservative projected site area population distribution for year 2080 (i.e., assumes a distribution over a 60 year plant design life which bounds the site area population distribution associated with the 40 year plant operating license application for CCNPP Unit 3) along with annual average atmospheric dispersion factors and food production rates for milk, meat and vegetables which are listed in Tables 11 through 18 in the response attachment to RAI Item Number104. ER Section 5.4 (Tables 5.4-1, 5.4-4, 5.4-24, and 5.4-27 through and 5.4-31) also provides a summary of the food production information while ER Section 2.7.6 provides the listings of 50 mile X/Q and D/Q values used in the collective dose calculations for CCNPP Unit 3.

ER Impact:

No changes to the ER are required.

Item Number 109 **ER Section 5.4.2**

Request:

Provide input decks for code of meteorological joint frequency data.

Response:

Since AREVA and the NRC use different computer codes to produce joint frequency distribution (JFD) tables of wind speed and direction as a function of atmospheric stability, the requested input decks would not be useful or useable for NRC calculational purposes.

The following input were used by AREVA to produce the JFD tables.

Parameter	Value(s)
Anemometer starting speed	0.5 miles per hour
Temperature sensor separation	50 meters
Wind instrument height	
Meteorological channel units of measure	Wind speed – mph; Wind direction – degrees from True North; Delta-Temperature – degrees Fahrenheit per sensor separation
Order of data channels	Wind speed, wind direction, wind range, delta temperature, precipitation

Meteorological joint frequency data is provided in electronic format accompanying this submittal as follows:

File Name	File Description
1970005.jfd	197' 2000-2005 JFD tables in RG 1.23 format
330005.jfd	33' 2000-2005 JFD tables in RG 1.23 format
cc1972000.jfd	197' 2000 JFD tables in RG 1.23 format
cc1972001.jfd	197' 2001 JFD tables in RG 1.23 format
cc1972002.jfd	197' 2002 JFD tables in RG 1.23 format
cc1972003.jfd	197' 2003 JFD tables in RG 1.23 format
cc1972004.jfd	197' 2004 JFD tables in RG 1.23 format
cc1972005.jfd	197' 2005 JFD tables in RG 1.23 format
cc322000.jfd	33' 2000 JFD tables in RG 1.23 format
cc332001.jfd	33' 2001 JFD tables in RG 1.23 format
cc332002.jfd	33' 2002 JFD tables in RG 1.23 format
cc332003.jfd	133' 2003 JFD tables in RG 1.23 format
cc332004.jfd	33' 2004 JFD tables in RG 1.23 format
cc332005.jfd	33' 2005 JFD tables in RG 1.23 format

ER Impact:

No changes to the ER are required.

Item Number 110 **ER Section 5.4.3**

Request:

State how collective population doses were determined. Provide references.

Response:

Population doses were calculated using the LADTAP II (for liquids) and GASPAR II (for gaseous effluents) computer codes and the inputs described in the response to RAI Item Number 108. The methodology used follows that given in Regulatory Guide 1.109, Rev. 1, as described in ER Section 5.4.3.

ER Impact:

No changes to the ER are required.

Item Number 111 **ER Section 5.4.3**

Request:

What are natural radiation sources at the location of the site? (This should be in the REMP.)

Response:

The background sources of radiation at the Calvert Cliffs site were characterized during the preoperational environmental radioactivity monitoring program for CCNPP Units 1 and 2 during 1970 through 1973. A summary of background radiation levels found in various sampling media is provided in the following table. The average ambient radiation field for the site was measured to be approximately 50 mR/year by on-site TLD in the pre-operational monitoring program. This is consistent with the NCRP 94 (NCRP, 1987) values of about 25 mrad/year absorbed dose in air at sea level from cosmic radiation, plus 26 mrad/year average absorbed dose in air from terrestrial sources in the area (Norfolk, VA portion of the Atlantic Coastal Plain).

NCRP, 1987: "Exposure of the Population in the United States and Canada from Natural Background Radiation", National Council on Radiation Protection and Measurement (NCRP) Report No. 94, December 30, 1987.

ER Impact:

No changes to the ER are required.

Background Radionuclides Measured Pre-Operationally at CCNPP
(1970 through 1973)

Sample Type	Nuclide or Analysis Type	Average Concentration	Concentration Range
TLDs	Exposure	4.06 mR/30d	2.76 – 5.67 mR/30d
Air Particulates	Gross Beta	0.028 pCi/m^3	<0.006 – 0.076 pCi/m^3
Bay Water	^{40}K	86 pCi/l	< 60 – 270 pCi/l
	^{3}H	< 200 pCi/l	< 80 – 1096 pCi/l
	^{90}Sr	< 1.0 pCi/l	< 1.0 – 2,8 pCi/l
Ground Water	^{3}H	< 200 pCI/l	< 80 – 180 pCi/l
	^{40}K	< 80 pCi/l	< 60 pCi/l
	^{137}Cs	18 pCi/l	9 – 29 pCi/l
Precipitation	^{3}H	< 200 pCi/l	< 200 – 405 pCi/l
	^{40}K	< 60 pCi/l	< 60 pCi/l
	^{137}Cs	72 pCi/l	38 – 106 pCi/l
Fish	^{40}K	3 pCi/g	1.1 – 6.3 pCi/g
	^{65}Zn	0.03 pCi/g	0.02 – 0.05 pCi/g
	^{90}Sr	0.05 pCi/g	< 0.01 – 0.19 pCi/g
	^{95}Zr- ^{95}Nb	0.05 pCi/g	0,03 -0.04 pCi/g
	^{137}Cs	0.07 pCi/g	0.02 – 0.10 pCi/g
	^{141}Ce	0.5 pCi/g	0.3 – 0.7 pCi/g
Crab	^{40}K	2.31 pCi/g	1.66 – 3.0 pCi/g
	^{137}Cs	0.05 pCi/g	0.02 – 0.08 pCi/g
Oyster	^{40}K	1.31 pCi/g	< 0.5 – 1.9 pCi/g
	^{137}Cs	0.04 pCi/g	0.03 – 0.08 pCi/g
Bottom Sediment	^{40}K	6.2 pCi/g	< 1.5 – 21.0 pCi/g
	^{89}Sr	< 0.8 pCi/g	< 0.8 pCi/g
	^{90}Sr	< 0.8 pCi/g	< 0.8 pCi/g
	^{95}Zr- ^{95}Nb	0.37 pCi/g	0.08 – 1. pCi/g
	^{108}Ru	0.9 pCi/g	0.9 pCi/g
	^{137}Cs	0.5 pCi/g	< 0.1 – 3.0 pCi/g
	^{144}Ce	0.7 pCi/g	< 0.3 – 1.3 pCi/g
Soil	^{40}K	4.5 pCi/g	1.5 – 11.8 pCi/g
	^{89}Sr	< 0.25 pCi/g	< 0.25 pCi/g
	^{90}Sr	< 0.05 pCi/g	< 0.05 – 0.08 pCi/g
	^{95}Zr- ^{95}Nb	0.25 pCi/g	0.1 – 0.6 pCi/g
	^{108}Ru	0.45 pCi/g	0.4 – 0.5 pCi/g
	^{137}Cs	0.5 pCi/g	< 0.1 – 2.2 pCi/g
	^{144}Ce	0.41 pCi/g	0.3 – 0.8 pCi/l
Vegetation	^{40}K	19.0 pCi/g	1.2 – 100 pCi/g
	^{65}Zn	0.42 pCi/g	0.06 – 1.0 pCi/g
	^{137}Cs	0.2 pCi/g	0.02 – 0.5 pCi/g
	^{90}Sr	0.8 pCi/g	0.7 – 1.0 pCi/g

Item Number 112 **ER Section 5.5.1**
Request:

Identify the Chesapeake Bay water-quality release criteria for domestic, industrial and agricultural uses.

Response:

Section 303(d) of the Federal Clean Water Act requires that states establish water quality standards for its waters. The purpose of these standards is to maintain and improve the quality of surface waters. For Maryland, these water quality standards can be found in the Code of Maryland Regulations (COMAR), Title 26, Department of Environment, Subtitle 8, Water Pollution, Section .02.

Wastewater discharge quality limitations and parameters from CCNPP Unit 3 will be established as part of the National Pollution Discharge Elimination System (NPDES) permit issued by the Maryland Department of the Environment.

Reference

COMAR, 2008. Code of Maryland Regulations (COMAR), Title 26, Department of Environment, Subtitle 8, Water Pollution, website: http://www.dsd.state.md.us/comar/subtitle_chapters/26_Chapters.htm#Subtitle08, accessed June 10, 2008.

ER Impact:

No changes to the ER are required.

Item Number 113 **ER Section 5.5.2**

Request:

Identify disposal plans for mixed waste (e.g., to a permitted mixed-waste disposal facility, shipment to treatment facility, or storage onsite).

Response:

As noted In ER Section 5.5.2, the anticipated small quantities of mixed waste at CCNPP Unit 3 will be temporarily stored onslte, similar to CCNPP Units 1 and 2, and then shipped for treatment and disposal to an offsite permitted facility.

ER Impact:

No changes to the ER are required.

Item Number 114 **ER Section 5.6.2**

Request:

Provide support that shows the potential impacts to freshwater habitats and species from increased temperatures from reduced shade cover and runoff of defoliants and herbicides related to transmission lines will be "minor.""

Response:

As noted in Section 5.6.2.3, maintenance practices, which potentially include tree trimming and application of biocides, are expected, based on practices implemented for the existing transmission lines, to be infrequent. Maintenance will be conducted in accordance with ANSI standards. The length of the corridor is small (1 mile), especially compared to the many miles of existing transmission lines. No water bodies are crossed by the corridor and all water bodies, with the exception of Johns Creek, are distal to the corridor. Reduction in canopy from occasional maintenance will be negligible. Measures and controls will be implemented to minimize erosion and sedimentation, sparingly use biocides, and maintain shade in Johns Creek.

ER Impact:

No changes to the ER are required.

Item Number 115 **ER Section 5.6.2**

Request:

Identify specific water bodies that may be affected by transmission lines.

Response:

As noted in Section 5.6.2.3: "The new transmission lines do not cross over any onsite water bodies. At one point, the transmission corridor right-of-way is near Johns Creek."

ER Impact:

No changes to the ER are required.

Item Number 116 **ER Section 5.7**

Request:

Are there any features of Unit 3 that could result in environmental impacts substantially different from those described by NRC for model LWRs?

Response:

There are no features of CCNPP Unit 3 that would result in environmental impacts substantially different from those described by NRC for current model LWRs.

ER Impact:

No changes to the ER are required.

Item Number 117 **ER Section 5.8**

Request:

Identify the socioeconomic impacts of transmission line operations.

Response:

A response to this RAI will be provided by August 15, 2008.

ER Impact:

No changes to the ER are required.

Item Number 118 **ER Section 5.8.1.4**

Request:

Provide additional information needed regarding mitigation programs (4th paragraph).

Response:

As noted in Section 4.4.1.3, the State of Maryland, Department of Labor, Licensing and Regulation, implements occupational health and safety regulations that set limits to protect workers from adverse conditions, including air emissions. If localized emissions result in limits being exceeded, corrective and protective measures will be implemented to reduce emissions (or otherwise protect workers in some cases) in accordance with the applicable regulations. Typically, to mitigate these releases, the plant health and safety program develops emission-specific strategies, procedures, or other measures to ensure compliance with the applicable regulatory limits.

ER Impact:

No changes to the ER are required.

Item Number 119 **ER Section 5.8.1.5**

Request:

In 5.3.3.1.x, there is no discussion of plume persistence; provide the basis for the statement that the directions change frequently (last paragraph).

Response:

The CWS cooling tower design now includes a hybrid section. The installation of a hybrid cooling tower will eliminate a visible water vapor plume. There will be no visual impact from the plume at nearby residences and recreational areas.

ER Impact:

Discussions of plume persistence will be updated to reflect hybrid cooling tower operation in a future ER revision.

Item Number 120 **ER Section 5.8.1.6**

Request:

Provide applicable Federal and/or State standards related to air quality.

Response:

ER Section 5.8.1.6 includes information on air emission standards that apply to sources associated with CCNPP Unit 3. In addition, the response to RAI Item Number 43 provides details of applicable air emission standards. The National Ambient Air Quality Standards are summarized in Table 1. These standards have been developed for criteria pollutants, i.e., particulate matter less than 10 microns in aerodynamic diameter (PM-10), particulate matter less than 2.5 microns in aerodynamic diameter (PM-2.5), sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead. The standards and averaging periods are shown for each pollutant. Maryland has adopted these standards in COMAR 26.11.04.02 but has retained the annual standard for PM-10 of 50 $\mu g/m^3$ that was revoked by EPA. In addition Maryland has a standard for fluorides in COMAR 26.11.04.01.

Table 1 National Ambient Air Quality Standards

Pollutant	Standard Value
Carbon Monoxide (CO)	
8-hour Average	9 ppm (10 $\mu g/m^3$)
1-hour Average	35 ppm (40 $\mu g/m^3$)
Lead (Pb)	
Quarterly Average	1.5 $\mu g/m^3$
Nitrogen Dioxide (NO_2)	
Annual Arithmetic Mean	0.053 ppm (100 $\mu g/m^3$)
Ozone (O_3)	
8-hour Average	0.08 ppm (157 $\mu g/m^3$)
Particulate Matter (PM-10)	
24-hour Average	150 $\mu g/m^3$
Particulate Matter (PM-2.5)	
Annual Arithmetic Mean	15 $\mu g/m^3$
24-hour Average	35 $\mu g/m^3$
Sulfur Dioxide (SO_2)	
Annual Arithmetic Mean	0.03 ppm (80 $\mu g/m^3$)
24-hour Average	0.14 ppm (365 $\mu g/m^3$)

ER Impact:

No changes to the ER are required.

Item Number 121 **ER Section 5.8.1.7**

Request:

With the exception of drift eliminators, proposed mitigation methods are not discussed – only statements that permit requirements and standards will be complied with, but not the options or specifically how they will be complied with.

Response:

The installation of a hybrid cooling tower for the CWS, in combination with high efficiency drift eliminators, will eliminate a visible water vapor plume from the CCNPP Unit 3 cooling tower. As hybrid cooling towers are typically used in plants where disturbing effects must be eliminated, they are equipped with sound prevention components such as low-noise fans and sound attenuators. The hybrid tower was selected after extensive analysis as documented in ER Section 9.4.1. The analysis considered such options as cooling ponds, natural draft cooling towers, once-through cooling systems and dry cooling systems.

The efficiency of the drift elimination system will be designed to limit the drift to 0.0005% of the recirculating water rate, thus significantly limiting particulate/salt emissions and salt deposition. This drift eliminator design is 10 times nore efficient than is reflected in the current ER. The performance of the cooling tower will be certified by the manufacturer. This level of cooling system performance represents the best available control technology (BACT) for cooling towers based on many BACT determinations for larger cooling towers.

The diesel generators will be housed in buildings that are located on the CCNPP Unit 3 site to minimize any visual or noise impacts. The buildings will be relatively low as will the 33-foot high, 2.8-foot diameter stacks that release exhaust from the engines. The engines will be equipped with particulate traps to minimize visible emissions and meet applicable opacity limits. The diesel generator engines will be subject to the federal New Source Performance Standards (NSPS) for Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60 Subpart IIII). The NSPS includes emission limits that apply to new diesel emergency generators at the time of purchase based on the engine model year.

The engines will consume low sulfur diesel fuel to meet the NSPS. The fuel quality will be 500 ppm (0.05 weight percent) or lower, which is significantly lower than the Maryland requirement of 0.3 weight percent. The engines will incorporate design features to limit nitrogen oxides and hydrocarbon emissions and traps to limit particulate emissions. These techniques for controlling emissions are considered state of the art and BACT for these engines. They will result in meeting the applicable emission limits of the NSPS, which is a technology-forcing regulatory program for new sources. The manufacturer will certify the emissions performance of the engines.

ER Impact:

Replacement of the current drift eliminator design (i.e., 0.005%) with higher efficiency drift eliminators (i.e., 0.0005%) will be reflected in a future revision to the ER.

Item Number 122 **ER Section 5.8.2**

Request:

Provide quantification of estimated impacts and/or similar construction activities to show levels/numbers of police calls, EMS calls, fire calls, etc. relative to baseline.

Response:

An analysis similar to that done for RAI Item Number 76 was performed to address this comment for operations. The analysis is based on the information in ER Section 5.8.2, Table 5.8.2-1. Information on the relative impact of other non-nuclear construction activities of similar size was not immediately available. The following analysis therefore puts the numbers in relative perspective.

The relative increase in population would be comparatively small during operations compared to construction. The increase in In-migrating workers and corresponding population size is about 1,064 in Calvert County and 360 in St. Mary's County (Table 5.8.2-1). For Calvert County the increased population corresponds to 1.2% of the 2005 population (88,750). Again assuming that EMS and fire calls are proportional to population size, the number of calls is estimated to increase about 200 annually, less than one per day. For St. Mary's County the percent increase represents about a 0.4% increase above the existing 96,550 people residing there. As a result, the impact should be small.

ER Impact:

This information will be incorporated into ER Section 5.8.2.7.1 in a future revision to the ER.

Item Number 123 **ER Section 5.8.2**

Request:

Provide a statement on plans to help transition public facilities from construction to operation and agencies responsible for this adjustment. The discussion of indirect jobs in the entire section is unclear. What is the number of indirect jobs? How many will be taken by local residents versus in-migrating family members? Check the chapter for consistency in discussion.

Response:

1) As stated in ER Section 5.8.2, the impacts on population, housing and services in the region of influence is small; therefore, any stresses on resources should be small and should not be a concern. There are no plans to provide public facilities with additional assistance to transition from construction to operations because, as cited above, the impacts of operation are small.

2) The sections have been thoroughly reviewed for consistency. The perceived lack of clarity may stem from the fact that in some cases the data are given by county, some times by ROI. Table 5.8.2-1 provides the clearest summary of indirect jobs. It is possible that some of the new indirect jobs would be taken by existing family members to the extent there are unmet needs. The analysis does not account for local residents competing for jobs, it just accounts for the potential new jobs created.

ER Impact:

No changes to the ER are required.

Item Number 124 **ER Section 5.8.2**

Request:

Need to more clearly state estimated income and tax revenue related to baseline.

Response:

In 2005, total revenues in Calvert County were about $174.1 million with 45.3% ($78.8 million) from property taxes, 31.2% ($54.4 million) from income taxes and 8.3% ($14.5 million) from other taxes. In 2005, St. Mary's received approximately $145 million in revenues. Of this, $54.1 million was raised from income taxes, or about 37%. As stated in ER Section 5.8.2.3, the increase in direct and indirect wages in Calvert County from CCNPP Unit 3 would be about $53.4 million. At an income tax rate of 2.8%, the tax increase from income would be about 1.5 million. St. Mary's County would realize a net tax increase from wages of about $500,000. These increments are relatively small compared to the total income and to income from wages alone.

ER Impact:

This response will be incorporated into ER Section 5.8.2 in a future revision to the ER.

Item Number 125 **ER Section 5.8.2.2**

Request:

Define “direct” and “indirect household” and explain the use of the concepts in the analysis. Describe how direct and indirect employees and residents relate to the concepts of direct and indirect households.

Response:

Direct household applies to those households related to the construction and/or operations workers attributed to CCNPP Unit 3. The assumption is that a CCNPP Unit 3 worker represents one new direct household. Indirect households are those that result from influx of new workers taking employment that results from the added direct workforce. Again the assumption is that for every new indirect worker there is a corresponding new household. These indirect households represent other than CCNPP Unit 3 workers.

Accounting for both types of workers and households results from a multiplicative spin-off from additional services required to support the influx of direct workers.

ER Impact:

No changes to the ER are required.

Item Number 126 **ER Table 5.8.2-1**

Request:

Table 5.8.2-1 indicates 2.6 additional family members per in-migrating worker, clarify analyses of socioeconomic impacts that do not use 2.6 additional family members. Define "indirect workforce" and "unmet indirect jobs." Does the analysis assume a second round of in-migration? If yes, explain basis for assuming the second round.

Response:

As stated in the Notes in Table 4.4.2-5, the 2.61 multiplier is based on the number of people per household in Maryland taken from the U.S Census data (USCB, 2008). It was assumed that an incoming worker was included within the 2.6 family members per household.

<u>Reference:</u>

USCB, 2008. US Census Bureau Factfinder. Maryland State Summary File 1 (SF 1) and Summary File 3 (SF 3)

ER Impact:

No changes to the ER are required.

Item Number 127 **ER Table 5.8.2-1**

Request:

What is the basis for assuming indirect jobs will be filled by the spouses of in-migrating workers?

Response:

As stated in Table 4.4.2-5, the U.S. Census Bureau data indicates that, within the state of Maryland, 59.5% of households had a working spouse.

ER Impact:

No changes to the ER are required.

Item Number 128 **ER Section 5.8.2.4.2**

Request:

Revenue generating property is typically valued by its revenue, not its depreciated construction cost. Confirm your assumptions are correct and provide references.

Response:

A response to this RAI will be provided by August 15, 2008.

ER Impact:

No changes to the ER are required.

Item Number 129 **ER Section 5.8.2.7.2**

Request:

The 408 new households discussed appears to be in conflict with 5.8.2.3. Resolve and explain.

Response:

The number of new households in Calvert County is estimated to be 408. The number cited in ER Section 5.8.2.2 was incorrectly shown as 410. The correct number is also shown in ER Section 5.8.2.3. These estimates are consistent with that reported in 5.8.2.7.2. This estimate results from adding the estimated direct workforce in Calvert County, with the unmet workforce needs (247+161) (Table 5.8.2.1)

ER Impact:

The text in ER Section 5.8.2.2 will be revised as follows in a future revision to the ER.

> Of the estimated 545 direct and indirect households migrating into the ROI as a result of operating CCNPP Unit 3, it is estimated that 408 households (75%) would reside in Calvert County and 137 (25%) would reside in St. Mary's County

Item Number 130 **ER Section 5.8.3**

Request:

Provide sections/statements on environmental and socioeconomic effects on minority and low income populations – impacts, pathways, comparison to the geographic area. If there are no expected impacts in this category, state this. Provide analytical maps of the roads in the ROI and an overlay map of roads and the minority / low-income census tracts.

Response:

A response to this RAI will be provided by August 15, 2008.

ER Impact:

No changes to the ER are required.

Item Number 131 **ER Sections 5.8.1.3, 5.8.1.4**

Request:

Relate noise and emissions to baseline to show impacts.

Response:

Noise

The estimated noise generated from the CCNPP Unit 3 cooling tower operation was modeled to assess the impact on the nearby community (Hessler, 2007). The predicted sound levels beyond the CCNPP site boundary, regardless of the season, are below both the daytime and nighttime maximum allowable levels of 65 dBA and 55 dBA, respectively, as well as the day-night environmental noise standard of 55 dBA (Ldn). Since the estimated noise levels generated from the CCNPP Unit 3 cooling tower operation are much less than the ambient measured noise levels previously shown in ER Table 2.7-116, noise from cooling tower operation will not add to the baseline noise levels.

Air Emissions

To evaluate the impacts on the surrounding community of the air emissions from CCNPP Unit 3, the EPA AERMOD atmospheric dispersion model was used. Inputs into the model were the emission rate information for the engines and cooling towers shown in Table 1, exhaust stack parameters, meteorological data representative of the site for a 5-year period, and site characteristics accounting for the building layout and spatial distribution of the sources. A grid receptor network was established for predicting downwind concentrations. The cooling towers were input into the model as operating 24 hours per day, 365 days per year. The EDG generators were assumed to operate a total of 600 hours and the SBO generators a total of 200 hours. The modeling analysis addressed potential impacts for PM10, SO2, NOx and CO. The resulting impacts in combination with representative measured background levels was determined to be in compliance with the national ambient air quality standards (NAAQS) as shown in Table 2.

References

Hessler, 2007. Estimated Cooling Tower Sound Emissions for the Calvert Cliffs Nuclear Power Plant (CCNPP) Expansion Project, Report Number 051007-1, Hessler Associates, Inc., May 2007.

Table 1. Non-Radioactive Gaseous Effluents

Source	Maximum Annual Releases in tons/yr (MT/yr)			
	SOx	Particulate	NOx	Hydrocarbon
Emergency Diesel Generator (EDG) (Single Unit)	0.33 (0.30)	0.23 (0.20)	2.7 (2.4)	0.65 (0.59)
Station Blackout Diesel Generator (SBO) (Single Unit)	0.004 (0.003)	0.25 (0.23)	6.1 (5.5)	0.61 (0.55)
Annual Generators Total (4xEDG + 2xSBO)	1.3 (1.2)	1.6 (1.5)	22.8 (20.7)	3.8 (3.4)
CWS Cooling Tower	-	306.3 (277.9)	-	-
ESWS Cooling Towers (4 Units)	-	15.5 (14)	-	-
TOTAL All Sources	1.3 (1.2)	311.0 (282.1)	22.8 (20.7)	3.8 (3.4)

NOTES :

- Generator emissions based on maximum hours of operation combined of 600 for EDG engines and 200 for SBO engines.
- CWS Cooling Tower emissions based on drift eliminator efficiency of 0.0005% of recirculating water, operating on an annual average of two cycles of concentration and worst-case influent Chesapeake Bay water salinity of 17.5 parts per thousand (ppt).
- ESWS Cooling Towers emissions based on two units operating, drift eliminator efficiency of 0.005% of recirculating water, operating on an annual average of ten cycles of concentration and worst-case total dissolved (TDS) in influent water from desalination plant of 0.37 ppt.

Table 2. Estimated Air Impacts from CCNPP Unit 3 Operations

Pollutant	Averaging Time	Background (μg/m³)	Modeled Impact[a] (μg/m³)	Total Impact (μg/m³)	NAAQS (μg/m³)
PM_{10}	24-hr	38	8	46	150
SO2	3-hr	69	16	85	1,300
	24-hr	31	4	35	365
	Annual	8	1	9	80
NOx	Annual	18	1	19	100
CO	1-hr	1802	666	2,468	40,075
	8-hr	1495	229	1,724	10,305

[a] The cumulative impacts of all modeled sources.

ER Impact:

No changes to the ER are required.

Item Number 132a **ER Section 6.1**

Request:

Provide a map of the bathymetry of water body before and after construction activities.

Response:

Current bathymetry characteristics are addressed in Section 2.3.1 of the ER and depicted on Figure 2.3.1-27 (i.e., before construction activities). An "after construction" bathymetry map is not needed because the construction of the intake and discharge structures will not significantly alter the bathymetry in those areas.

The discharge pipe will be buried up to the point where it surfaces and extends, complete with the discharge port diffusers, vertically above the bay floor. Scour action is predicted to be minimal because the port diffusers will be directed upwards toward the water surface rather than laterally or down into the bed.

As noted in Section 2.3.1.1.2.5, a forebay with earth retaining side walls will be constructed to draw water from the intake channel to the new intake structures. This will have a minor effect on the local bathymetry, as the expected length will be only approximately 123 ft (37 m) and the width 100 ft (30 m). Because of the minimal changes in the bathymetry of the affected bay areas during construction, it is not necessary to produce an "after construction" bathymetry map.

ER Impact:

No changes to the ER are required.

Item Number 132b **ER Section 6.1**

Request:

Only one thermal monitoring station is proposed, at the Unit 3 discharge structure outfall. Describe the monitoring equipment and whether it is similar to Units 1 and 2.

Response:

It is anticipated that thermal monitoring equipment for CCNPP Unit 3 will be similar to CCNPP Units 1 and 2 and comply with that specified in the NPDES permit for the new plant.

ER Impact:

For clarification purposes, a statement will be added to the third to last paragraph of Section 6.1.1 stating that thermal monitoring equipment for CCNPP Unit 3 is anticipated to be similar to CCNPP Units 1 and 2 in a future revision of the ER..

Item Number 133 **ER Section 6.2**

Request:

Sample program data are presented without justification of data selection, e.g., sample sites, frequency, sample sizes, measuring durations. Please provide references for same.

Response:

The Radiological Environmental Monitoring Program (REMP) for CCNPP Unit 3 was designed following the guidance criteria in NUREG-1301, Table 3.12-1, including, when consistent with the guidance criteria, the current REMP sampling conducted by CCNPP Units 1 and 2. The justification for the selection of sample media, locations and collection frequencies that make up the REMP is based on the need to provide representative measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposure of Members of the Public resulting from plant operations.

The REMP implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the Radiological Effluent Monitoring Program by verifying that measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of effluent measurements and modeling of the environmental exposure pathways. ER Table 6.2-1 identifies the liquid and gaseous effluent pathways of exposure to Members of the Public and lines them up with the selection of sample media that are included in the REMP to monitor those pathways.

The exposure pathways to be sampled along with the sampling frequency or collection duration and a description of the sampling location requirements are provided in Table 1 for CCNPP Unit 3. This table will be incorporated into the ER as new Table 6.2-4.

Tables 2 and 3 provide specific sampling locations for both the existing REMP (i.e., CCNPP Units 1 and 2) and for CCNPP Unit 3, respectively. These tables update and replace ER Tables 6.2-3 and 6.2-5. Table 4 provides the environmental monitoring sample sites associated with the Independent Spent Fuel Storage Installation. This table updates and replaces ER Table 6.2-7.

The revised ER also includes ground water monitoring locations that have been added in accordance with NEI 07-07 and are shown in revised ER Figures 6.2-1 and 6.2-5, and Table 6.2-5. The basis for on-site ground water monitoring locations is to provide early indication of liquid leaks from the highest potential plant structures which contain radioactive liquids. Figure 6.2-1 and 6.2-5 are updated and shown as Figures 1 and 2, and Table 6.2-5 is updated and shown as Table 3. Table 6.2-9 of the revised ER gives specifics on sample sizes for the different types of environmental media based on commercial counting laboratory requirements can be routinely achieved.

ER Impact:

Tables and figures provided with this response will be incorporated into the ER in a future revision as follows:

- Table 1 will be incorporated into the ER as new Table 6.2-4.
- Tables 2 and 3 will update and replace ER Tables 6.2-3 and 6.2-5, respectively.
- Table 4 will update and replace ER Table 6.2-7.
- Figures 1 and 2 will update and replace ER Figures 6.2-1 and 6.2-5, respectively.

Table 1: Radiological Environmental Monitoring Program for CCNPP Unit 3

Exposure Pathway And/Or Sample	Number of Representative Samples and Sample Locations[a]	Sampling and Collection Frequency	Type and Frequency of Analysis
1. Direct Radiation[b]	23 routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of stations, one in each meteorological sector in the general area of the Site Boundary. An outer ring of stations, one in each meteorological sector in the 4 to 5 mi (6 to 8 km) range from the site. The remaining stations to be placed in special interest areas such as population centers, nearby residences, schools, and in one area to serve as a control station.	Quarterly	Gamma Dose Quarterly
2. Airborne Radioiodine and Particulates	Samples from 5 locations[c]: 3 samples from close to the 3 Site Boundary locations, in different sectors, of high calculated annual average ground-level D/Q. 1 sample from the vicinity of a community having a high calculated annual average ground-level D/Q. 1 sample from a control location, as for example 9 to 19 mi (15 to 30 km) distance and in a non-prevalent wind direction.	Continuous sampler operation with sample collection weekly - or more frequently if required by dust loading.	<u>Radioiodine Canister</u>: I-131 analysis weekly <u>Particulate Sampler</u>: Gross beta radioactivity analysis following filter change[d] Gamma isotopic analysis[e] of composite (by location) quarterly.

Table 1: Radiological Environmental Monitoring Program for CCNPP Unit 3

(Cont'd)

Exposure Pathway And/Or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
3. Waterborne a. Surface	1 sample at intake area 1 sample at discharge area	Composite Sample[f] over 1-month period	Gamma Isotopic Analysis[e] monthly. Composite for tritium analysis quarterly
b. Sediment from shoreline	1 sample from downstream area with existing or potential recreational value	Semiannually	Gamma Isotopic Analysis[e] semiannually
c. Ground Water	1 sample from 8 on-site locations near plant facilities with liquid radioactive inventory that could influence ground water.	Quarterly	Gamma Isotopic and tritium analysis quarterly
4. Ingestion a. Milk [if available [i]]	Samples from milking animals in three locations within 3 mi (5 km) distance having the highest dose potential. If there are none, then one sample from milking animals in each of three areas between 3 to 8 mi (5 to 8 km) distances where doses are calculated to be greater than 1 mrem/yr.[j] One sample from milking animals at a control location 9 to 19 mi (15 to 30 km) distance and in a non-prevalent wind direction.	Semimonthly when animals are on pasture; monthly at other times	Gamma Isotopic Analysis [e] and I-131 analysis semimonthly when animals are on pasture; monthly at other times.
b. Fish and Invertebrates	3 samples of commercially and/or recreationally important species (2 fish species and 1 invertebrate species) in vicinity of plant discharge area. 3 samples of same species in areas not influenced by plant discharge.	Sample in season, or semiannually if they are not seasonal	Gamma Isotopic Analysis[e] on edible portions.

Table 1: Radiological Environmental Monitoring Program for CCNPP Unit 3

(Cont'd)

Exposure Pathway And/Or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
c. Food Products	Samples of 3 different kinds of broad leaf vegetation[g] grown near the Site Boundary at 2 different locations of high predicted annual average ground level D/Q[h][i]. 1 sample of each of the similar-broad leaf vegetation grown 9 to 19 mi (15-30 km) distant in a non-prevalent wind direction.	Monthly during growing season	Gamma Isotopic[e] and 1-131 analysis.

Table 1: Radiological Environmental Monitoring Program for CCNPP Unit 3

(Cont'd)

Notes to Table 1

(a) Deviations are permitted from the required sampling schedule if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability and malfunction of automatic sampling equipment. If specimens are unobtainable due to sampling equipment malfunction, effort shall be made to complete corrective action prior to the end of the next sampling period.

(b) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. Due to geographical limitations, 9 sectors are monitored around CCNPP site as referenced to Units 1 & 2. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.)

(c) Optimal air sampling locations are based not only on D/Q but on factors such as population in the area, year-round access to the site, and availability of power.

(d) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, Gamma Isotopic Analysis shall be performed on the individual samples.

(e) Gamma Isotopic Analysis is an analytical method of measurement used for the identification and quantification of gamma emitting radionuclides which may be attributable to the effluents from the facility.

(f) A composite sample is one in which the quantity (aliquot) of liquid is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program, COMPOSITE SAMPLE aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure a representative sample is obtained.

(g) If broad leaf vegetation is unavailable, other vegetation will be sampled. Attention shall be paid to including samples of tuberous and root food products.

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

(i) Broad leaf vegetation sampling is performed in lieu of milk sampling if the required minimum number of milk locations is not available in the site area. Milk samples need be collected and analyzed if the milk is commercially available in quantities greater than 130 liters (34.3.gal) per year.

(j) The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

Table 2: Existing Environmental Monitoring Sites for CCNPP

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

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

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

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