CCNPP3COLA NPEmails

From: Nash, Harriet
Sent: Tuesday, February 02, 2010 12:15 PM
To: Bruner, Douglas
Cc: Quinn, Laura; Moser, Michelle; CCNPP3COL Resource; Willingham, Michael
Subject: RE: Chapter 9 - Calvert Cliffs
Attachments: HLNChapter 9 Alternatives.doc

Doug,

I deleted that column. Attached is my edited ch9 since it looks like all the changes weren't made or understood. You might want to look at my other comments to see if they were incorporated correctly.

I'll have to get back to you on the land use comment. Looks like I'll have to write something or get PNNL to write something.

H

From: Bruner, Douglas
Sent: Tuesday, February 02, 2010 11:55 AM
To: Nash, Harriet
Cc: Quinn, Laura; Moser, Michelle
Subject: FW: Chapter 9 - Calvert Cliffs

Harriet,

As part of Andy's review of Chapter 9 for the Calvert EIS, he had a couple of comments in Section 9.3 regarding T & E and Land Use. The comments are provided below, and the page numbers are provided for reference on the attached document. If at all possible, it would be appreciated if you could respond COB today.

Thanks,

Doug

9.3.4.3 Terrestrial and Wetland Resources (page 9-90, line 30, Table 9-9)

Table 9-9. State-Listed Terrestrial Species that Occur in Frederick County and May Occur on the Eastalco Site (MDNR 2007b)

Scientific Name	Common Name	Federal Status	State Status
Bartramia longicauda	Upland Sandpiper		Endangered
Cicindela patruela	Green-patterned Tiger Beetle		Endangered
Dendroica fusca	Blackburnian Warbler		Threatened
Haliaeetus leucocephalus	Bald Eagle		Threatened

9.3.5.1 Land Use (page 9-123, line 28)

The nearest dedicated land (Federal, State, or Tribal)…

Hearing Identifier: CalvertCliffs_Unit3Cola_NonPublic_EX
Email Number: 3506

Mail Envelope Properties (7DCCA810A55FEC4B8822CD43063A4942147E80FADB)

Subject: RE: Chapter 9 - Calvert Cliffs
Sent Date: 2/2/2010 12:14:38 PM
Received Date: 2/2/2010 12:15:15 PM
From: Nash, Harriet

Created By: Harriet.Nash@nrc.gov

Recipients:
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Post Office: HQCLSTR02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	1962	2/2/2010 12:15:15 PM
HLNChapter 9 Alternatives.doc	23226362	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

9.0 Environmental Impacts of Alternatives

This chapter describes alternatives to the proposed NRC action for a combined license (COL) and the U.S. Army Corps of Engineers' (Corps or USACE) action for a Department of Army (DA) Individual Permit and discusses the environmental impacts of those alternatives. Section 9.1 discusses the no-action alternative. Section 9.2 addresses alternative energy sources. Section 9.3 reviews UniStar's region of interest (ROI), its site -selection process, issues that are common to all of the alternative sites, and summarizes and compares the environmental impacts for the proposed and alternative sites and for the no-action alternative. UniStar selected the State of Maryland as its ROI (UniStar 2009a). Section 9.4 examines plant design alternatives., and Section 9.5 describes onsite alternatives. Section 9.6 lists the references cited in this chapter.

The need to compare the proposed action with alternatives arises from the requirement in Section 102(2)(c)(iii) of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321) that environmental impact statements (EIS) include an analysis of alternatives to the proposed action. The U.S. Nuclear Regulatory Commission (NRC) implements this comparison through its Environmental Standard Review Plan (ESRP) (NRC 2000a). The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance— – SMALL, MODERATE, or LARGE— – developed using Council on Environmental Quality (CEQ) guidelines (40 CFR 1508.27) and set forth in the footnotes to Table B-1 of Title 10 of the Code of Federal Regulations (CFR) Part 51, Subpart A, Appendix B. The issues evaluated in this chapter are the same as those addressed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999a)[a] with the additional issue of environmental justice. The NRC issues a site-specific supplemental EIS, adding to determinations already made in the NUREG-1437, for each proposed action of license renewal for a nuclear plant. Although NUREG-1437 was developed for license renewal, it provides useful information for this review and is referenced throughout this chapter.

As part of the evaluation of permit applications subject to Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (must define the Corps, also abbreviated USACE) overall project purpose in addition to the basic project purpose. The overall project purpose establishes the scope of the alternatives analysis and is required by regulation to apply the criteria set forth inused for evaluating practicable alternatives under the Environmental Protection Agency's (EPA)EPA's) Clean Water Act 404(b)(1) gGuidelines (40 CFR Part 230). These guidelines establish criteria that must be met in order for the proposed activities to be permitted pursuant to

Field Code Changed

(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999 (NRC 1999a). Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

In accordance with the Guidelines and USACE Headquarters guidance (HQUSACE 1989), the overall project purpose must be specific enough to define the applicant's needs, but not so narrow and restrictive as to preclude a proper evaluation of alternatives. The Corps is responsible for controlling every aspect of the Guidelines analysis. In this regard, defining the overall project purpose is the sole responsibility of the Corps. While generally focusing on the applicant's statement, the Corps will, in all cases, exercise independent judgment in defining the purpose and need for the project from both the applicant's alternatives and the public's perspective [33 CFR Part 325 Appendix B (9)(c)(4); see also 53 FR 3136 (February 3, 1988)].

Section ~~404, which governs disposal sites for dredged or fill material. Specifically, these guidelines state, in part, that~~ 230.10(a) of the Guidelines requires that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge ~~that~~which would have less adverse impact on the aquatic ecosystem~~ provided~~ , so long as the alternative does not have other significant adverse environmental consequences~~. An~~." Section 230.10(a)(2) of the Guidelines states that "an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant which could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered~~ if it is otherwise a practicable alternative~~." Thus, this analysis is necessary to determine which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) that meets the project purpose and need. The UniStar onsite and offsite LEDPA Analysis is included in Appendix J.

Where the activity associated with a discharge is proposed for a special aquatic site (as defined in 40 CFR Part 230, Subpart E), and does not require access or proximity to or siting within these types of areas to fulfill its basic project purpose (i.e., the project is not "water dependent"), practicable alternatives that avoid special aquatic sites are presumed to be available, unless clearly demonstrated otherwise [40 CFR 230.10(a)(3)].

9.1 No-Action Alternative

For purposes of an ~~NRC~~application for a combined license (COL~~) application,~~), the no-action alternative refers to a scenario in which the NRC would deny ~~UniStar's application for a~~the COL~~. The~~ requested by UniStar. Likewise, the Corps could also take no action or deny the ~~Corps permit~~DA Individual Permit request. Upon such a denial by NRC, the construction and operation of a new nuclear ~~generating~~ unit at the Calvert Cliffs site in accordance with 10 CFR Part 52 would not occur. ~~There would be no environmental impacts at the Calvert Cliffs site associated with not issuing the COL, except the~~Preconstruction impacts associated with activities not within the definition of construction ~~at~~in 10 CFR 50.10(a) and 51.4~~. However, notwithstanding the interest of the Corps, preconstruction impacts are not reviewed as a direct effect of~~ may occur. The no-action alternative would result in the proposed ~~NRC action~~facility

not being built. The predicted environmental impacts from the project would not occur if the facility were not built. If no other power plant were built or electrical power supply strategy implemented to take its place, the electrical capacity to be provided by the project would not become available. At the same time, the benefits (electricity generation) associated with the proposed action would not occur.

~~If the COL application is denied by NRC or the project is denied by the Corps or not constructed, the power would still be needed as discussed in Chapter 8 of this EIS. UniStar would have a variety of options for meeting~~ If no additional measures (e.g., conservation, importing power, restarting retired power plants, and/or extending the life of existing power plants) were enacted to realize the amount of electrical capacity that would otherwise be required for power in the ROI, then the need for baseload power~~ needs including constructing a new nuclear power plant at another site or constructing a coal- or natural gas-fired plant at the Calvert Cliffs site or at another site. There would be environmental impacts associated with each of these options that would occur at the site of implementation. The impacts of the no-action alternative are compared to the proposed action and the alternative sites in Section 9.3.6.6 of the EIS~~, discussed in Chapter 8 of this EIS, would not be met. Therefore, the purpose and need of this proposed project would not be satisfied if the no-action alternative was chosen, and the need for power was not met by other means.

If other generating sources were built either at another site or using a different energy source, the environmental impacts associated with these other sources would eventually occur. As discussed in Chapter 8, there is a demonstrated need for power. It is reasonable to assume that the Maryland Public Service Commission (MPSC) would confirm that the need for power would be met. This needed power may be provided and supported through a number of alternatives that are discussed in Section 9.2.

9.2 Energy Alternatives

The purpose and need for the proposed project identified in Section 1.1.1 of ~~the~~this EIS is to generate baseload power for use by the applicant and for possible future sale on the wholesale market. This section examines the potential environmental impacts associated with alternatives to construction of a new baseload nuclear generating facility. Section 9.2.1 discusses energy alternatives not requiring new generating capacity. Section 9.2.2 discusses energy alternatives requiring new generating capacity. Other alternatives are discussed in Section 9.2.3. A combination of alternatives is discussed in ~~s~~Section 9.2.4. Section 9.2.5 compares the environmental impacts from new nuclear, coal-fired, and natural gas-fired generating units at the Calvert Cliffs site.

For analysis of energy alternatives, UniStar assumed a target installed capacity of 1600 MW(e) electrical output (UniStar 200~~8~~9a). The staff also used this level of output in analyzing energy alternatives.

9.2.1 Alternatives Not Requiring New Generating Capacity

Four alternatives to the proposed action that do not require UniStar to construct new generating capacity are to:

- purchase the needed electric power from other suppliers
- reactivate retired power plants
- extend the operating life of existing power plants
- implement conservation or demand-side management programs.

As discussed in Chapter 8~~ of this EIS~~, Maryland ~~(MD) is~~ already is a large importer of electricity and faces constraints to further electricity imports. The ~~Maryland Public Service Commission (~~MPSC~~)~~ concluded that a balanced approach is required to ~~ensure~~provide adequate electricity supplies for Maryland, including adding new generation, upgrading the transmission system, preserving existing generati~~o~~ng resources, and encouraging cost-effective conservation and demand response actions on the part of energy consumers (MPSC 2007).

If power to replace the capacity of the proposed new nuclear unit was to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one that could provide baseload power (e.g., coal, natural gas, or nuclear, as discussed later in this section), as previously described by the NRC in its *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG-1437, NRC 1996). NUREG-1437's description of the environmental impacts of other technologies is representative of the impacts associated with the construction and operation of new generating units at the Calvert Cliffs site. Under the purchased power alternative, the environmental impacts of power production would still occur but would be located elsewhere within the region, nation, or in another country. The environmental impacts of coal-fired and natural gas-fired plants are discussed in Section 9.2.2.

If the purchased power alternative were to be implemented, the most significant environmental unknown would be whether new transmission line corridors would be required. The construction of new transmission lines could have environmental consequences, particularly if new transmission line corridors were needed. The staff concludes that the local environmental impacts from purchased power would be SMALL when existing transmission line corridors are used and could range from SMALL to LARGE if acquisition of new corridors is required. The environmental impacts of power generation would depend on the generation technology and location of the generation site and, therefore, are unknown. However, as discussed in Section 9.2.5, the staff concluded that from an environmental perspective, none of the viable

energy alternatives would be clearly preferable to construction of a new baseload nuclear power generation plant located within UniStar's ROI.

Nuclear power facilities are initially licensed by the NRC for a period of 40 years. The operating license can be renewed for up to 20 years, and NRC regulations provide for the possibility of additional license renewal. The owner of proposed Unit 3 would be UniStar (200~~8~~9a). Constellation Energy Nuclear Group, LLC (Constellation) owns the two existing nuclear units at the Calvert Cliffs site, a nuclear generation unit at the R.E. Ginna site in New York State, and two nuclear generating units at the Nine Mile Point (NMP) site in New York State. Constellation has received renewed operating licenses for all of its nuclear units from NRC. The environmental impacts of continued operation of a nuclear power plant are significantly less than construction of a new plant. ~~However~~As a result, continued operation of ~~an~~the existing nuclear ~~plant does not provide additional generating capacity~~plants has already been accounted for in energy planning.

Retired generating plants, predominately coal-fired and natural gas-fired plants that potentially could be reactivated, would ordinarily require extensive refurbishment prior to reactivation. Such vintage plants would typically require costly refurbishment to meet current environmental requirements~~ would likely be very costly.~~. The environmental impacts of any reactivation scenario would be bounded by the impacts associated with coal-fired and natural gas-fired alternatives (see Section 9.2.2).~~ The~~ Given both these costs and the environmental impacts of operating such facilities, the staff concludes that reactivating retired generating plants would not be a reasonable alternative to the proposed action.

Older existing fossil-fueled plants, predominately coal-fired and natural gas-fired plants, are likely to need refurbishing to extend plant life for an extended period (the proposed action assumes a minimum operating period of 40 years), and meeting current environmental requirements would also be costly. UniStar identified four older power plants scheduled for retirement in New Jersey, but none in Maryland (UniStar ~~2008a). As of December 2008,~~2009a). The MPSC stated that no ~~power plant retirements have been announced for~~ generating facilities ~~within the~~in Maryland were scheduled for retirement as of early 2009 (MPSC 2009b). The Reliability*First* Corporation (RFC) expects retirement of approximately 1700 MW of existing generation capacity in its region through 2018 (RFC 200~~8~~9). RFC is one of the eight approved regional entities in North America under the North American Electric Reliability Corporation. Maryland is included in the RFC region. ~~The staff concludes that~~Given both the costs of refurbishment and the environmental impacts of ~~a refurbishment scenario would be bounded by the coal and natural gas-fired alternatives (see Section 9.2.2) and~~operating such facilities, the staff concludes that extending the life of existing generating plants would not be a reasonable alternative to the proposed action.

Improved energy efficiency can cost less than construction of new generation and provide a hedge against market, fuel, and environmental risks. Baltimore Gas and Electric Company

(BGE), the regulated electric distribution affiliate of Constellation Generation Group, has residential, commercial, and industrial programs designed to reduce both peak demands and daily energy consumption. Program components include the following elements (UniStar 2008a):

- Peak clipping program~~s~~ – Including energy saver switches for air conditioners, heat pumps, and water heaters, allowing interruption of electrical service to reduce load during periods of peak demand; dispersed generation, giving dispatch control over customer backup generation resources; and curtailable service, allowing customers~~'~~ load to be reduced during periods of peak demand.
- Load shifting programs – Using time-of-use rates and cool storage rebate programs to encourage shifting loads from peak to off-peak periods.
- Conservation programs – Promoting high-efficiency heating, ventilating, and air conditioning; encouraging construction of energy-efficient homes and commercial buildings; improving energy efficiency in existing homes; providing incentives for use of energy-efficient lighting, motors, and compressors.

UniStar estimates ~~that~~ the BGE program results in an annual peak demand generation reduction of about 700 MW(e~~),~~) and believes that generation savings can continue to be increased under the programs. ~~The~~Based on existing programs, the load growth projection anticipates a savings of approximately 1000 MW(e) in 2016 (UniStar 200~~8~~9a).

In 2007, the MPSC approved the following BGE “fast track” Energy Star conservation and energy efficiency programs: compact fluorescent light bulbs, window air conditioner replacement, and rebates for certain large appliances (MPSC 2008a).

In 2008, BGE started implementation of its voluntary demand response initiative for residential customers. Under the program, BGE will cycle off customers’ air conditioning units during specified periods. Overall, BGE estimates a benefit of 600 MW of demand reduction from implementing the demand response initiative (MPSC 2008a).

The Maryland General Assembly enacted the EmPower Maryland Energy Efficiency Act in April 2008. Under the Act, each Maryland utility is required to develop and implement cost-effective programs and services that encourage and promote the efficient use and conservation of energy by consumers and utilities alike. The Act also establishes long-term target reduction goals for electric consumption and demand based on a per capita basis and a 2007 energy consumption baseline (MPSC 2009b).

The MPSC issued an Order on December 31, 2008, approving for implementation a series of energy efficiency and demand response programs proposed by BGE (MPSC 2008c). The proposed programs include new proposals, as well as its already-approved demand response

programs. The programs are designed to achieve an estimated reduction in peak demand of approximately 1190 MW for 2011. The programs cover six residential, two small commercial, and three large commercial programs.

As discussed in Chapter 8~~ of this EIS~~, the MPSC took account of demand side management, demand response, and distributed generation in preparing its *Electric Supply Adequacy Report of 2007* (MPSC 2007). ~~The~~In the report, the MPSC determined ~~in the report that~~ there was a need for power in Maryland, even taking into account conservation and demand side management programs. The role of conservation was also addressed in ~~the decision by MPSC to grant~~MPSC's Order granting a Certificate of Public Convenience and Necessity to UniStar for proposed Unit 3 (MPSC 2009a).

~~The staff believes it would be unreasonable for an applicant to request a COL, assuming plant operation for a minimum of 40 years, if (1) the power could be purchased from other electricity suppliers at a reasonable cost, (2) the power could be obtained by reactivating one or more retired generating plants or by extending the life of one or more existing generating plants, or (3) conservation or demand-side management programs could make the additional power from the proposed new nuclear unit unnecessary.~~

Based on the preceding discussion, the staff concludes that the options of purchasing electric power from other suppliers, reactivating retired power plants, extending the operating life of existing power plants, and conservation and demand-side programs are not reasonable alternatives to providing new baseload power generation capacity.

9.2.2 Alternatives Requiring New Generating Capacity

Consistent with the NRC's evaluation of alternatives to operating license renewal for nuclear power plants, a reasonable set of energy alternatives to the construction and operation of one or more new nuclear units at the Calvert Cliffs site should be limited to analysis of discrete power generation sources, a combination of sources, and those power generation technologies that are technically reasonable and commercially viable (NRC 1996).~~ In addition, the staff has analyzed one combination of generation alternatives in Section 9.2.4 of the EIS.~~ The current mix of baseload power generation options in Maryland is one indicator of the feasible choices for power generation technology within the State. As of January 2009, the generation capacity profile in Maryland was approximately as follows: coal (39 percent), dual-fueled (petroleum and natural gas) (26 percent), nuclear (14 percent), natural gas and other gases (9 percent), petroleum (7 percent), hydroelectric (4 percent), and other renewable sources (1 percent) (MPSC 2009b). Coal and nuclear power plants typically operate in a baseload manner. Consequently, in 2007 coal-fired power plants were the source of 59.4 percent of the electricity generated in Maryland and nuclear plants 28.7 percent (MPSC 2009b).

This section discusses the environmental impacts of energy alternatives to the proposed action that would require UniStar to construct new generating capacity. The three primary energy sources for generating electric power in the United States are coal, natural gas, and nuclear energy (DOE/EIA 2007). Coal-fired plants are the primary source of baseload generation in the United States (DOE/EIA 2007). Natural gas combined-cycle generation plants are often used as intermediate generation sources (DOE/EIA 2007), but ~~can be and~~ are also used as baseload generation sources ~~(Progress Energy 2008).~~. The discussion in Section 9.2.2 is limited to the individual alternatives that appear to the staff to be viable baseload generation sources: coal-fired and natural gas combined cycle-fired generation. The impacts discussed in Section 9.2.2 are estimates based on present technology.

The staff assumed that (1) new generation capacity would be located at the Calvert Cliffs site for the coal- and natural gas-fired alternatives~~,~~; (2) a combination dry and wet (hybrid) cooling tower, as proposed by UniStar for Unit 3, would be used for plant cooling~~,~~; and (3) no new offsite transmission corridors would be needed, which is consistent with UniStar's COL application for Unit 3.

Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an annual energy outlook. In its ~~u~~*Updated Annual Energy Outlook 2009* (DOE/EIA 2009~~a~~), EIA's reference case projects that total electric generating capacity additions between 2007 and 2030 will use the following ~~fuels~~fuel types in the approximate percentages: natural gas plants (55 percent), renewables (27 percent), coal-fired plants (14 percent), and nuclear plants (5 percent) (DOE/EIA ~~Annual~~ Updated Annual Energy Outlook 2009~~)~~). The EIA ~~projections are~~projection includes baseload, intermittent, and peaking units and is based on the assumption that providers of new generating capacity would seek to minimize cost while meeting applicable environmental requirements.

9.2.2.1 Coal-Fired Generation

For the coal-fired generation alternative, the staff assumed construction of supercritical pulverized coal-fired units at the Calvert Cliffs site. Supercritical pulverized coal-fired plants are similar to conventional pulverized coal-fired plants except they operate at slightly higher temperatures and higher pressures, which allows for greater thermal efficiency. Supercritical coal-fired plants are commercially proven and represent an increasing proportion of new coal-fired power plants. ~~A coal-fired plant is assumed to have an operating life of 40 years.~~

The staff also considered an integrated gasification combined cycle (IGCC) coal-fired plant. IGCC is an emerging technology for generating electricity with coal that combines modern coal gasification technology with both gas turbine and steam turbine power generation. The technology is cleaner than conventional pulverized coal plants because major pollutants can be removed from the gas stream before combustion. The IGCC alternative also generates less solid waste than the pulverized coal-fired alternative. The largest solid waste stream produced

by IGCC installations is slag, a black, glassy, sand-like material that is potentially a marketable byproduct. The other large-volume byproduct produced by IGCC plants is sulfur, which is extracted during the gasification process and can be marketed rather than placed in a landfill. IGCC units do not produce ash or scrubber wastes. In spite of the preceding advantages, the staff concludes that, at present, a new IGCC plant is not a reasonable alternative to a 1600-MW(e) nuclear power generation facility for the following reasons: (1) IGCC plants are more expensive than comparable pulverized coal plants (NETL 2007), (2) existing IGCC plants have considerably smaller capacity that the proposed 1600-MW(e) nuclear plant, (3) system reliability of existing IGCC plants has been lower than pulverized coal plants, (4) the existing IGCC plants have had an extended (though ultimately successful) ~~shakedown~~operational testing period (NPCC 2005), and (5) a lack of overall plant performance warranties for IGCC plants has hindered commercial financing (NPCC 2005). For these reasons, IGCC plants are not considered further in this EIS.

A 1600-MW(e) coal-fired plant sited at Calvert Cliffs would consume approximately 4.5 million tons of coal per year (NETL 2007). It is assumed that coal and lime (calcium oxide or calcium hydroxide) or limestone (calcium carbonate) for a coal-fired plant would likely be delivered to the Calvert Cliffs site by barge. There is no direct rail access in Calvert and St. Mary~~'~~s Counties within an 8-mi vicinity of the Calvert Cliffs site (UniStar 2008c). UniStar ~~estimates~~assumed that the plant would burn bituminous coal ~~with a sulfur content of approximately 2 percent by weight~~ (UniStar 200~~8~~9a). Lime or limestone, used in the scrubbing process for control of sulfur dioxide (SO_2) emissions, is injected as a slurry into the hot effluent combustion gases to remove entrained SO_2. The lime-based scrubbing solution reacts with SO_2 to form calcium sulfite, which precipitates and is removed from the process as sludge. Approximately 450,000 tons/yr of limestone would be needed for flue gas desulfurization (NETL 2007).

Air Quality

The impacts on air quality from coal-fired generation would vary considerably from those of nuclear generation because of emissions of SO_2, nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), and hazardous air pollutants (such as mercury~~-~~). In its COL application, UniStar assumed a coal-fired plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. UniStar estimates that the coal-fired alternative emissions for SO_2 and nitrogen dioxide (NO_2) would be approximately as follows (UniStar 2009a):

- SO2 – 5177 tons/yr
- NO2 – 4278 tons/yr
- PM – 795 tons/yr
- CO2 – 12.4 million tons/yr.

The staff determined that the preceding emission estimates are reasonable. The plant would also emit some carbon monoxide, small amounts of mercury and other hazardous air pollutants, and some naturally occurring radioactive materials.

The acid rain requirements of the Clean Air Act capped the nation's SO_2 emissions from power plants. UniStar would need to obtain sufficient pollution credits either from a set-aside pool or purchases on the open market to cover annual emissions from the plant. ~~The market-based allowance system used for SO_2 emissions is not used for NO_x emissions.~~

A new coal-fired generation plant at the Calvert Cliffs site would likely need a prevention of significant deterioration (PSD) permit and an operating permit from the Maryland Department of the Environment (MDE). The plant would need to comply with the new source performance standards for such plants in 40 CFR Part 60, Subpart Da. The standards establish emission limits for PM and opacity (40 CFR 60.42Da), SO_2 (40 CFR 60.43Da), NO_x (40 CFR 60.44Da), and mercury (40 CFR 60.45Da).

The ~~U.S. Environmental Protection Agency (~~EPA~~)~~ has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as in attainment or unclassified for criteria pollutants under the Clean Air Act [40 CFR 51.307(a)]. Criteria pollutants under the Clean Air Act are lead, ozone, particulates, CO, NO_2, and SO_2. Ambient air-quality standards for criteria pollutants are in 40 CFR Part 50. As discussed in Section 2.9.2, with the exception of the 8-hour National Ambient Air Quality Standard for ozone, the Calvert Cliffs site is in an area designated as in attainment or unclassified for all criteria pollutants (40 CFR 81.344).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment occurs because of air pollution resulting from human activities. In addition, EPA regulations provide that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for those days on which visibility is most impaired over the period of the implementation plan and ~~ensure~~confirm no degradation in visibility for the least visibility-impaired days over the same period [40 CFR 51.308(d)(1)]. If a new coal-fired power generation station were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no mandatory Class I Federal areas within 50 mi of the Calvert Cliffs site.

The fugitive dust emissions from construction activities would be mitigated using best management practices (BMP)~~;~~. ~~s~~ Such emissions would be temporary.

The staff did not quantify emissions from coal-fired power plants~~,~~ in NUREG-1437, but suggested ~~that~~ air impacts would be substantial. Global warming from unregulated carbon

dioxide emissions and acid rain from sulfur oxides and nitrogen oxide emissions is also mentioned as a potential impact (NRC 1996). Adverse human health effects, such as cancer and emphysema, have been associated with the byproducts of coal combustion. Overall, the staff concludes that air quality impacts from new coal-fired generation at the Calvert Cliffs site would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Waste Management

~~NRC's experience of preparing~~As the NRC has described in NUREG-1437 (NRC 1996) and ~~conducting~~verified during its preparation of operating license renewal supplemental EIS analyses since ~~then indicates~~the publication of that document, coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and scrubber sludge. UniStar estimates that landfill disposal of the ash and scrubber sludge generated by a 1600-MW(e) coal-fired plant over a 40-year plant life would require approximately 600 ac (UniStar 200~~8~~9a). Approximately 89,000 tons/yr of scrubber sludge and 356,000 tons/yr of ash would be generated by the plant (NETL 2007).

In May 2000, EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (65 FR 32214). The EPA concluded that some form of national regulation is warranted to address coal combustion waste products because of health concerns. Accordingly, EPA announced its intention to issue regulations for disposal of coal-combustion waste under Subtitle D of the Resource Conservation and Recovery Act of 1976, as amended (RCRA). As of November 2009, EPA is continuing to study the appropriate form of regulation for coal combustion waste products.

Waste impacts on groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use (because of the acreage needed for waste) and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Construction-related debris would be generated during plant construction activities.

For the reasons stated above, the staff concludes that the impacts from waste generated at a coal-fired plant would be MODERATE. The impacts would be clearly noticeable but would not destabilize any important resource.

Human Health

Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of

coal-combustion waste, and public risk from inhalation of stack emissions. In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993).

Regulatory agencies, including the EPA and State agencies, base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. Given the regulatory oversight exercised by the EPA and State agencies, the staff concludes that the human health impacts from radiological doses and inhaled toxins and particulates generated from coal-fired generation would be SMALL.

Other Impacts

Approximately 300 ac would need to be converted to industrial use for the powerblock, infrastructure and support facilities, coal and limestone storage, and handling sludge (UniStar 200~~8~~9a). Land-use changes would also occur offsite in an undetermined coal-mining area to supply coal for the plant and for landfill disposal of ash and scrubber sludge. In NUREG-1437, the staff estimated that approximately 22,000 ac would be needed for coal mining and waste disposal to supply a 1000-MW(e) coal-fired power plant over its operating life (NRC 1996~~). Overall~~), which would have to be scaled up for a 1600-~~-~~MW(e) facility. Based on the amount of land ~~impacted~~affected for both the site and mining, the staff concludes that land-use impacts would be MODERATE.

~~The~~The amounts of water used, and the impacts on water use and quality from constructing and operating a coal-fired plant at the Calvert Cliffs site would be comparable to ~~the impacts~~those associated with a new nuclear plant. All discharges would be regulated by the MDE through a National Pollutant Discharge Elimination System (NPDES) permit. Indirectly, water quality could be affected by acids and mercury from air emissions. However, these emissions are regulated to minimize impacts. In NUREG-1437, the staff determined that some erosion and sedimentation would likely occur during construction of new facilities (NRC 1996). These impacts would be similar to those for a new nuclear plant. Overall, the staff concludes that the water-use and water-quality impacts would be SMALL.

The coal-fired generation alternative would introduce impacts from construction and new incremental impacts from operations. The impacts ~~could~~would be similar to those of the proposed action. The noticeable impacts would include ~~terrestrial~~loss of wetland area and ~~aquatic functional loss, habitat~~ function, elimination of onsite streams and ponds, forest fragmentation~~ and/or~~ , habitat loss~~, reduced productivity~~ for important species, and ~~a local reduction in biological diversity. The impacts could occur at the Calvert Cliffs site~~disruption and ~~at~~ conversion of benthic habitats in the ~~sites used for coal and limestone mining.~~Bay. Some of the impact at the Calvert Cliffs site would occur in areas that were previously disturbed during the construction of Units 1 and 2~~.~~, thereby limiting potential ecological effects. Disposal of waste products ash could affect aquatic and terrestrial resources. ~~Additional impacts~~ Impacts

on threatened and endangered species ~~could result from ash disposal and mining activities than~~ would likely be ~~expected~~ similar to the impacts from a new nuclear facility located at the Calvert Cliffs site. ~~Overall,~~ Although the expected impact footprint for a coal-fired plant would be somewhat smaller than that for a nuclear facility (assuming waste disposal at another location), the staff concludes that the ecological impacts would be MODERATE.

Socioeconomic impacts would result from the workers needed to construct and operate the plant, demands on housing and public services during construction, and the loss of jobs after construction. Overall, the staff concludes that these impacts would be similar to those for a new nuclear plant, SMALL to MODERATE. UniStar would pay significant property taxes for the plant to Calvert County. Considering the population and economic condition of the ~~c~~County, the staff concludes that the taxes would have a LARGE beneficial impact to ~~the tax recipients~~Calvert County.

The coal-fired powerblock units and cooling tower may be visible from Chesapeake Bay. The hybrid cooling tower would not produce any visible plume (UniStar 200~~8~~9a). The exhaust stacks would be as much as 600 ft high and would be visible from Chesapeake Bay. The stacks and associated emissions would likely be visible in daylight hours for distances greater than 10 mi. The powerblock units and associated stacks would also be visible at night because of outside lighting. The Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 200 ft above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2007). The visual impacts of a new coal-fired plant could be mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting, enhanced use of downfacing lighting (provided the lighting meets FAA requirements~~,~~), and appropriate use of shielding. Overall, the staff concludes that the aesthetic impacts associated with new coal-fired power generation at the Calvert Cliffs site would be MODERATE.

Coal-fired power generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise impacts associated with ~~truck~~barge delivery of coal and lime/limestone would be ~~most significant for residents living in the vicinity of the facility and along the delivery route.~~minimal. The staff concludes that the impacts of noise on residents in the vicinity of the facility would be ~~MODERATE.~~SMALL. Noise and light from the plant would be detectable offsite.

Historic and cultural resource impacts for a new coal-fired plant located at the Calvert Cliffs site would be similar to the impacts for a new nuclear plant, as discussed in Sections 4.6 and 5.6 of this EIS. A cultural resources inventory would likely be needed for any onsite property that has

not been previously surveyed. Other lands, if any, that are acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of the adverse effect from ground-disturbing actions. The studies would likely be needed for all areas of potential disturbance at the plant site, ; any offsite affected areas, such as mining and waste-disposal sites, ; and along associated corridors where new construction would occur, such as roads. Because adverse effects are likely to affect fourthree National Register of Historic Places (NRHP)-eligible resources, the staff concludes that the historic and cultural resource impacts [awaiting final determination of impact level].would be MODERATE to LARGE.

As discussed in Section 2.6 of this EIS, there are minority and low-income persons in the population near the Calvert Cliffs site. However, environmental impacts on minority and low-income populations associated with a new coal-fired plant located at the Calvert Cliffs site and at the sites used for coal and limestone mining would likely be similar to those for a new nuclear plant, which the review team has concluded are SMALL.

Other construction and operation impacts are likely to be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The staff's characterizations of the construction and operation impacts of coal-fired power generation at the Calvert Cliffs site are summarized in Table 9-1Table 9-1Table 9-1.

~~**Table -**. Summary of Environmental Impacts of Coal-Fired Power Generation~~

~~**Impact Category**~~	~~**Impact**~~	~~**Comment**~~
~~Land use~~	~~MODERATE~~	~~Uses approximately 900 ac for the powerblock, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. Mining activities would have additional impacts offsite.~~
~~Air quality~~	~~MODERATE~~	~~Estimated emissions:~~ ~~SO_2 – 5177 tons/yr~~ ~~NO_2 – 4278 tons/yr~~ ~~PM – 795 tons/yr~~ ~~CO_2 – 12.4 million tons/yr~~ ~~Some CO and small amounts of hazardous air pollutants~~
~~Water use and quality~~	~~SMALL~~	~~Impacts would be comparable to the impacts for a new nuclear power plant located at the Calvert Cliffs site.~~
~~Ecology~~	~~MODERATE~~	~~Impacts could include terrestrial and aquatic functional loss, habitat fragmentation and/or loss, reduced productivity, and a local reduction in biological diversity. Impacts could occur at the Calvert Cliffs site and in the vicinity and at the sites used for coal and limestone mining. Disposal of fly ash could affect the terrestrial and aquatic environment. Additional impacts on threatened and endangered species could result from ash disposal and mining activities than would be expected from a new nuclear facility at the Calvert Cliffs site.~~
~~Waste management~~	~~MODERATE~~	~~Approximately 89,000 tons/yr of scrubber sludge and 356,000 tons/yr of ash would be generated.~~
~~Socioeconomics~~	~~LARGE~~ ~~Beneficial to~~ ~~MODERATE~~ ~~Adverse~~	~~Construction-related impacts would be noticeable. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Impacts of coal transportation during operation would be noticeable. The plant would have aesthetic impacts. Some offsite noise impacts would occur.~~
~~Human health~~	~~SMALL~~	~~Regulatory controls and oversight are assumed to be protective of human health.~~
~~Historic and cultural resources~~	~~[MODERATE to LARGE - TBD]~~	~~Adverse effects are likely to four NRHP-eligible resources.~~
~~Environmental justice~~	~~SMALL~~	~~There are minority and low-income persons in the local population; however, impacts to such persons would likely be minimal.~~

9.2.2.2 Natural Gas-Fired Generation

For the natural gas alternative, the staff assumed construction and operation of a natural gas-fired plant located at the Calvert Cliffs site. The staff assumed that the plant would use combined-cycle combustion turbines.

Air Quality

Natural gas is a relatively clean-burning fuel. When compared to a coal-fired plant, a natural gas-fired plant would release similar types of emissions, but in lower quantities.

A new natural gas-fired power generation plant would likely need a PSD permit and an operating permit from the MDE. A new natural gas-fired combined-cycle plant would also be subject to the new source performance standards in 40 CFR Part 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_X.

Table 9-1. Summary of Environmental Impacts of Coal-Fired Power Generation

Impact Category	Impact	Comment
Land use	MODERATE	Uses approximately 900 ac for the powerblock, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. Mining activities would have additional impacts offsite.
Air quality	MODERATE	Estimated emissions: SO_2–5177 tons/yr NO_2–4278 tons/yr PM–795 tons/yr CO_2–12.4 million tons/yr Some CO and small amounts of hazardous air pollutants.
Water use and quality	SMALL	Impacts would be comparable to the impacts for a new nuclear power plant located at the Calvert Cliffs site.
Ecology	MODERATE	The impacts would be similar to those of the proposed action. The noticeable impacts would include loss of wetland area and function, elimination of onsite streams and ponds, forest fragmentation and habitat loss for important species, and disruption and conversion of benthic habitats in the Bay. Impacts on threatened and endangered species would be similar to the impacts from a new nuclear facility at the Calvert Cliffs site.
Waste management	MODERATE	Approximately 89,000 tons/yr of scrubber sludge and 356,000 tons/yr of ash would be generated.
Socioeconomics	LARGE Beneficial to MODERATE Adverse	Construction-related impacts would be noticeable. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Impacts of coal transportation during operation would be noticeable. The plant would have aesthetic impacts. Some offsite noise impacts would occur.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	MODERATE to LARGE	Adverse effects are likely to four NRHP-eligible resources.
Environmental justice	SMALL	There are minority and low-income persons in the local population; however, impacts to such persons would likely be minimal.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as in attainment or unclassified under the Clean Air Act. As discussed in Section 2.9.2, with the exception of the 8-hour National Ambient Air Quality Standard for ozone, the Calvert Cliffs site is in an area designated as in attainment or unclassified for criteria pollutants (40 CFR 81.32).

Section 169A of the Clean Air Act (42 USC 7491) establishes a national goal of preventing future impairment of visibility and remedying existing impairment in mandatory Class I Federal areas when impairment is from air pollution caused by human activities. In addition, EPA regulations provide that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and ~~ensure~~verify no degradation in visibility for the least-impaired days over the same period [40 CFR 51.308(d)(1)]. If a new natural gas-fired power plant were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. There are no mandatory Class I Federal areas within 50 mi of the Calvert Cliffs site.

UniStar estimates that a natural gas-fired plant equipped with pollution control technology to meet emission limits would have approximately the following emissions (UniStar 2009a):

- SO_2 – 92 tons/yr
- NO_2 – 424 tons/yr
- CO_2 – 5.6 million tons/yr.

The staff determined that the preceding estimates are reasonable. The plant would also emit some carbon monoxide and small amounts of hazardous air pollutants and particulate matter.

~~A natural gas-fired power plant would also have unregulated carbon dioxide emissions of approximately 5.6 million tons/yr that could contribute to global warming (UniStar 2009a).~~

The combustion turbine portion of the combined-cycle plant would be subject to EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR Part 63, Subpart YYYY) if the site is a major source of hazardous air pollutants. Major sources have the potential to emit 10 tons/yr or more of any single hazardous air pollutant or 25 tons/yr or more of any combination of hazardous air pollutants ~~(~~[40 CFR 63.6085(b~~)).~~)].

The fugitive dust emissions from construction activities would be mitigated using BMPs; such emissions would be temporary.

The impacts of emissions from a natural gas-fired power generation plant would be clearly noticeable, but would not be sufficient to destabilize air resources. Overall, the staff concludes that air quality impacts resulting from construction and operation of new natural gas-fired power generation at the Calvert Cliffs site would be SMALL to MODERATE.

Waste Management

In NUREG-1437, the staff concluded that waste generation from natural gas-fired technology would be minimal (NRC 1996). The only significant waste generated at a natural gas-fired power plant would be spent SCR catalyst, which is used to control NO_x emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent SCR catalyst, waste generation at an operating natural gas-fired plant would be largely limited to typical operations and maintenance waste. Construction-related debris would be generated during construction activities. Overall, the staff concludes that waste impacts from natural gas-fired power generation would be SMALL.

Human Health

Natural gas-fired power generation introduces public risk from inhalation of gaseous emissions. The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risk. ~~Air emissions from a natural gas-fired power generation plant located at~~Regulatory agencies, including the ~~Calvert Cliffs~~EPA and State agencies, base air emission standards and requirements on human health impacts. These agencies also impose site~~ would be regulated by the MDE. As a result of~~ specific emission limits as needed to protect human health. Given the regulatory ~~controls~~oversight exercised by the EPA and State agencies, the staff concludes that the ~~impacts on~~ human health impacts from natural gas-fired power generation would be SMALL.

Other Impacts

A natural gas-fired generating plant would require approximately ~~64~~60 ac for the power-block and support facilities (UniStar 200~~8~~9a). Construction of a natural gas pipeline from the Calvert Cliffs site to the closest natural gas distribution line would require approximately 10 ac (UniStar 200~~8~~9a). The Cove Point Liquid Natural Gas pipeline runs parallel to Maryland~~ (MD)~~ State Route 2/4 and would be the closest natural gas pipeline to the Calvert Cliffs site. Thus, the total land commitment would be approximately ~~74~~70 ac. Overall, the staff concludes that the land-use impacts from new natural gas-fired power generation at the Calvert Cliffs site would be SMALL.

~~The~~The amount of water used and the impacts on water use and quality from constructing and operating a natural gas-fired plant at the Calvert Cliffs site would be ~~comparable to~~somewhat less than the impacts associated with constructing and operating a new nuclear facility. The impacts on water quality from sedimentation during construction of a natural gas-fired plant

were characterized in NUREG-1437 as SMALL (NRC 1996). NRC also noted in this document that the impacts on water quality from operations would be similar to, or less than, the impacts from other generating technologies (NRC 1996). Overall, the staff concludes that impacts on water use and quality would be SMALL.

A natural gas-fired plant at the Calvert Cliffs site would have less extensive ecological impacts ~~that would be comparable to~~than a new nuclear facility. ~~Some~~Most of the ~~impact would occur in~~impacts could be limited to areas that were previously disturbed during the construction of Units 1 and 2. ~~Constructing~~Although constructing a new underground gas pipeline to the site would result in ~~permanent loss of some terrestrial and aquatic function and~~ conversion and fragmentation of about 10 ac of terrestrial habitat~~.~~, no important ecological attributes would be noticeably altered. Impacts on threatened and endangered species would likely be similar to the impacts from a new nuclear facility located at the Calvert Cliffs site. Overall, the staff concludes that ecological impacts would be SMALL ~~to MODERATE~~.

Socioeconomic impacts would result from the workers needed to construct and operate the plant, demands on housing and public services during construction, and the loss of jobs after construction. Overall, the staff concludes that these impacts would be SMALL because of the mitigating influence of the site's proximity to the surrounding population area and the relatively small number of workers needed to construct and operate the plant in comparison to nuclear and coal-fired generation alternatives. UniStar would pay property taxes for the plant to Calvert County. Considering the population and economic condition of the ~~c~~County, the staff concludes that the taxes would have a MODERATE beneficial impact on ~~the county~~Calvert County.

The turbine buildings, four exhaust stacks (approximately 200 ft tall) and associated emissions, cooling towers, condensation plumes from the cooling towers, and the gas pipeline compressors would be visible during daylight hours from offsite. Noise and light from the plant would be detectable offsite. An ameliorating factor is that the Calvert Cliffs site is currently an industrial site located in a rural, forested area. Overall, the staff concludes that the aesthetic impacts associated with new natural gas-fired power generation at the Calvert Cliffs site would be ~~SMALL.~~similar to those for a nuclear plant and, therefore, SMALL.

Historic and cultural resource impacts for a new natural gas-fired plant located at the Calvert Cliffs site would be similar to the impacts for a new nuclear plant as discussed in Sections 4.6 and 5.6 of this EIS. A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, ~~that would be~~ acquired to support the plant would also likely need an inventory of field cultural resources, identification, and recording of existing historic and archaeological resources, and possible mitigation of the adverse effect from ground-disturbing actions. The studies would likely be needed for all areas of potential disturbance at the plant site~~,~~; any offsite affected areas, such as mining and waste disposal sites~~,~~; and along associated corridors where new construction would occur, such as roads. Because adverse effects are likely to four NRHP-eligible resources, the staff concludes

that the historic and cultural resource impacts [~~awaiting impact determination~~]~~.~~would be MODERATE to LARGE.

As described in Section 2.6~~ of the EIS~~, there are minority and low-income persons in the population around the Calvert Cliffs site. The impacts of a natural gas-fired plant at the Calvert Cliffs site on minority or low-income populations would ~~likely be~~be similar to the impacts for a nuclear plant and, therefore, SMALL.

Other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Because of the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The construction and operational impacts of natural gas-fired power generation at the Calvert Cliffs site are summarized in Table 9-2.

~~9.2.3 Other Alternatives~~

~~This section discusses other energy alternatives, the staff's conclusions about the feasibility of each alternative, and the staff's bases for those conclusions. A new nuclear unit at the Calvert Cliffs site would be a baseload generation plant. Any feasible alternative to the new unit would need to generate baseload power. In performing its initial evaluation in the ER, UniStar used the findings documented in NUREG-1437 (NRC 1996; UniStar 2008a). The staff also reviewed the information submitted by UniStar, conducted an independent review, and determined that the other energy alternatives are not reasonable alternatives to a new nuclear unit that would provide baseload power.~~

~~The staff has not assigned significance levels to the environmental impacts associated with the alternatives discussed in this section because, in general, the generation alternatives would have to be installed at a location other than the Calvert Cliffs site. Any attempt to assign significance levels would require the staff's speculation about the unknown site.~~

Table 9-2. Summary of Environmental Impacts of Natural Gas-Fired Power Generation

Impact Category	Impact	Comment
Land use	SMALL	Approximately ~~74~~70 ac would be needed for the power-block and support systems and connection to a natural gas pipeline.

Air quality	SMALL to MODERATE	Estimated emissions: SO_2 – 92 tons/yr NO_2 – 424 tons/yr CO_2 – 5.6 million tons/yr Some CO and small amounts of PM and hazardous air pollutants.
Water use and quality	SMALL	Impacts would be ~~comparable to~~somewhat less than the impacts for a new nuclear power plant located at the Calvert Cliffs site.
Ecology	~~MODERATE~~ SMALL	~~A~~Most of the impacts would be limited to in areas that were previously disturbed during the construction of Units 1 and 2. Although constructing a new underground gas pipeline to the site would result in ~~some~~ permanent loss of some terrestrial and aquatic function and conversion and fragmentation of ~~habitat. Impacts on~~about 10 ac of terrestrial ~~ecology from cooling tower drift could occur~~habitat, no important ecological attributes would be noticeably altered. Impacts on threatened and endangered species would be ~~similar to the impacts~~ less than or possibly similar to those from a new nuclear facility at the Calvert Cliffs site. ~~Impacts from pipeline construction would primarily be temporary.~~
Waste management	SMALL	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions.
Socioeconomics	MODERATE Beneficial to ~~MODERATE~~ SMALL Adverse	Construction and operations workforces would be relatively small. Additions to the property tax base, while smaller than for a nuclear or coal-fired plant, would still be noticeable. ~~Construction-related impacts would be noticeable.~~ Impacts during operation would be minor because of the small work-force involved. The plant would have aesthetic impacts.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	[MODERATE to LARGE–~~TBD~~]	Adverse effects are likely to four NRHP-eligible resources.
Environmental justice	SMALL	There are minority and low-income persons in the local population; however, impacts to such persons would likely be minimal.

9.2.3 Other Alternatives

This section discusses other energy alternatives, the staff's conclusions about the feasibility of each alternative, and the staff's bases for those conclusions. A new nuclear unit at the Calvert

Cliffs site would be a baseload generation plant. Any feasible alternative to the new unit would need to generate baseload power. In performing its initial evaluation in the ER, UniStar used the findings documented in NUREG-1437 (NRC 1996; UniStar 2009a). The staff also reviewed the information submitted by UniStar, conducted an independent review, and determined the other energy alternatives are not reasonable alternatives to a new nuclear unit that would provide baseload power.

The staff has not assigned significance levels to the environmental impacts associated with the alternatives discussed in this section because, in general, the generation alternatives would have to be installed at a location other than the Calvert Cliffs site. Any attempt to assign significance levels would require the staff's speculation about the unknown site.

9.2.3.1 Oil-Fired Generation

In its Updated *Annual Energy Outlook 2009,* EIA's reference case projects that oil-fired power plants will not account for any new electric power generation capacity in the United States through the year 2030 (DOE/EIA 2009~~a~~). Oil-fired generation is more expensive than nuclear, natural gas-fired, or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive. The high cost of oil has resulted in a decline in its use for electricity generation. In section 8.3.11 of NUREG-1437, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 120 ac of land (NRC 1996). Operation of an oil-fired ~~powerplant~~power plant would have environmental impacts that would be similar to those of a comparably sized coal-fired plant (NRC 1996).

For the preceding economic and environmental reasons, the staff concludes that an oil-fired power plant ~~at or in the vicinity of the Calvert Cliffs site or elsewhere in UniStar's ROI~~ would not be a reasonable alternative to construction of a 1600-MW(e) nuclear power generation facility that would be operated as a baseload plant within UniStar's ROI.

9.2.3.2 Wind Power

The Maryland Department of Natural Resources (MDNR) Power Plant Research Program has estimated Maryland's wind energy potential as between 627 and 1078 MW (PPRP 2008). The MPSC considered the potential for wind power in Maryland in a 2008 report (MPSC 2008b) and concluded the economic benefits from renewables remain uncertain and challenging. Onshore wind yields net economic benefits, albeit on a small scale. Offshore wind, as modeled in the report, does not yield economic benefits.

Newer wind turbines typically operate at approximately a 36 percent capacity factor (DOE 2008a). In comparison, the average capacity factor for a nuclear generation plant in 200~~7~~8 in the United States was ~~nearly 92~~approximately 91.5 percent (NEI 200~~8~~9). Wind turbines generally can serve as an intermittent baseload power supply (NPCC 2005). Wind power, in

conjunction with energy storage mechanisms such as pumped hydroelectric or compressed air storage, or another readily dispatchable power source like, such as hydropower, might serve as a means of providing baseload power. However the staff concludes that there is a limited near-term likelihood of siting an energy-storage facility for a 1600-MW(e) intermittent power plant in Maryland.

EIA is not projecting any growth in pumped storage capacity through 2030 (DOE/EIA 2009c|Updated Annual Energy Outlook 2009|).2009). In addition, the staff concludes in Section 9.2.3.4 that the potential for new hydroelectric development in Maryland is limited. Therefore, the staff concludes that the use of pumped storage in combination with wind turbines to generate 1600 MW(e) is unlikely in Maryland.

A CAES plant consists of motor-driven air compressors that use low-cost, off-peak electricity to compress air into an underground storage medium. During high electricity demand periods, the stored energy is recovered by releasing the compressed air through a combustion turbine to generate electricity (NPCC 2009). Only two CAES plants are currently in operation. A 290 MW plant near Bremen, Germany began operating in 1978. A 110-MW plant located in McIntosh, Alabama has been operating since 1991 (ESP 2008). Both facilities use mined salt caverns (Succar and Williams 2008). A CAES plant requires suitable geology such as an underground cavern for energy storage. A 268-MW CAES plant coupled to a wind farm, the Iowa Stored Energy Park, has been proposed for construction near Des Moines, Iowa. The facility would use a porous rock storage reservoir for the compressed air (Succar and Williams 2008). To date, nothing approaching the scale of a 1600 MW(e) facility has been contemplated. Therefore, the staff concludes that the use of CAES in combination with wind turbines to generate 1600 MW(e) in Maryland is unlikely.

Southern Company and the Georgia Institute of Technology (GIT) studied the viability of offshore wind turbines in the southeast (Southern and GIT 2007). Among the conclusions of the study authors were the following: (1) the available wind data indicates that a wind farm located offshore of Georgia would likely have an adequate wind speed to support a project, although offshore project costs run approximately 50 to 100 percent higher than land-based systems; (2) based on today's prices for wind turbines, the 20-year levelized cost of electricity produced from an offshore wind farm would be above the current production costs from existing power generation facilities; (3) the current commercially available offshore wind turbines are not built to withstand major hurricanes above a Category 3 or a 1-minute sustained wind speed of 124 mph; and (4) the U.S. Department of Interior Minerals Management Service (MMS) has jurisdiction, as authorized in the Energy Policy Act of 2005, over alternative energy-related projects on the outer continental shelf, including wind power developments. MMS issued final regulations in April 2009 (74 FR 19638) to establish a program to grant leases, easements, and rights-of-way for renewable energy project activities on the outer continental shelf. The staff

believes that the preceding conclusions would generally apply to a wind farm located offshore of Maryland based on similarities in the physical and regulatory environments.

~~The MPSC considered the potential for wind power in Maryland in a 2008 report (MPSC 2008b). The MPSC concluded that the economic benefits from renewables remain uncertain and challenging. Onshore wind yields net economic benefits, albeit on a small scale. Offshore wind, as modeled in the report, does not yield economic benefits.~~

For the preceding reasons, the staff concludes that a wind energy facility ~~at or in the vicinity of the Calvert Cliffs site or elsewhere in UniStar's ROI~~ would not currently be a reasonable alternative to construction of a 1600-MW(e) nuclear power generation facility that would be operated as a baseload plant within UniStar's ROI.

9.2.3.3 Solar Power

Solar technologies use energy and light from the sun to provide heating and cooling, light, hot water, and electricity for consumers. Solar energy can be converted to electricity using solar thermal technologies or photovoltaics. Solar thermal technologies employ concentrating devices to create temperatures suitable for power production. Concentrating thermal technologies are currently less costly than photovoltaics for bulk power production. They can also be provided with energy storage or auxiliary boilers to allow operation during periods when the sun is not shining (NPCC 2006).

The largest operational solar thermal plant is the 310-MW Solar Energy Generating System located in the Mojave Desert in ~~s~~Southern California (NextEra Energy 2009).

Solar radiation has a low energy density relative to other common energy sources. Consequently, a large total acreage is needed to gather an appreciable amount of energy. Typical solar-to-electric power plants require 5 to 10 ac for every MW of generating capacity (TSECO 2008). Thus, approximately 8000–16,000 ac would be needed for a hypothetical 1600-MW(e) solar power plant. For a large solar plant to be practical, a means to store large quantities of energy (those discussed in Section 9.2.3.2) for distribution when the plant is producing less that 1600 MW(e) would be needed. However, the use of these storage ~~possibilities are limited~~mechanisms on this scale in Maryland is unlikely, as discussed in Section 9.2.3.2.

~~For~~Looking at the specific technologies, for flat-plate photovoltaic collectors, DOE states that Maryland has a good, useful solar resource throughout most of the State. For concentrating collectors, Maryland has a marginal solar resource. Although certain technologies may work in specific applications, most concentrating collectors are not effective with ~~this~~Maryland's solar resource (DOE 2008b).

The MPSC considered the potential for solar power in Maryland in a 2008 report (MPSC 2008b~~). The MPSC~~) and concluded ~~that~~ the economic benefits from renewables remain uncertain and challenging. For solar energy, the MPSC concluded that the overall economics of solar remain negative, but could improve if technology progresses much faster than contemplated in the report and various financial incentives continue over the long term.

For the preceding reasons, the staff concludes that solar energy facilities ~~at or in the vicinity of the Calvert Cliffs site or elsewhere in UniStar's ROI~~ would not currently be a reasonable alternative to construction of a 1600-MW(e) nuclear power generation facility that would be operated as a baseload plant within UniStar's ROI.

9.2.3.4 Hydropower

Maryland has a relatively low hydropower resource as a percentage of the State~~'~~'s electricity generation (DOE 2008b). The Conowingo ~~hydroelectric plant~~Hydroelectric Plant on the Susquehanna River, one of Maryland~~'~~'s largest generation facilities, provides almost all of the State's hydroelectricity (DOE/EIA 2008~~b~~). A 1997 study by the Idaho National Engineering and Environmental Laboratory (INEEL) identified an approximate additional 29 MW of undeveloped hydro resource in Maryland (Conner and Francfort 1997).

EIA's reference case in its Updated *Annual Energy Outlook 2009* projects that U.S. electricity production from hydropower plants will remain essentially stable through the year 2030 (DOE/EIA 2009a).

In NUREG-1437, the staff estimated that land requirements for hydroelectric power are approximately 1 million ac per 1000 MW(e) (NRC 1996).

Because of the relatively low amount of undeveloped hydropower resource in Maryland and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 1600 MW(e), the staff concludes that hydropower ~~in UniStar's ROI~~ is not a feasible alternative to construction of a new 1600 MW(e) nuclear power generation facility operated as a baseload plant within UniStar's ROI.

9.2.3.5 Geothermal Energy

Hydrothermal resources – reservoirs of steam or hot water – are available primarily in the western states, Alaska, and Hawaii. However, Earth's energy can be tapped almost anywhere with geothermal heat pumps and direct-use applications. Sources of other geothermal resources (e.g., hot dry rock, magma) require further technology development (DOE 2006).

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal technology is not widely used as baseload power

generation because of the limited geographical availability of the resource and immature status of the technology (NRC 1996). Geothermal systems have a relatively small footprint and minimal emissions (MIT 2006). A recent study led by the Massachusetts Institute of Technology concluded that a $300~~-$~~–$400 million investment over 15 years would be needed to make early-generation enhanced geothermal system power plant installations competitive in the evolving U.S. electricity supply markets (MIT 2006).

Maryland has vast low-temperature resources suitable for geothermal heat pumps. However, Maryland does not have sufficient resources to use other geothermal technologies (DOE 2008b).

For the preceding reasons, the staff concludes that one or more geothermal energy facilities ~~in UniStar's ROI~~ would not currently be a reasonable alternative to construction of a 1600-MW(e) nuclear power generation facility operated as a baseload plant within UniStar's ROI.

9.2.3.6 Wood Waste

In NUREG-1437, the staff determined that a wood-burning facility can provide baseload power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). The fuels required are variable and site-specific. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in NUREG-1437 suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload power plant, the ecological impacts of large-scale timber cutting (for example, soil erosion and loss of wildlife habitat), and high inefficiency, the staff concludes that wood waste-based generation would not be a reasonable alternative ~~in UniStar's ROI~~ to a 1600-MW(e) nuclear power generation facility operated as a baseload plant within UniStar's ROI.

9.2.3.7 Municipal Solid Waste

Municipal solid-waste combustors incinerate the waste and use the resultant heat to produce steam, hot water, or electricity. The combustion process reduces the volume of waste and the need for new solid waste landfills (EPA 200~~8~~9a). Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001). Mass burning technologies are most commonly used in the United States. This group of technologies

processes raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion. In NUREG-1437, the staff determined that the initial capital cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Municipal solid-waste combustors generate an ash residue that is buried in landfills. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue gases using fabric filters and/or scrubbers (DOE/EIA 2001).

Currently, approximately ~~89~~87 waste-to-energy plants are operating in the United States (EPA 200~~8~~9a). These plants collectively generate approximately 2500 MW(e), or an average of approximately ~~28~~29 MW(e) per plant (EPA 200~~8~~9a). Given the small size of existing plants, the staff concludes that generating electricity from municipal solid waste would not be a reasonable alternative to a 1600-MW(e) nuclear power generation facility operated as a baseload plant within UniStar's ROI.

9.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuel, several other biomass-derived fuels are available for fueling electric generators, including burning crops, converting crops to a liquid fuel (such as ethanol~~,~~), and gasifying crops (including wood waste). ~~In~~ EIA estimates that wind and biomass will be the largest source of renewable electricity generation among the nonhydropower renewable fuels through the year 2030 (DOE/EIA 2009). However, in NUREG-~~-~~1437, the staff determined that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a large baseload generating plant (NRC 1996).

~~EIA estimates that wind and biomass will be the largest source of renewable electricity generation among the nonhydropower renewable fuels through the year 2030 (DOE/EIA 2009a).~~

Co-firing biomass with coal is possible when low-cost biomass resources are available. Co-firing is the most economic option for the near future to introduce new biomass power generation. These projects require small capital investments per unit of power generation capacity. Co-firing systems range in size from 1 to 30 MW(e) of biopower capacity (DOE 2008e).

The staff concludes that given the relatively small size of biomass generation facilities, biomass-derived fuels do not offer a reasonable alternative to a 1600-MW(e) nuclear power generation facility operated as a baseload plant within UniStar's ROI.

9.2.3.9 Fuel Cells

Fuel cells work without combustion and its associated environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode, and then separating the two by an electrolyte. The only byproducts are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. Higher-temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

During the past three decades, significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, but progress has been slow. The cost of fuel cell power systems must be reduced before they can be competitive with conventional technologies (DOE 2008d).

The staff concludes that, at the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Future gains in cost competitiveness for fuel cells compared to other fuels are speculative.

For the preceding reasons, the staff concludes that a fuel cell energy facility ~~located in UniStar's ROI~~ would not currently be a reasonable alternative to construction of a 1600-MW(e) nuclear power generation facility operated as a baseload plant within UniStar's ROI.

9.2.4 Combination of Alternatives

Individual alternatives to the construction of a new nuclear unit at the Calvert Cliffs site might not be sufficient on their own to generate UniStar's target value of 1600 MW(e) because of the small size of the resource or lack of cost-effective opportunities. Nevertheless, it is conceivable that a combination of alternatives might be cost effective. There are many possible combinations of alternatives. It would not be reasonable to examine every possible combination of energy alternatives in an EIS. Doing so would be counter to CEQ's direction that an EIS should be analytic rather than encyclopedic, shall be kept concise, and shall be no longer than absolutely necessary to comply with NEPA and CEQ's regulations [40 CFR 1502.2(a), (b)]. Given that UniStar's objective is for a new baseload generation facility, a fossil energy source,

most likely coal or natural gas, would need to be a significant contributor to any reasonable alternative energy combination.

Section 9.2.2.2 assumes the construction of natural gas combined-cycle generating units at the Calvert Cliffs site using the cooling technology proposed by UniStar for Unit 3. For a combined alternatives option, the staff assessed the environmental impacts of an assumed combination of 1200 MW(e) of natural gas combined-cycle generating units at the Calvert Cliffs site~~,~~ and the following contributions from within UniStar's ROI: ~~100~~25 MW(e) of hydropower; 75 MW(e) from solar power, 100 MW(e) from biomass sources, including municipal solid waste~~,~~; 100 MW(e) from conservation and demand-side management programs~~,~~; and 100 MW(e) from wind power. ~~The~~ Based on the information presented in the preceding sections of this chapter, the staff believes that ~~the preceding~~ these contributions are reasonable and representative. ~~The contributions reflect the staff's analysis in Section 9.2 of the EIS.~~ A summary of the staff's characterization of the environmental impacts associated with the construction and operation of the preceding combination of energy alternatives is shown in Table 9-3.

~~9.2.5 Summary Comparison of Alternatives~~

~~contains a summary of the staff's environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural gas-fired, combined-cycle generating units at the Calvert Cliffs site. The combination of alternatives shown in assumes siting of natural gas combined-cycle generating units at the Calvert Cliffs site and siting of other generating units within UniStar's ROI.~~

~~The staff reviewed the available information on the environmental impacts of power generation alternatives compared to the construction of a new nuclear unit at the Calvert Cliffs site. Based on this review, the staff concludes that, from an environmental perspective, none of the viable energy alternatives are clearly preferable to construction of a new baseload nuclear power generation plant located within UniStar's ROI.~~

Table 9-3. Summary of Environmental Impacts of a Combination of Power Sources

Impact Category	Impact	Comment
Land use	MODERATE	A natural gas-fired plant would have land-use impacts for the powerblock, cooling towers and support systems, and connection to a natural gas pipeline. Wind, solar, hydroelectric, and biomass facilities and associated transmission lines would have land-use impacts in addition to the land-use impacts of the natural gas-fired plant. Both offshore wind development and hydropower plants would potentially impede navigation.

Air quality	SMALL to MODERATE	Emissions from the natural gas-fired plant would be approximately: SO_2 ~~– 14~~ – 69 tons/yr NO_2 ~~– 547 tons/yr~~ ~~CO – 118 tons/yr~~ ~~PM – 28 tons/yr~~ ~~PM_{10} – 19~~ – 318 tons/yr CO_2 ~~–~~ – 4.2 million tons/yr Some CO and small amounts of PM and hazardous air pollutants would be emitted. Municipal solid waste and biomass facilities would also have emissions.
Water use and quality	SMALL	Impacts would be somewhat less than the impacts for a new nuclear power plant located at the Calvert Cliffs site.
Ecology	MODERATE	~~Impacts on terrestrial ecology from cooling tower drift could occur.~~ Wind energy facilities could result in some avian mortality and also affect aquatic resources if placed in Chesapeake Bay or offshore. Hydropower facilities would substantially affect terrestrial and aquatic ecosystems through permanent habitat ~~and species~~conversion.
Waste management	SMALL to MODERATE	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions and ash from biomass and municipal solid waste sources.
Socioeconomics	MODERATE Beneficial to MODERATE Adverse	Construction and operations workforces would be relatively small. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small workforce involved. The plants would have aesthetic impacts.
Human health	SMALL	Regulatory controls and oversight would be protective of human health.
Historic and cultural resources	[MODERATE to LARGE-TBD]	Adverse effects are likely to four NRHP-eligible resources.
Environmental justice	SMALL	Some impacts on housing availability and prices during construction may occur, as might beneficial impacts from property tax revenues.

9.2.5 Summary Comparison of Alternatives

Table 9-4 contains a summary of the staff's environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural gas-fired combined-cycle generating units at the Calvert Cliffs site. The combination of alternatives shown in Table 9-4 assumes siting of natural gas combined-cycle generating units at the Calvert Cliffs site and siting of other generating units within UniStar's ROI.

Table 9-4. Summary of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural Gas-Fired Generating Units~~,~~ and a Combination of Alternatives

Impact Category	Nuclear	Coal	Natural Gas	Combination of Alternatives
Land use	SMALL	MODERATE	SMALL	MODERATE
Air quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water use and quality	SMALL	SMALL	SMALL	SMALL
Ecology	~~SMALL to~~ MODERATE	MODERATE	~~MODERATE~~ SMALL	MODERATE
Waste management	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	LARGE Beneficial to MODERATE Adverse	LARGE Beneficial to MODERATE Adverse	MODERATE Beneficial to ~~MODERATE~~ SMALL Adverse	MODERATE Beneficial to MODERATE Adverse
Human health	SMALL	SMALL	SMALL	SMALL
Historic and cultural resources ~~[TBD]~~	[MODERATE to LARGE]	[MODERATE to LARGE]	[MODERATE to LARGE]	[MODERATE to LARGE]
Environmental justice	SMALL	SMALL	SMALL	SMALL

The staff reviewed the available information on the environmental impacts of power generation alternatives compared to the construction of a new nuclear unit at the Calvert Cliffs site. Based on this review, the staff concludes, from an environmental perspective, none of the viable energy alternatives are clearly preferable to construction of a new baseload nuclear power generating plant located within UniStar's ROI.

Comment [hln1]: I think this statement needs more explanation. When looking at table 9-4, it seems clear to me that natural gas would be environmentally preferable based on the ecology and socio conclusions even when taking into account air quality.

Because of current concerns related to greenhouse gas emissions, the review team believes that it is appropriate to specifically discuss the differences among the alternative energy sources regarding carbon dioxide emissions. Carbon dioxide emissions for the proposed action and energy generation alternatives are discussed in Sections 5.7.2, 9.2.2.1, 9.2.2.2, and 9.2.4. Table 9-5~~Table 9-5Table 9-5~~ summarizes the CO_2 emission estimates for a 40-year period for the alternatives considered by the review team to be viable for baseload power generation. These estimates are limited to the emissions from power generation and do not include CO_2 emissions for workforce transportation, construction fuel-cycle, or decommissioning. Among the viable energy generation alternatives, the CO_2 emissions for nuclear power are a small fraction of the emissions of the other viable energy generation alternatives. Adding the transportation emissions for the nuclear plant workforce and fuel cycle emissions, would increase the emissions for plant operation over a 40-year period to about 35,000,000 metric tons.

Table 9-5. Comparison of Carbon Dioxide Emissions for Energy Alternatives

Generation Type	Years	CO_2 Emission (metric tons)
Nuclear Power[(a)]	40	191,000
Coal-Fired Generation[(b)]	40	496,000,000
Natural Gas-Fired Generation[(c)]	40	224,000,000
Combination of Alternatives[(d)]	40	168,000,000

(a) From Appendix L
(b) From Section 9.2.2.1
(c) From Section 9.2.2.2
(d) From Section 9.2.4 (assuming only natural gas generation has significant CO_2 emissions)

Carbon dioxide emissions associated with generation alternatives, such as wind power, solar power and hydropower, would be associated with workforce transportation, construction, and decommissioning of the facilities. Because these generation alternatives do not involve combustion, the staff considers the emissions to be small and concludes the emissions would have a SMALL cumulative impact. Other energy generation alternatives involving combustion of oil, wood waste, municipal solid waste, or biomass-derived fuels would have CO_2 emissions from combustion, as well as from workforce transportation, plant construction, and plant decommissioning. It is likely that the CO_2 emissions from the combustion process for these alternatives would dominate the other CO_2 emissions associated with the generation alternative. It is also likely that the CO_2 emissions from these alternatives would be the same order of magnitude as the emissions for the fossil-fuel alternatives considered in Sections 9.2.2.1, 9.2.2.2, and 9.2.4. However, because these alternatives were determined by the staff not to meet the need for baseload power generation, the staff has not evaluated the CO_2 emissions quantitatively.

As discussed in Chapter 8, the review team has concluded that the need for the additional baseload power generation has been demonstrated. Also, as discussed earlier in this chapter, the review team concludes the viable alternatives to the proposed action all would involve the use of fossil fuels (coal or natural gas). The review team concludes the proposed action results in the lowest level of emissions of greenhouse gases among the viable alternatives.

9.3 Alternative Sites

NRC EISs prepared in conjunction with a COL application are to analyze alternatives to the proposed action [10 CFR 51.71(d)]. The review team uses NRC guidance (ESRP 9.3; NRC 2000a) to evaluate the alternative sites ~~to~~and determine if any obviously superior alternative exists to the site proposed. This section discusses UniStar's process for selecting its proposed and alternative sites, and the review team's evaluation of the process. UniStar's site selection process was based on guidance in the following documents (UniStar 2009a): NRC's Environmental Standard Review Plan (ESRP) (NRC 2000a), Regulatory Guide 4.2 (NRC 1976),

Regulatory Guide 4.7 (NRC 1998), 10 CFR Part 100, and the Electric Power Research Institute's (EPRI) Siting Guide (EPRI 2002).

This section describes UniStar's site selection process, the review team's evaluation process, descriptions of the alternative sites selected by UniStar, and discussions of the environmental impacts of locating a new nuclear generating unit at each alternative site. For the purposes of this alternative sites evaluation, impacts evaluated include NRC-authorized construction, operation, and other cumulative impacts including preconstruction activities. ~~Characterization of additional factors that are not site-specific in their impacts are discussed in Section 9.3.2.~~ Sections 9.3.3 through 9.3.5 provide a site-specific description of the environmental impacts at each alternative site based on issues such as land use, air quality, water resources, terrestrial and aquatic ecology, socioeconomics and environmental justice, historic and cultural resources, and transmission corridors. Section 9.3.6 contains tables of the staff's characterization of the impacts at the alternative sites and comparison with the proposed site to determine if there are any alternative sites that are environmentally preferable to the proposed site.

9.3.1 Alternative Site Selection Process

NRC's site selection process guidance calls for identification of a region of interest (ROI), the geographic area considered by an applicant in searching for candidate areas and potential sites for possible siting of a new nuclear power plant (NRC 2000a, ESRP 9.3). Within that ROI, screening criteria are applied to sequentially evaluate candidate areas, potential sites, and candidate sites. This systematic process leads to the selection of a proposed site and alternative sites unless the applicant proposes a site based on the special case identified in ESRP 9.3 for proposing to locate a new nuclear facility on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review. UniStar used the ESRP 9.3 special case to select the Calvert Cliffs site as its proposed site for a third unit. ~~The process UniStar used to select its alternative sites~~

The review team raised a number of concerns related to UniStar's site selection process and associated results submitted by UniStar in the COL application (through Revision 5 of the application) (UniStar 2009d). The most significant questions were documented in requests for additional information from the NRC dated May 13, 2008 (NRC 2008), February 3, 2009 (NRC 2009b), and September 18, 2009 (NRC 2009c). As a result of these information requests, UniStar developed a major revision to its site selection process and documented it in Revision 6 to the ER (UniStar 2009a and in a separate Siting Report (UniStar 2009e). The process UniStar used to select its alternative sites and documented in ER Revision 6 (UniStar 2009a) is described in the following sections.

9.3.1.1 Selection of Region of Interest

UniStar selected the State of Maryland for its ROI (UniStar 2009a). The State of Maryland's shortfall in net generating capacity was documented by the Maryland Public Service Commission (PSC) (MPSC 2007) and verified in its granting of a Certificate of Public Convenience and Necessity (~~CPCN, Case No. 9127; Maryland PSC 2009~~MPSC 2009a) to UniStar for the proposed Calvert Cliffs Unit 3 (see the discussion in ~~Ch.~~Chapter 8 of the EIS).

As described in ESRP 9.3 (NRC 2000a), an ROI is typically selected based on geographic boundaries (e.g., the State in which the proposed site is located) or the relevant service area for the proposed plant. By selecting the State of Maryland, UniStar's designated ROI is consistent with expectations for an ROI. The review team concludes that the ROI used in UniStar's COL application is reasonable for consideration and analysis of potential sites. The review team also finds that UniStar's basis for defining its ROI did not arbitrarily exclude desirable candidate locations.

9.3.1.2 UniStar's Site Selection Process

In its COL application, UniStar proposed the Calvert Cliffs Nuclear Power Plant site for a new U.S. EPR nuclear unit. The decision to select the Calvert Cliffs site was based on a special case exception from the systematic site-selection process (NRC 2000a). This exception allows the applicant to select an existing nuclear facility as the proposed site for a new unit or units.

UniStar embarked on a systematic review of candidate areas, potential sites, and candidate sites within the State of Maryland to identify alternative sites for comparison with the Calvert Cliffs proposed site. UniStar's selection process to identify candidate areas and potential, candidate, and alternative sites is described in the following sections.

Selection of Candidate Areas

In describing the basis for its systematic selection of candidate areas, UniStar refers to the use of ESRP guidance (NRC 2000a) and the EPRI siting guide (EPRI 2002). UniStar applied the following screening criteria for candidate areas within Maryland: population density, distance to transmission lines, access to a suitable cooling water source, and if the site was available (UniStar 2008b). More specifically, areas were removed from further consideration if they exceeded the following characteristics:

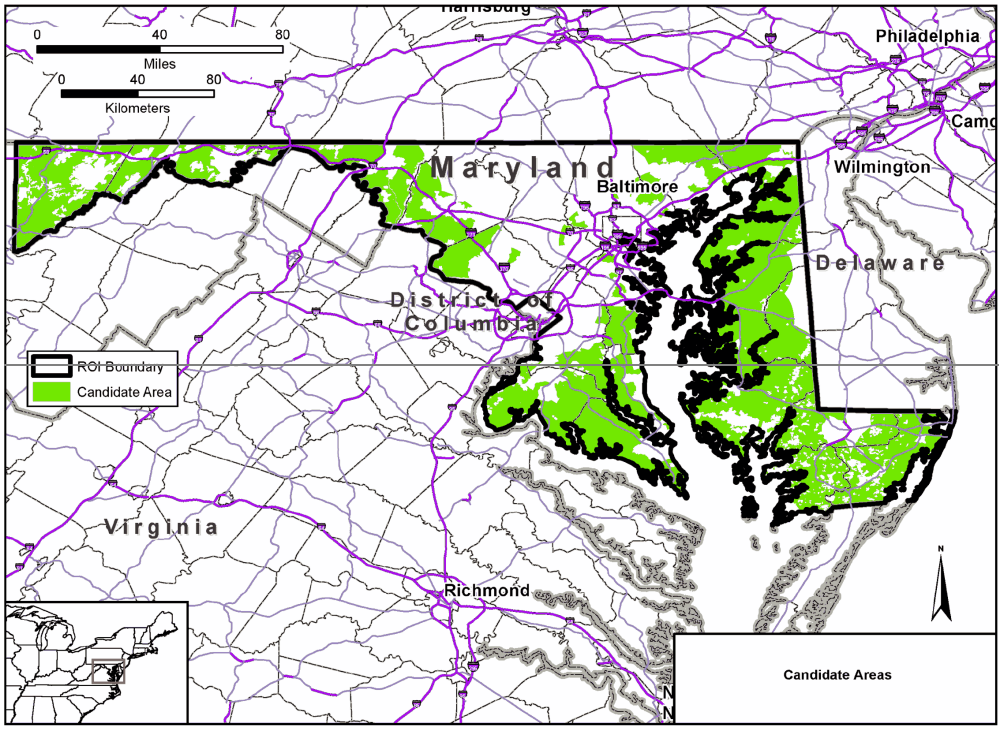
- Exhibited a population density of more than 300 persons per square mile~~.~~
- were located more than 30 mi from 345-kV or higher transmission lines~~.~~
- were located more than 15 mi from an adequate source of cooling water~~.~~

- contained land that was dedicated to other uses, such as national and state parks~~,~~ and tribal lands.

UniStar developed a map representing each exclusionary criterion, and these were combined into a summary map of designated candidate areas (Figure 9-1~~Figure 9-1Figure 9-1~~) that were not eliminated by these criteria. These candidate areas are shown as darkened areas near the Chesapeake Bay and the Potom~~i~~ac, Susquehanna, and Patuxent Rivers.

Selection of Potential and Candidate Sites

In its selection process of potential sites within its candidate areas, UniStar made use of two databases: the Maryland Department of the Environment~~'~~'s *Brownfield, Voluntary Cleanup Programs and State Remediation Site* database and the U.S. ~~Department of Energy's~~DOE Energy Information Administration~~'~~'s (EIA) *State Energy Profile* database. The two databases provided a pool of 1036 possible sites in the ROI, including brownfield sites, remediation sites, and power facilities. These sites were plotted on the State map. Of those 1036 possible sites, 206 sites were located within the candidate areas and ~~were~~ retained for further consideration.



~~**Figure** -. Map Showing the Locations of UniStar's Candidate Areas in Maryland (UniStar 2009a)~~

UniStar applied a ~~"~~"de-select~~"~~" criterion to narrow the list of 206 sites by removing all sites that did not meet a minimum of 420 ac needed to site a U.S. EPR unit, its ancillary structures, construction laydown areas, and parking. This reduced the ~~sites~~total to eight potential sites, which were evaluated for viability and potential licensability. These were identified as:

- Bainbridge Naval Training Center
- BWI Airport (located near the airport)
- Beiler Property
- Conowingo
- Eastalco
- Thiokol Site (formerly owned by Thiokol)

- Morgantown
- Sparrows Point~~.~~

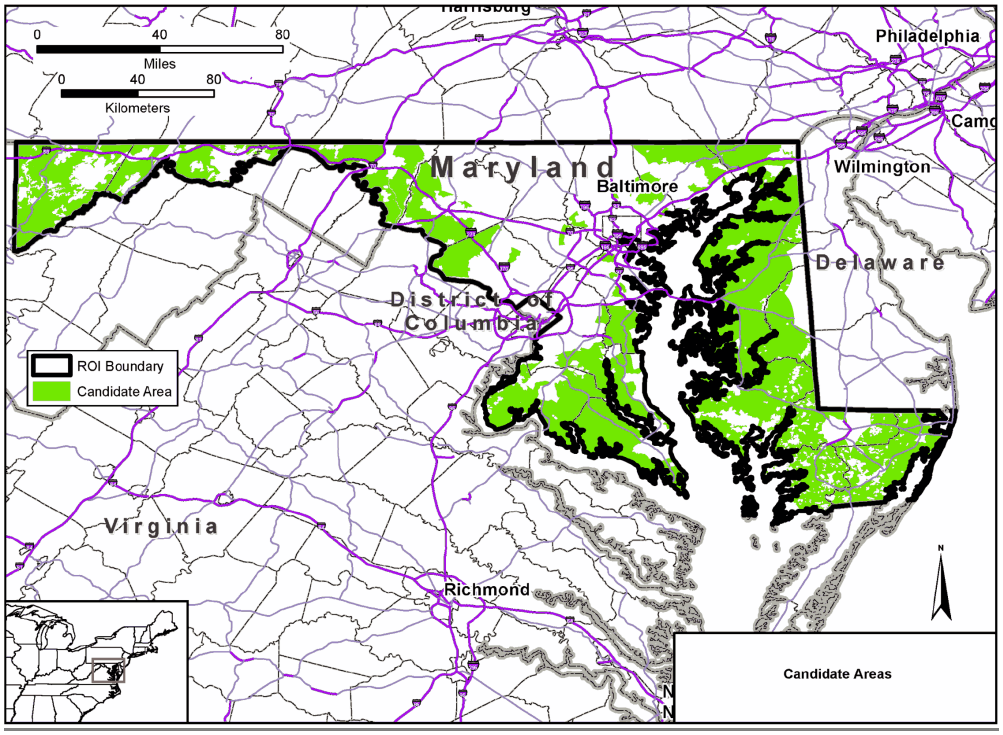


Figure 9-1~~Of~~. Map Showing the Locations of UniStar's Candidate Areas in Maryland (UniStar 2009a)

UniStar looked more closely at the eight potential sites, ~~one~~and, for various reasons, eliminated four of them. One site was eliminated because of its proximity to a major airport (BWI airport~~);~~), and a second that met the previous density criteria was too near Baltimore for serious consideration (Sparrows Point~~); a~~). A third site contained an operating baseload fossil fuel facility, which is needed to meet current Maryland energy production and would be displaced by a new nuclear unit (Morgantown~~); and a~~). A fourth site ~~which~~, although passing the candidate area screening for a water source, upon further reconnaissance-level evaluation, was unlikely to meet the volume requirement for water and depth for an intake structure (Beiler). After removing these four potential sites from further consideration, the remaining four potential sites were selected as what UniStar considered candidate sites~~.~~ :

- Bainbridge Naval Training Center
- Conowingo
- Eastalco
- Thiokol.

ESRP 9.3 considers candidate sites to include only the proposed and alternative sites. UniStar uses the term to include sites being considered ~~as~~for screening down to alternative sites, a difference that is not critical to the evaluation. UniStar then scored the candidate sites to select the alternative sites.

A generic greenfield site was also characterized in a separate evaluation by UniStar (2009a). A greenfield site implies that the site has not been used previously for industrial purposes, but may have been disturbed for activities such as agriculture. No specific geographic location was identified by UniStar for the greenfield site location~~;~~. ~~h~~ However, UniStar assumed this hypothetical site would be located near the Chesapeake Bay or the lower reaches of the main rivers within the ROI to have an adequate water supply. UniStar also assumed it would not be "detrimentally challenged with grid interconnection issues." Citing particularly (1) the likely need ~~(1)~~ for land for switchyard and transmission lines in addition to the need to acquire, rezone, and disturb land for a plant site~~,~~; (2) the likely need to integrate a plant into the socioeonomic and aesthetic environment; and (3) the likely need to improve roadways to a relatively remote, nonurban setting and associated transportation impacts, UniStar concluded that a greenfield site would offer no environmental advantages over the Calvert Cliffs site and would increase the ~~cost of the new facility and the~~ severity of impacts (UniStar 2009a).

Selection of Alternative Sites

The next step of UniStar~~'~~'s process was to select alternative sites from its list of four candidate sites using 16 major criteria categories and 42 sub-criteria and ranking each candidate site against these criteria. Commercial criteria, such as cost-related criteria, were not included in this evaluation. UniStar organized a ~~9~~nine-member Delphi panel consisting of personnel from UniStar, AREVA, and CH2MHill to evaluate the four sites against the criteria. The panel represented a wide range of interests and expertise and had access to subject matter experts from CH2MHILL and AREVA for additional input (UniStar ~~2009 |Alternative Site Evaluation Report|).~~2009e). In its analysis, the panel used publicly available data, information available through UniStar and Constellation Energy sources, and ~~GoogleEarth~~Google Earth images to evaluate the four sites (UniStar ~~2009x |Alternative Site Evaluation report|).~~2009e). Site investigations supplemented the evaluation as needed. For consistency in the analysis, the panel assumed that building and operation practices described for the proposed Calvert Cliffs Unit 3 in Chapters 4 and 5 of this EIS would generally apply at each site.

Weighting factors were applied to each criteria with water resources weighted the highest followed by population density, wetlands, resources related to transmission corridors, and terrestrial and aquatic resources (weighted toward threatened and endangered species, floodplains, and water resource temperature at the discharge). These weighting factors were followed by geology/seismology, human health, socioeconomics, transportation access, historic resources, environmental justice, postulated accidents, air quality, and fuel cycle impacts. Although the review team would have preferred more emphasis on terrestrial and aquatic species (in addition to threatened and endangered species) and habitats, such factors were unlikely to have discriminated across the four sites. The review team found that the criteria and weighting factors were not unreasonable.

The Delphi panel developed a rating system (1 = least suitable~~,~~; 5 = most suitable) for each criterion and scored the four sites using this system. The nine scores for each major criterion were averaged, and ~~computed~~ the composite ratings ~~for~~computed to rank the four sites from highest to lowest (UniStar ~~2009a) |Alternative Site Evaluation Report|~~ 2009e). The results for the four sites were closely clustered with no obviously better or worse candidates. The site receiving the highest ranking was Eastalco, followed by Thiokol, Bainbridge, and Conowingo. The review team considered the ranking system to be a relatively qualitative screening despite the numerical scores, but found that it was not unreasonable.

UniStar selected the three sites with the highest scores as its alternative sites. These are:

- Bainbridge, the former Naval Training Center
- Eastalco, on property across from ~~a retired~~an inactive aluminum smelter
- Thiokol, a former manufacturing site of certain munitions components, since remediated.

Their locations along with the Calvert Cliffs proposed site are shown in Figure 9-2~~Figure 9-2Figure 9-2~~.

UniStar and its site selection contractor described these sites at a reconnaissance level in ~~UniStar's ER (UniStar 2009a).~~UniStar's ER (UniStar 2009a). Reconnaissance information is data that is readily available from agencies and other public sources. It can also include information obtained through visits to the site area. A formal environmental assessment has not been conducted at any of the alternative sites. UniStar compared the sites with the proposed Calvert Cliffs site for siting a new nuclear unit and determined that no alternatives were environmentally preferable to the Calvert Cliffs site.

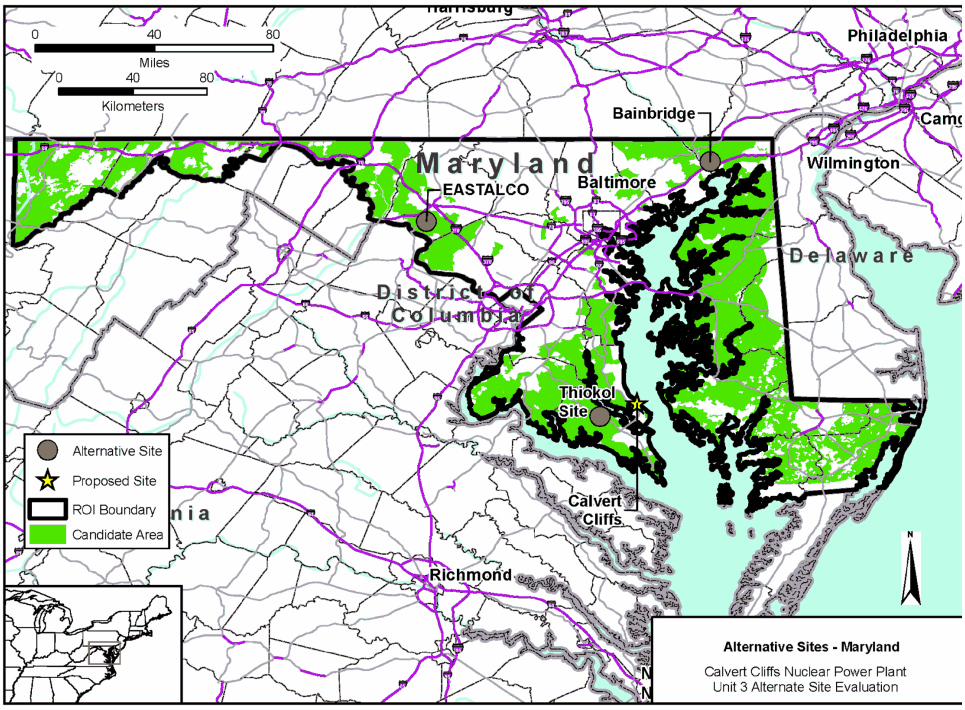


Figure 9-2. Location of Alternative Sites and Proposed Site (UniStar 2009a)

9.3.2 NRC/Corps Alternative Site Evaluation

The review team reviewed the siting methodology used by UniStar to select its ROI, candidate areas, potential sites, candidate sites, and alternative sites. Based on UniStar's description of its process and the review team's evaluation of the criteria used~~, and~~ (as addressed in the commentary in the previous section~~,~~), the review team determined ~~that~~ the process used to identify alternative sites was a logical approach ~~and was~~consistent with NRC guidance (NRC 2000a) and, therefore, was adequate.

In accordance with ESRP 9.3 (NRC 2000a), the review team also performed an independent comparison of the proposed and alternative sites. The review team visited each of the alternative sites between October 2008 and August 2009. Following the guidance in ESRP 9.3, the review team collected and analyzed reconnaissance-level ~~and ground-level~~ information for each of the alternative sites. The team then used the information provided in the environmental report~~,~~ (ER), RAI responses, information from other Federal and State agencies, and information gathered at the visits to each alternative site to evaluate the cumulative impacts of

building and operating a new nuclear power plant at those sites. ~~The~~ Therefore, the analysis ~~therefore~~ includes the impacts of NRC-authorized construction and operation ~~and also includes~~, as well as impacts from other actions affecting the same resources. Cumulative impacts occur when the effects of an action are added to or interact with other effects in a particular place and within a particular time~~; as~~. As a result, the cumulative impact assessment entails a more extensive and broader review of possible effects of the action beyond the site boundary.

The cumulative analysis for the impacts at the alternative sites was performed in the same manner as discussed in Chapter 7 for the proposed site except, as specified in ESRP 9.3 (NRC 2000a), the analysis was conducted at the reconnaissance level for the alternative sites. To inform the cumulative analysis, the review team researched EPA databases for recent EISs within the State~~;~~, used an EPA database for permits for water discharges in the geographic area to identify water-use projects~~;~~, and used www.recovery.gov to identify projects in the geographic area funded by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). The review team developed tables of the major projects near each alternative site that were considered relevant in the cumulative analysis. The review team used the information to perform an independent evaluation of the direct and cumulative impacts of the proposed action at the alternative sites to determine if one or more of the alternative sites were environmentally preferable to the proposed site.

Included are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. For purposes of this analysis, the past is defined as the time period prior to receipt of the COL application. The present is defined as the time period from the receipt of the COL application until the start of building ~~the~~ proposed Unit 3. The future is defined as the start of building ~~of~~ Unit 3 through operation and eventual decommissioning.

Using Chapter 7 of this EIS as a guide, the specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographical area were identified. The affected environment that serves as the baseline for the cumulative impacts analysis is described for each alternative site~~,~~ and includes a qualitative discussion of the general effects of past actions. For each resource area, the geographical area over which past, present, and future actions could reasonably contribute to cumulative impacts is defined and ~~is~~ described in later sections ~~for each resource area.~~. The analysis for each resource area at each alternative site concludes with a cumulative impact finding (SMALL, MODERATE, or LARGE).

The cumulative impacts are summarized for each resource area in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area. The findings for each resource area at each alternative site ~~are~~ then are compared in a table at the end of Section 9.3~~,~~ to the cumulative impacts at the proposed site (brought forward from

Chapter 7). The results of this comparison are used to determine if any of the alternative sites are environmentally preferable to the proposed site.

~~Some impacts such as fuel cycle, transportation, postulated accidents and decommissioning impacts are similar at all sites (proposed and alternative sites) and therefore impacts at the alternative sites are similar to the ones discussed for the proposed site. Because the associated impacts do not differentiate between the proposed and alternative sites, they are addressed generically below and are not evaluated for each alternative site.~~

~~9.3.3 Issues Among Sites Handled Generically~~

~~In evaluating the alternative sites, the staff found certain impacts would not vary among sites, and, as a result, would not affect the evaluation of whether an alternative site is environmentally preferable to the proposed site. These impacts include some operational terrestrial impacts, some areas of socioeconomics; nonradiological and radiological effects on members of the public, workforce, and biota; postulated accidents. As a result, the impacts of these five impact categories are not evaluated as part of the site-specific alternatives analysis. In addition, there were generic aspects of other impact categories that were not included in the discussions of each site. Instead, they are discussed generically in the following subsections.~~

~~9.3.3.1 Terrestrial Resources (Operations Only)~~

~~Site development impacts to terrestrial resources are site-specific and are discussed separately for each alternative site in Section 9.3.3. Terrestrial ecological impacts that may result from operation of a new nuclear unit at the alternative sites include those associated with the cooling system, transmission system structures, and maintenance of transmission line corridors. An evaluation of impacts resulting from operation of the cooling system, transmission lines, and transmission line corridor maintenance cannot be conducted in great detail, because the type, number, and specific location of cooling towers at each alternative site, and locations of any new corridors that could result from transmission system upgrades has not been determined. Consequently, conclusions in the NUREG-1437 (NRC 1996) were used to assess terrestrial impacts resulting from the operation of cooling towers and impacts from transmission line corridor maintenance and operation.~~

~~In NUREG-1437 (NRC 1996), the review team evaluated terrestrial ecological impacts resulting from operation of existing nuclear power plants. The types of terrestrial ecological impacts resulting from operation of new nuclear units would be similar to those of existing nuclear power plants.~~

~~For impacts resulting from transmission line operation and transmission line corridor maintenance, the staff assumed that locating a new nuclear unit at an alternative site would require a new transmission line that to be built. Given the above assumption, conclusions in~~

~~NUREG-1437 (NRC 1996) were used for impacts resulting from transmission line operation and transmission line corridor maintenance. For impacts related to cooling system operations, the staff assumed the number and type of cooling towers proposed for Unit 3 at the Calvert Cliffs site would be used at any of the alternative sites. Conclusions in NUREG-1437 (NRC 1996) were used to assess impacts resulting from cooling system operation.~~

~~***Cooling Towers***~~

~~The operation of a cooling tower results in the loss of water through evaporative loss and through drift. Drift is described as small, unevaporated water droplets that are exhausted out the top of the tower. These droplets may carry minerals, debris, microorganisms, and chemicals that may impact crops, ornamental vegetation, and native plants. Adverse impacts from cooling tower drift cannot be evaluated in detail in the absence of information on the type (mechanical or natural draft), number, and specific location of cooling towers at each alternative site. General guidelines for predicting effects of drift deposition on plants suggest that many species have thresholds for visible leaf damage in the range of 9 to 18 lb/ac/mo on leaves during the growing season (NRC 1996). The proposed Unit 3 cooling tower, which includes plume abatement, would be drawing salt/brackish water for cooling from the Chesapeake Bay through a desalination facility. Thiokol would use similar cooling from the Patuxent River, and the salt content of the Susquehanna River near the Bainbridge site is influenced by the Chesapeake Bay. The Potomac River near the Eastalco is a freshwater source. Because the maximum deposition for the proposed Unit 3 is far below the level that could cause leaf damage in many common species, the impacts would be negligible both on the Calvert Cliffs site and in the vicinity. Deposition would be similar at the Thiokol site. Likewise, one could expect even less impact at the Bainbridge and Eastalco sites because the salt content in the cooling water source would be lower. In general, the impacts of drift on crops, ornamental vegetation, and native plants were evaluated for existing nuclear power plants and were found to be of minor significance (NRC 1996). This determination also included nuclear power plants with more than one cooling tower.~~

~~Similarly, detailed mortality from bird collisions with cooling towers depend on the type (mechanical or natural draft for a wet cooling system; dry for a dry system) and number of cooling towers at each alternative site. In this case, a single large mechanical draft cooling tower is proposed. The impacts of bird collisions for existing power plants were evaluated and found to be of minor significance for all operating nuclear plants, including those with various numbers and types of cooling towers (NRC 1996). On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling tower drift and bird collisions with cooling towers resulting from operation of new nuclear units at all of the alternative sites would be minor.~~

~~Typical noise levels that can be expected at 1300 ft from the cooling tower are 65 dBA (UniStar 2008a). Noise from plant operation would also be quickly attenuated by surrounding forest~~

~~cover, further limiting any impact. Local wildlife will likely adapt to noise levels, while cooling tower and transformer noise may also serve to limit the potential for avian collision. Consequently, the review team concludes that the impacts of cooling tower noise on wildlife would be minimal at all the alternative sites.~~

~~***Transmission Lines***~~

~~The impacts associated with transmission line operation consist of bird collisions with transmission lines and electromagnetic field (EMF) effects on flora and fauna. The impacts associated with corridor maintenance activities are alteration of habitat due to cutting and herbicide application, and similar related impacts where corridors cross floodplains, wetlands, and other important habitats.~~

~~Direct mortality resulting from birds colliding with tall structures has been observed (Avatar 2004). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). However, in NUREG-1437, the staff concluded that the threat of avian collision being a biologically significant source of mortality is very low as only a very small fraction of total bird mortality could be attributed to collision with nuclear power plant structures, including transmission corridors with multiple transmission lines (NRC 1996). Although collision may contribute to local losses, thriving bird populations can withstand these losses without threat to their existence (Brown 1993). Although additional transmission lines would be required for a new nuclear unit at the alternative sites, increases in bird collisions would be minor and these would likely not be expected to cause a measurable reduction in local bird populations. Consequently, the incremental direct mortality posed by the addition of new transmission lines for a new nuclear unit would be negligible at all the alternative sites.~~

~~EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). [update with latest text in Chapter 5] The impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines and lines energized at levels less than 765 kV (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003).~~

~~Therefore, the incremental EMF impact posed by operation of existing transmission lines and the addition of new lines for new nuclear units would be negligible at all the alternative sites.~~

~~Existing roads providing access to the existing transmission line corridors at the alternative sites would likely be sufficient for use in any expanded corridors; however, new roads would be required during the development of new transmission line corridors. Transmission line corridor management activities (cutting and herbicide application) and related impacts to floodplains and wetlands in transmission line corridors are of minor significance at operating nuclear power plants, including those with transmission line corridors of variable widths (NRC 1996). Consequently, the incremental effects of transmission line corridor maintenance and associated impacts to floodplains and wetlands for a new nuclear unit would be negligible at all the alternative sites.~~

~~***Conclusion***~~

~~Based on information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative impacts to terrestrial resources from operation of a new nuclear unit (including cooling towers, transmission lines, and transmission line corridors) at any of the alternative sites would be SMALL.~~

~~9.3.3.2 Socioeconomics~~

~~There are several physical impacts with socioeconomic consequences where generic treatment of issues related to construction and operation of new nuclear units would be appropriate.~~

~~***Physical Impacts***~~

~~Many of the physical impacts of construction and operation would be similar regardless of the site. Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from building a new unit would be SMALL incremental impacts associated with their normal operation.~~

~~Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions. A new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. By inference, this practice also would be expected to apply to all alternative sites. Commuter traffic would be controlled by~~

~~speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the alternative site.~~

~~Any new unit at an alternative site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, a new unit would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.~~

~~Site development activities would be temporary and would occur mainly within the boundaries of the alternative site. Offsite impacts would represent SMALL to MODERATE [conflict with SMALL in statement below?] incremental changes to offsite services supporting the building activities. During facility operations, noise levels would be managed to State and local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the physical impacts of construction would be SMALL and operational impacts would be SMALL.~~

~~Because of the dissimilarities among the sites, the demographic, infrastructure and community impacts at each of the alternative sites has been covered in the site-specific discussions.~~

~~9.3.3.3 Nonradiological Health Impacts~~

~~Nonradiological health impacts from construction of a new nuclear unit on the construction workers at the alternative sites would be similar to those evaluated in Section 4.8. They include occupational injuries, noise, odor, vehicle exhaust, and dust. Applicable Federal and State regulations on air quality and noise would be complied with during the plant construction phase. None of the alternative sites have characteristics that would be expected to lead to fewer or more construction accidents than would be expected for any of the other alternative sites. All of the alternative sites are in rural areas and construction impacts would likely be minimal on the surrounding populations that are classified as medium and low population areas.~~

~~Occupational health impacts to operations employees would likely be the same for all of the alternative sites. Thermophilic microorganisms would not be a concern at the alternative sites using a closed-cycle, wet cooling system with mechanical draft cooling towers. Health impacts to workers from occupational injuries, noise, and electric fields would be similar. Noise and electric fields would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations.~~

~~The staff expects that the occupational health impacts to operations employees of a new nuclear unit at any of the alternative sites would be SMALL. Similarly, impacts to public health~~

~~of a new nuclear unit operating at any of the alternative sites would be expected to be minimal. The staff concludes that the public health impacts would be SMALL.~~

~~9.3.3.4 Radiological Impacts of Normal Operations~~

~~Exposure pathways for gaseous and liquid effluents from a new nuclear unit on the Calvert Cliffs site or an alternative site would be similar. Gaseous effluent pathways include external exposure to the airborne plume, external exposure to contaminated ground, inhalation of airborne activity, and ingestion of contaminated agricultural products. Liquid effluent pathways include ingestion of aquatic foods, ingestion of drinking water, external exposure to shoreline sediments, and external exposure to water through boating and swimming.~~

~~Section 5.9 discusses the estimates of doses to the maximally exposed individual and the general population for a new nuclear unit at the proposed Calvert Cliffs site for both liquid effluent and gaseous-effluent pathways. The estimated doses to the maximally exposed individual were well within the design objectives of 10 CFR Part 50, Appendix I. The same bounding liquid and gaseous effluent releases would be used to evaluate doses to the maximally exposed individual and the population at each alternative site. Even with differences in pathways, atmospheric and water dispersion factors, and population, doses estimated to the maximally exposed individual for the alternative sites would be expected to be well within the Appendix I design objectives. Population doses within 50 mi of the proposed facility would be similar for the alternative sites because the Calvert Cliffs site and the three alternative sites are each in medium or low population areas; however, they would still be small compared to the population dose from natural background radiation. Therefore, the staff concludes that radiation doses and related health impacts from a new nuclear unit's operations would be SMALL at all of the alternative sites.~~

~~9.3.3.5 Postulated Accidents~~

~~In Section 5.10 of Chapter 5, the staff considered a suite of design-basis accidents for a U.S. EPR at the Calvert Cliffs site. The evaluation involved calculation of doses for specified periods at the exclusion area and low-population zone boundaries, and comparison of those doses with doses based on regulatory limits and guidelines. Similar analyses have not been conducted at the alternative sites. Had such evaluations been conducted, the differences in the results would only have been the result of meteorological conditions and the distances to the site boundaries. The release characteristics would have been the same at all sites.~~

~~For the Calvert Cliffs site and meteorology, the doses for each accident sequence considered were well below the corresponding regulatory limits and guidelines. The general climatological conditions at the alternative sites are sufficiently similar to the conditions at the proposed site that it is highly unlikely that differences in local meteorological conditions would be sufficient to cause doses from design-basis accidents for a new reactor at any of the alternative sites to~~

~~exceed regulatory limits or guidelines. Similarly, it is unlikely that differences in distances to the exclusion area and low population zone boundaries would be sufficient to cause doses from design-basis accidents for a U.S. EPR at any of the alternative sites to exceed regulatory limits or guidelines. Therefore, the staff concludes that for the purposes of consideration of alternative sites, the impact of design basis accidents at each of the alternative sites would be SMALL.~~

~~Section 5.10 also includes a detailed analysis of the potential consequences of severe accidents for a U.S. EPR at the Calvert Cliffs site. Similar analyses have not been conducted the alternative sites. Had such evaluations been conducted, the differences in the results would only have been the result of site-specific factors such as meteorological conditions, population distribution, and land-use distribution. The release characteristics would have been the same at all sites.~~

~~The probability weighted consequences estimated for severe accidents for a U.S. EPR at the Calvert Cliffs site are well below the consequences estimated for severe accidents at current-generation reactors (see Section 5.10). This result suggests that the consequences of severe accidents at the any of the alternative sites would be less than the consequences of a severe accident at an existing plant. The Commission has determined that the probability weighted consequences of severe accidents are SMALL for all existing plants (10 CFR 51, Subpart B, Table B-1). On this basis, the staff concludes that, for the purposes of consideration of alternative sites, the impact of severe accidents at each of the alternative sites likely would be SMALL.~~

~~9.3.4~~9.3.3 Bainbridge Naval Training Center

This section covers the review team~~'~~'s evaluation of the potential environmental impacts of siting a new nuclear unit at the Bainbridge Naval Training Center (Bainbridge) site in northeast Maryland near the Susquehanna River just above its discharge into Chesapeake Bay. The Bainbridge site is located within the Upland Section of the Piedmont Plateau physiographic province in Cecil County, Maryland (MDNR 2001~~ |WEBPhysiographic Provinces of Maryland.pdf|).~~). This province is described as rolling hills and stream valleys covered with hardwood forests ~~|US~~(FWS 2001~~: USFWS2001_MD Piedmont[1].pdf|.~~).

Part of the Bainbridge site was home to ~~a private boy''s school~~the Tome School for Boys beginning in the early 1900s~~;~~, and many of the school buildings are still standing. The Bainbridge Naval Training Center was constructed in 1942 for training Navy recruits during World War II (EPA Superfund Record of Decision, Naval Training Center Bainbridge, EPA ID: MDD985397256, OU 01, 02, Bainbridge, MD, 02/10/2000). The training center was deactivated in 1976. Although some office buildings and personnel quarters remain, most of the training center structures have been demolished and removed, and biota succession has reclaimed areas formerly maintained as open space.

The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographical area were assessed. This assessment includes the impacts of NRC-authorized construction and operations and impacts of preconstruction activities. Also included are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. Other actions and projects considered in this cumulative analysis are described in Table 9-6~~Table 9-6Table 9-6~~.

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~~**Table -.** Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Bainbridge Site Cumulative Analysis~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
~~**Energy Projects**~~			
~~Conowingo Hydroelectric Station~~	~~548 MW hydroelectric facility~~	~~Darlington MD in Harford County, approx 10 miles NW of Bainbridge site~~	~~Operational, license expires 2014, pursuing relicensing~~
~~Rock Springs Generation Facility~~	~~670 MW gas fired peaking facility~~	~~Rising Sun MD in Cecil County, about 7 miles NE of Bainbridge site~~	~~Operational~~
~~Peach Bottom Atomic Power Station Units 2 and 3~~	~~1140 MW each unit, nuclear power plant Link to Peach Bottom LR Final EIS (no clear cumulative analysis): http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement10/sr1437s10.pdf~~	~~Delta, PA approx 15 miles NW of Bainbridge site~~	~~Operational, licenses expire in 2033 and 2034~~
~~PPL Holtwood Electric Plant~~	~~108 MW hydroelectric facility~~	~~Holtwood, PA approx 20 miles NW of Bainbridge site~~	~~FERC license expires in 2014. PPL Holtwood applied 12/2007 for 80 MW increase and requested a 16-year extension of the current license term until August 31, 2030.~~
~~**Transportation Projects**~~			
~~**Parks and Aquaculture Facilities**~~			
~~Deer Creek State Park~~		~~7 miles from site.~~	~~Development likely limited within this park.~~
~~Other parks~~	~~Additional state and local parks, forests, reserves, and other recreational areas are located within the 10 mile region, including the~~	~~Throughout 10 mile region.~~	~~Parks are currently being managed by state and/or local agencies.~~

Project Name or Other Action	Summary of Project	Location	Status
	following: Susquehanna State Park, Elk Neck State Park.		

Table 9-5. (contd)

Project Name or Other Action	Summary of Project	Location	Status
Chesapeake Bay Critical Area (CBCA)	The CBCA Protection Act was enacted in 1984 by the Maryland General Assembly to help reverse the deterioration of the Chesapeake Bay and surrounding Environment (CAC2008a).	All land within 1000 ft of the mean high water line; all waters and lands under Chesapeake Bay and its tributaries.	It appears that Bainbridge is within the CBCA but cannot access maps online to verify. Does Lab have maps? No mitigation plan in ER if it is within CBCA.
Other Actions/Projects			
Great Lakes Dredge and Dock Company LLC – funding	Received over $8M in funding from Recovery Act to dredge Chesapeake Bay. Maintenance dredging performed at various locations along the Inland Waterway Chesapeake and Delaware Canal and Upper Chesapeake Bay areas.	Chesapeake Bay, Chesapeake City, MD	Project has not yet started. From recovery.gov website: http://www.recovery.gov/transparency/pages/home.aspx?State=MD&datasource=recipient
Aberdeen Proving Ground BRAC	BRAC may affect socioeconomics of Harford County and Baltimore County.	Harford County, MD	From Sparrows Point LNG EIS table
Dominion/Antero	250 mile pipeline to provide gas to the Dominion Keystone Pipeline	Green to Chester County, PA	From Sparrows Point LNG EIS table
Waste Water Treatment Plants		Six WWTPs in 10 mile radius of Bainbridge site.	
MAPPS transmission line project	(See Chapter 7 table for relevance)		
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land use planning documents.	Throughout region.	Construction would occur in the future, as described in state and local land use planning documents
Regional air quality	Cumulative air quality status without proposed plant	Throughout the region	40 CFR 81 provides background status for evaluating potential impacts of plant construction and operation.
Global Warming/	Short- or long-term changes in	Throughout	Impacts would occur in the

~~Table 9-5. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
~~natural environmental stressors~~	~~precipitation or temperature.~~	~~region.~~	~~future.~~

~~9.3.4.1~~9.3.3.1 Land Use and Transmission Line Corridors

Land Use

The Bainbridge site is an approximately 1185 ac tract of land located in Port Deposit, Cecil County, Maryland. The site is approximately 3 mi west of Interstate 95 and is bounded by State Highway 276 to the north and northwest, to the east by residential properties beyond which is State Highway 275, and by State Highway 222 to the south. The site is situated atop the Piedmont Plateau and overlooks the Susquehanna River and the Port Deposit town center (MDE 2008). The southwestern edge of the site is parallel to and less that~~t~~n 0.1 mi from the Susquehanna River (UniStar 2009a). Figure 9-3~~Figure 9-3~~~~Figure 9-3~~ shows the property boundary in relation to the lower reach of the Susquehanna River. A 420-ac site footprint is contained within the property boundary. Figure 9-4~~Figure 9-4~~~~Figure 9-4~~ shows an overhead view of the property.

Table 9-6. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Bainbridge Site Cumulative Analysis

Project Name or Other Action	Summary of Project	Location	Status
Energy Projects			
Conowingo Hydroelectric Station	Conowingo Hydroelectric Station is a hydroelectric facility (548 MW(e)).	Approximately 10 mi northwest of Bainbridge site	Operational. License expires 2014 March 12, 2009, Pre-Application Document filed with FERC to renew the license. [(a)]
Rock Springs Generation Facility	Rock Springs Generation Facility is a gas fired peaking facility (670 MW(e)).	Approximately 7 mi northeast of Bainbridge site	Operational.[(b)]
Operation and decommissioning Peach Bottom Atomic Power Station, Units 2 and 3	Peach Bottom consists of two existing power stations, Unit 2 and 3 (1140 MW(e) each).	Approximately 15 mi northwest of Bainbridge site	Operational. Licenses expire in 2033 and 2034.[(c)]
Operation and decommissioning of Hope Creek Generating Station,Unit 1	Hope Creek consists of one existing nuclear generating unit (1061 MW(e)).	Approximately 33 mi southeast of Bainbridge site	Operational. License expires April 11, 2026. [(d)]

Project Name or Other Action	Summary of Project	Location	Status
Operation and decommissioning of Salem Nuclear Generating Station, Units 1 and 2	Salem consists of two existing nuclear generating units, Unit 1 (1174 MW(e)) and Unit 2 (1130 MW(e)).	Approximately 33 mi southeast of Bainbridge site	Operational. Unit 1 license expires August 13, 2016.[e] Unit 2 license expires April 18, 2020. [f]
PSEG Proposed additional Unit(s) at the existing Salem-Hope Creek Site	One or two new units may be proposed adjacent to the existing Salem and Hope Creek units.	Approximately 33 mi southeast of Bainbridge site	NRC is expecting an ESP application in 2010. [g]
Operation and decommissioning of Three Mile Island Nuclear Station, Unit 1	Three Mile Island consists of one existing nuclear generating unit (786 MW(e)).	Approximately 50 mi northwest of Bainbridge site	Operational. License expires April 19, 2014. [h]
Operation and decommissioning of Limerick Generating Station, Units 1 and 2	Limerick consists of two existing nuclear generating units, Unit 1 (1134 MW(e)) and Unit 2 (1134 MW(e)).	Approximately 50 mi northeast of Bainbridge site	Operational. Unit 1 license expires October 26, 2024. [i] Unit 2 license expires June 22, 2029. [j]
PPL Holtwood Electric Plant	PPL Holtwood consists of one hydroelectric facility (108 MW(e)).	Approximately 20 mi northwest of Bainbridge site	Operational. FERC license expires in 2014. Application for expansion in process. [k]

Table 9-6~~Table 9-6Table 9-6~~. (contd)

Project Name or Other Action	Summary of Project	Location	Status
Other Actions/Projects			
Great Lakes Dredge and Dock Company LLC	Perform maintenance dredging at various locations along the Inland Waterway Chesapeake and Delaware Canal and Upper Chesapeake Bay areas.	Chesapeake Bay, Chesapeake City, MD; approximately 8 to 20 mi southeast of site	Planned. Over $8M contract awarded by U.S. Corps of Engineers on Sept. 28, 2009.[l]
Aberdeen Proving Ground (APG) Base Realignment and Closure (BRAC)	Under the base realignment and closure action DoD changing and in some cases expanding the sites mission such as, investing over $1.1 billion in construction at Aberdeen Proving Grounds for the new Army Team Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) center.	Approximately 15 mi south of Bainbridge site.	Ongoing site development projects.[m]
Dominion/Antero Keystone Pipeline	250 mi natural gas pipeline running from Green County to Chester County, PA	A portion would pass approximately 10	Proposed.[n]

Table 9-6~~Table 9-6Table 9-6~~. (contd)

Project Name or Other Action	Summary of Project	Location	Status
		mi northwest of the Bainbridge site.	
Mid-Atlantic Power Pathway (MAPP) Transmission Line Project	Proposed new 500-kV transmission line ~~(to impact 17,450 ft^3 of forested nontidal wetlands and 41,815 ft^2 along 3115 linear ft of streambed)~~	From Possum Point Substation in Virginia to the Calvert Cliffs Substation, with subsequent lines constructed under Chesapeake Bay terminating at the Vienna Substation in MD and the Indian River Substation in Delaware.	Proposed. June 2014 in-service date proposed by Potomac Electric Power Company (Pepco). Under consideration by the MD Public Service Commission as Case 9179.[(o)]
Waste Water Treatment Plants		Six WWTPs in 10 mi radius of Bainbridge site.	.
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land use planning documents.	Throughout region.	Construction would occur in the future, as described in State and local land use planning documents

(a) Source: Exelon 2009.
(b) Source: ConEdison Development 2009.
(c) Source: NRC 2003.
(d) Source: NRC 2009e
(e) Source: NRC 2009f
(f) Source: NRC 2009g
(g) Source: NRC 2009h
(h) Source: NRC 2009i
(i) Source: NRC 2009j
(j) Source: NRC 2009k
(k) Source: FERC 2008
(l) Source: Recovery.gov 2009
(m) Source: City of Aberdeen 2007
(n) Source: Dominion 2009
(o) Source: MAPP 2009

A portion of the site was used as a private school in the early 1900s. The U.S. Navy operated a training center on the site from 1942 to 1976. From 1978 to 1990, the U.S. Department of Labor

sponsored a Job Corps Center at the site. The Navy conducted a variety of cleanup operations at the site from 1988 to 1999. The property was transferred from the Navy to the Bainbridge Development Corporation in 2000. Approximately 60 structures remain on the site in varying stages of decay (MDE 2008). The site is currently used as a truck driving school and for archery deer hunting during the regulated hunting season. as a Maryland Cooperative Wildlife Management Area (CWMA).

The site is zoned Bainbridge Special Use. Industrial uses are permitted (Town of Port Deposit 2008). There are use restrictions covering the landfill cap for the landfill used by the Navy and use of groundwater where some contamination may remain (UniStar 2009a).

The majority of the elevation change on the site occurs near or along the bluff adjacent to the Susquehanna River. Within the interior of the site, the land is relatively level and could accommodate a new nuclear generating unit.

The nearest dedicated land (Federal, State, or Tribal) is Susquehanna State Park located approximately 3 mi northwest of Havre de Grace off Route 155 in Harford County.

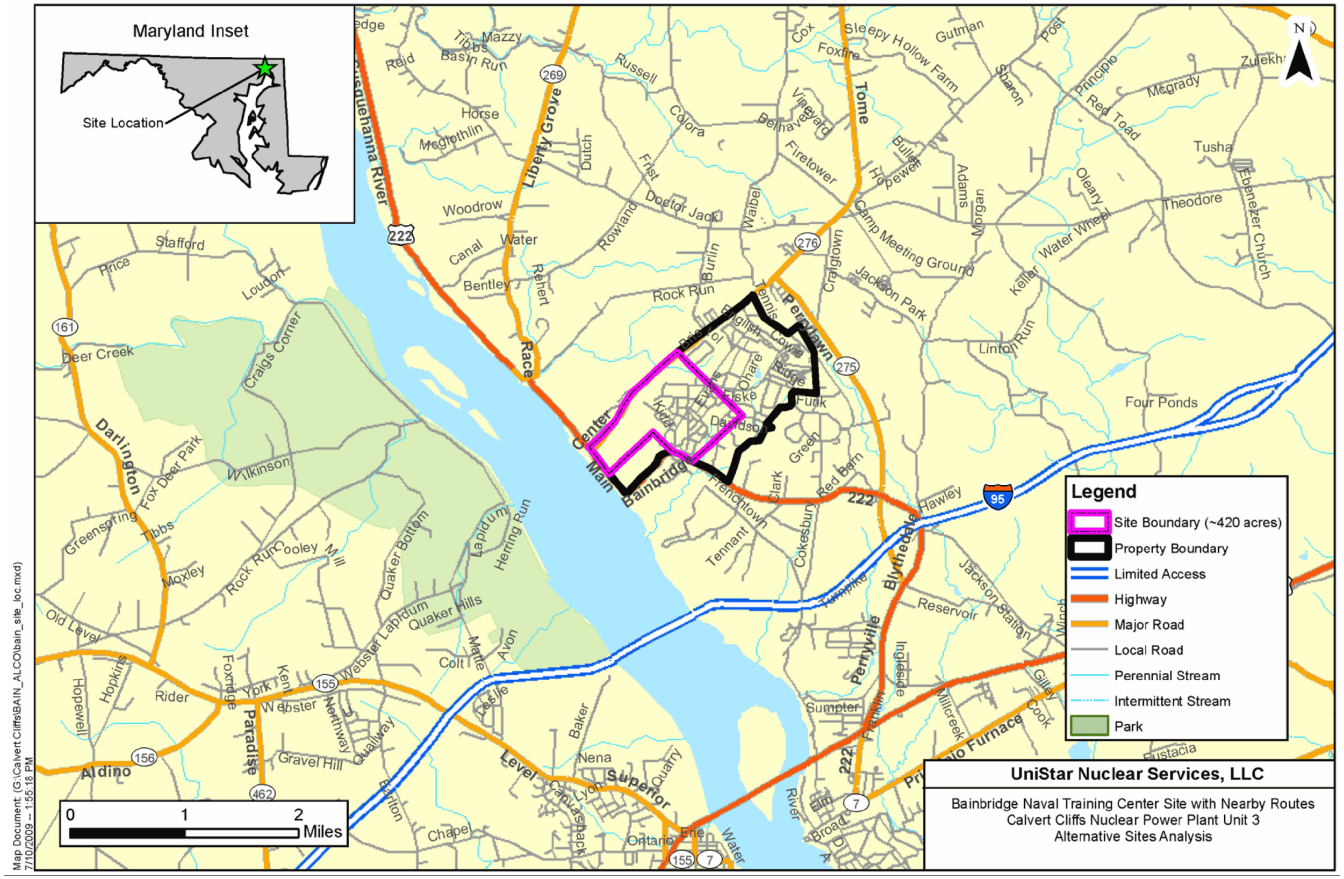

Figure 9-3. Site Location of the Bainbridge Naval Training Center (UniStar 2009a)

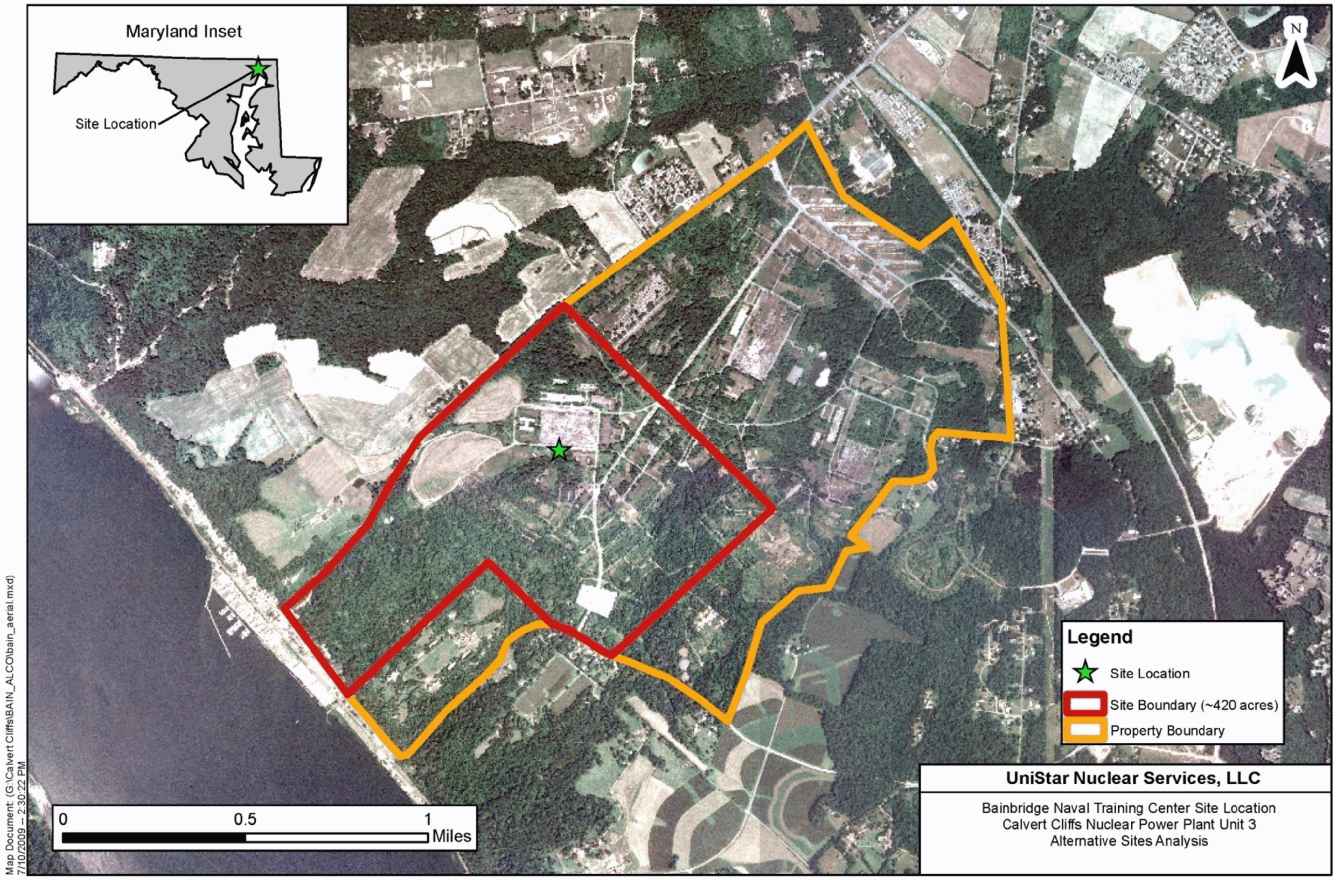

Figure 9-4. Vicinity of the Bainbridge Naval Training Center (UniStar 2009a)

If a new nuclear generating unit were constructed on the ~~site~~Bainbridge site, the 420–ac tract would be disturbed, and much of the mixed deciduous forest on the tract would be lost. In addition, some offsite land would be ~~impacted~~ affected to construct a pipeline to bring water for cooling to the site from the Susquehanna River. A pipeline from the river would need to cross railroad tracks and ~~several~~ a local road~~s~~ (UniStar 2009a).

Additionally, one or more new transmission corridors would be needed to connect the Bainbridge site to the grid. Four existing 500-kV transmission lines would be available for possible interconnection. One line is 5 mi north of the site, and the other three are between 10 and 20 mi from the site. There are five existing 230-kV transmission lines within 5 mi of the site, and there are six 230-kV transmission lines between 10 and 20 mi from the site (UniStar 2009a).

Because of the short distances to the transmission interconnections, the review team concludes that the land-use impacts of building and operating transmission lines for a new nuclear plant at the Bainbridge site would be minor.

Cumulative Impacts

For this cumulative land use analysis, the geographic area of interest is considered to be the 15-mi region surrounding the Bainbridge site. This area of interest includes the primary communities (Aberdeen, Havre de Grace, North East, and Perryville) that would be affected by the proposed project if it were located at the Bainbridge site.

The projects identified in Table 9-6~~Table 9-6Table 9-6~~ with the greatest likelihood of affecting land use in the geographic area of interest would be the Aberdeen Proving Ground Base Realignment and Closure (BRAC) and the Dominion/Antero pipeline. The Aberdeen Proving Ground BRAC would involve realignments through a combination of new construction, renovation, and reuse to accommodate incoming missions (U.S. Army 2007). Activities would be conducted on the existing Aberdeen Proving Ground site located about 8 mi southeast of the Bainbridge site. Some indirect offsite land use impacts may occur as a result of economic activity on the Aberdeen site. The Dominion/Antero pipeline route would pass approximately 10 mi northwest of the Bainbridge site. It would ~~impact~~affect a relatively narrow band of land within the review area. The Aberdeen BRAC and Dominion pipeline projects, along with other projects identified in Table 9-6~~Table 9-6Table 9-6Table 9-5 have or would contribute to~~, have contributed or would contribute to some decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas. Because the projects within the review area identified in Table 9-6~~Table 9-6Table 9-6Table 9-5~~

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would be consistent with applicable land-use plans and control policies, the review team considers the cumulative land-use impacts from the projects to be manageable. Due to the short distances to the transmission interconnections, the review team concludes that the cumulative transmission line land-use impacts of building and operating a new nuclear generating unit at the Bainbridge site would be minimal.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative land-use impacts of building and operating a new nuclear generating unit, including associated transmission lines, at the Bainbridge site would be SMALL. Land use impacts would be sufficiently minor to neither destabilize nor noticeably alter any important land use attribute.

Transmission Line Corridors

One or more new transmission corridors would be needed to connect the Bainbridge site to the grid. Four existing 500-kV transmission lines would be available for possible interconnection. One line is 5 -mi north of the site, and the other three are between 10 and 20 mi from the site. There are five existing 230-kV transmission lines within 5 mi of the site, and there are six 230-kV transmission lines between 10 and 20 mi from the site (UniStar 2009a).

Based on Because of the information it has availableshort distances to the transmission interconnections, the review team concludes that the cumulative transmission line land-use impacts of building and operating a new nuclear generating unit at the Bainbridge site would be SMALL to MODERATE.

9.3.4.29.3.3.2 Water Use and Quality

Water for the Bainbridge Site would be obtained primarily from the Susquehanna River. According to UniStar (2009a), the proposed plant would require the withdrawal of about 50 MGD for cooling and other uses; of. Of that total, about 27 MGD (42 cfs) would be consumed, and the remainder would be discharged back to the Susquehanna River. UniStar (2008b) states that the plant would use closed-cycle cooling with a cooling tower. The plant would have separate intake and discharge structures in the Susquehanna River. Discharge water would include cooling tower blowdown, treated process wastewater and, treated sanitary wastewater, and some radioactive water. The discharge would be at a slightly elevated temperature relative to the temperature of the Susquehanna River.

During a site visit on 19 August 2009, staff observed that the proposed location for the reactor would be the upper portion of the Bainbridge site, which is somewhat flat to undulating terrain. Moving westward toward the Susquehanna River, the terrain drops off more steeply until it reaches cliffs that abut the town of Port Deposit, which is on the river shoreline. There are several landfills on the Bainbridge site; landfill caps, deed restrictions, and groundwater use

restrictions apply. There are some minor surface water drainages on site, but no flow was observed. An approximately 3-ac pond was observed somewhat in the center of the site.

The Bainbridge site would require normal alterations, including grading, construction of roads, piers, jetties, and water intake and discharge structures in the Susquehanna River. Development of the intake/discharge pipes would affect the pipe corridor from the site to the river and would affect the river bed in the vicinity of the intake and discharge structures. Although the site is close to the river, UniStar (2008~~b~~9a) identified the potential need to build an onsite impoundment to provide an ultimate heat sink. UniStar estimates that the area and depth of such an impoundment would be approximately 4.7 ac and 25 ft, respectively (UniStar 2009a).

~~UniStar (2008b) states that ground water would not be used for operations, but may be needed temporarily for building activities. UniStar has not yet determined the quantities of water needed for development of this site. For this assessment, the review team assumed the groundwater requirement would be similar to those for Calvert Cliffs proposed Unit 3.~~

The average flow of the Susquehanna River at Conowingo Dam between October 1967 and August 2009 is 26,570 MGD (41,110 cfs) (USGS 2009~~; accessed).~~). The Bainbridge site is about 9 mi downstream of Conowingo Dam; in the vicinity of the site, the river is considered to be a tidal fresh water estuary. Water withdrawal for the proposed plant would represent less than 0.2 percent of average flow conditions at Conowingo Dam~~.~~; consumptive use would be less than 0.1 percent of the average flow. Although there appears to be sufficient water during average flow conditions, low-flow conditions could have the potential to impact plant operations. Such conditions are characterized using at a metric known as the 7Q10, which is the lowest 7-day average flow with a 10-year recurrence interval. UniStar (~~2009 |Alternative Site Evaluation|)~~2009e) reported a 7Q10 value for the Conowingo Dam of 2452 MGD~~.~~ (3793 cfs). Total water withdrawal would represent only two percent of the 7Q10 value. Consumptive use would be less, approximately 1 percent of the 7Q10 value. Withdrawals of water from the Susquehanna River require approval by the MDE Water Management Administration and the Susquehanna River Basin Commission. Given that the Susquehanna River near the Bainbridge site is tidally influenced, the water consumed by the plant will likely be ~~very~~quite small with respect to the existing resource.

The Bainbridge site has a shallow unconfined aquifer that overlies crystalline rock aquifers. The shallow aquifer is contaminated in some locations and deed restrictions limit its use. There are no known public or private wells that would be affected by the onsite contaminants. The crystalline rock aquifers could be used for potable water; median production rates in the region are 30 gpm. UniStar (2009a) states that groundwater would not be used for operations, but may be needed temporarily for building activities. UniStar has not yet determined the quantities of water needed for development of this site.

Building activities, including surface alterations and dewatering, have the potential to affect the local hydrology, but because the site has already been heavily developed, any impacts from building a nuclear power plant would be temporary and localized. ~~Groundwater from~~The groundwater resource in the deeper aquifers ~~would~~may be ~~much less~~temporarily affected by withdrawals for construction purposes but would not be affected during operations because this resource would not be used~~.~~ for that purpose.

Water quality alterations to the both the surface water and groundwater would be regulated by NPDES discharge and stormwater permits. BMPs would prevent or mitigate spills from altering surface or groundwater resource'~~s~~ quality. The nutrient load from the plant's sanitary effluent system would be a ~~very~~ minor contribution to the ~~Chesapeake Bay's~~Susquehanna River's cumulative nutrient load.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that although the local hydrology would be impacted, the ~~cumulative~~ impacts on regional surface and groundwater resources of building and operating a new nuclear generating unit at the Bainbridge site would be ~~SMALL~~minor.

Cumulative Impacts

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Bainbridge site is considered to be the drainage basin of the Susquehanna River upstream and downstream of the site because this is the resource that would be impacted by the proposed project. Key actions that have past, present, and future potential impacts to water supply and water quality in the Susquehanna River basin include the operation of the Peach Bottom Atomic Power Station Units 2 and 3 and other municipal and industrial activities in the Susquehanna River basin. For the cumulative analysis of impacts on groundwater, the geographic area of interest is the extent within Cecil County of the groundwater aquifers beneath the site.

Water Use. The surface-water-use impacts of building and operating a nuclear power plant at this site would be dominated by the demands that would occur under normal operation. As noted above, the impacts would be small relative to existing measures of water availability in the Susquehanna River; those measures reflect cumulative consumptive uses of current users upstream of the site.

The review team determined the consumptive use of water by the operation of a nuclear reactor at the Bainbridge site and all other consumptive uses (existing or likely future uses) could not plausibly alter the volume of water in the Susquehanna River in the vicinity of the Bainbridge site.

The review team is also aware of the potential climate changes that could affect the water resources available for cooling and the impacts of reactor operations on water resources for

other users. The impact of climate change on the water available at the Bainbridge site would be small because of the availability of water from the tidally influenced portion of the Susquehanna River.

Increases in consumptive use of water in the Susquehanna River drainage is anticipated in the future. The impacts of the other operational projects listed in Table 9-6Table 9-6Table 9-6 are considered in the analysis included above or would have little or no impact on surface water use.

Based on its evaluation, the review team concludes that the cumulative impacts to surface water would be SMALL.

The regional crystalline rock aquifer is not as productive as the coastal plain aquifers, which explains why there are no significant groundwater users near the Bainbridge site. The nearest town, Port Deposit, derives its water supply from the Susquehanna River. Therefore, the review team concludes that the cumulative impacts to the regional groundwater resource would be SMALL.

Water Quality. An MDE-issued NPDES permit would be required to operate the nuclear project at this site and would ensure that the discharges complied with the Clean Water Act. Point and non-point sources have impacted the water quality of the Susquehanna River upstream and downstream of the site. For example, elevated levels of nutrients, turbidity, and temperature have been observed upstream at the Conowingo Dam in 2007 and 2008. The impacts of other projects listed in Table 9-6Table 9-6Table 9-6 are either considered in the analysis included above or would have little or no impact on surface water quality. Therefore, the review team concludes the cumulative impact on surface water quality would be MODERATE.

The implementation of BMPs, the impacts on groundwater quality from building and operating a new nuclear unit at the Bainbridge site would be minimal. Regionally, the shallow and deep aquifers do not appear to be major groundwater resources. The impacts of other projects listed in Table 9-6Table 9-6Table 9-6 are either considered in the analysis included above or would have little or no impact on groundwater quality. Therefore, the review team concludes the cumulative impact on groundwater quality would be SMALL.

9.3.4.39.3.3.3 Terrestrial and Wetland Resources

The Bainbridge site is heavily vegetated and contains mixed deciduous forest stands in various stages of succession, scrub-shrub, and a small area dominated by grasses. Stands of mixed deciduous forest likely represent species known to occur in the region and may include tulip poplar (*Liriodendron tulipifera*), chestnut oak (*Quercus prinus*), and mountain laurel (*Kalmia latifolia*). More mature forest stands are present where forest was retained during the operation of the training facility. Young, regenerating forest and scrub-shrub scrub occupy an areas

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around former facilities and other areas formerly maintained as open space. A capped landfill covered with grass lies within the western site boundary.

Review of the National Wetlands Inventory data indicated there are a few small wetlands on the site (FWS 2008a). These wetlands total 4.6 ac (UniStar 2009: Sep25 RAI Response ML092730188|.2009f). In addition, there are a few small stream courses that amount to 8,6548654 linear feetft of stream on the site (UniStar 2009: Sep25 RAI Response ML092730188|.2009f). Although the site does not contain or border a water body suitable for supplying water to the cooling system, the site is 0.1-mi away from the Susquehanna River. However, access to the Susquehanna River would require construction of a pipeline, part of which would occur outside the existing site boundary.

Within Cecil County there are three Federal-ly listed animal species and one Federally listed plant (Table 9-7). None of these species have been observed or are known to occur on the site, and critical habitat has not been designated for any of these species. Each of these four species has very specific habitat requirements that would likely preclude any of them from occurring on the Bainbridge site. The Puritan tiger beetle (*Cicindela puritana*) lives only on bare bluffs with narrow beaches below, neither of which are on the Bainbridge site (FWS 1993: Puritan Tiger Beetle Recovery Plan|.). The bog turtle (*Glyptemys muhlenbergii*) prefers small (<2 -ac), open canopy sedge- or grass- -dominated meadows among forests, which also is not present on the site (FWS 2001: Bog Turtle Recovery Plan|.). The Delmarva fox squirrel (*Sciurus niger cinereus*) occurs in mature deciduous and mixed deciduous forests with a closed canopy and an open understory, and it generally occurs in forest stands associated with farmlands |FWS 2008: DelmarvaSquirrelFactSheet.pdf|.(FWS 2008b). Although both deciduous and mixed deciduous forest habitats are present on the Bainbridge site, these habitats are not mature and are not characterized by closed canopies with open understories. Since the specific habitat the Delmarva fox squirrel prefers is not present, it is highly unlikely this species is present on the Bainbridge site. Swamp pinkSwamp pink (*Helonias bullata*) is an obligate wetland plant that occurs along streams and seeps in freshwater swamps and other similar wetland habitats and is strongly associated with coniferous trees (FWS 1991: Swamp Pink Recovery Plan|.). Although there are limited wetland habitats presenthabitat exists on the Bainbridge site, like the other Federal-listed species, the specific habitat for this plant is freshwater swamps are not present on the Bainbridge site; this likely precludes the swamp pink from being found on the site.

Table 9-7—. Federally and State-Listed Terrestrial Fauna and Flora Listed as Threatened or EndangeredSpecies that Occur in Cecil County and May Occur on the Bainbridge Site or in the Immediate VicinitySiteVicinity

Scientific Name	Common Name	Federal Status	State Status
Cicindela puritana	Puritan Tiger Beetle	Threatened	Endangered

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Glyptemys muhlenbergii	Bog Turtle	Threatened	Threatened
Sciurus niger cinereus	Delmarva Fox Squirrel	Endangered	Endangered
Helonias bullata	Swamp Pink	Threatened	Endangered
Agalinis obtusifolia	Blunt-leaved Gerardia		Endangered
Agalinis setacea	Thread-leaved Gerardia		Endangered
Agrimonia striata	Woodland Agrimony		Endangered
Antennaria solitaria	Single-headed Pussytoes		Threatened
Arnica acaulis	Leopard's-bane		Endangered
Asplenium piddatifidum	Lobed Spleenwort		Endangered
Bromus latiglumis	Broad-glumed Brome		Endangered
Cardamine longii	Long's Bittercress		Endangered
Carex buxbaumii	Buxbaum's Sedge		Threatened
Carex hitchcockiana	Hitchcock's Sedge		Endangered
Carex hystericina	Porcupine Sedge		Endangered
Carex vestita	Velvety Sedge		Threatened
Castilleja coccinea	Indian Paintbrush		Endangered
Chenopodium standleyanum	Standley's Goosefoot		Endangered
Cicuta bulbifera	Bulb-bearing Water Hemlock		Endangered
Clematis occidentalis	Purple Clematis		Endangered
Corrallorhiza wisteriana	Wister's Coralroot		Endangered
Coreopsis tripteris	Tall Tickseed		Endangered
Deschampsia cespitosa	Tufted Hairgrass		Endangered
Desmodium pauciflorum	Few-flowered Tick-trefoil		Endangered
Desmodium rigidum	Rigid Tick-trefoil		Endangered
Dirca palustris	Leatherwood		Threatened
Elatine minima	Small Waterwort		Endangered
Eleocharis compressa	Flattened Spikerush		Endangered
Eleocharis halaphila	Salt-marsh Spikerush		Endangered
Epilobium ciliatum	Northern Willowherb		Endangered
Epilobium strictum	Downy Willowherb		Endangered
Equisetum fluviatile	Water Horsetail		Endangered

Table 9-7. (contd)

Scientific Name	Common Name	Federal Status	State Status
Equisetum sylvaticum	Wood Horsetail		Endangered
Eriocaulon aquaticum	Seven-angled Pipewort		Endangered

Table 9-7. (contd)

Scientific Name	Common Name	Federal Status	State Status
Eriocaulon parkeri	Parker's Pipewort		Threatened
Erythroniumalbidum	White Trout Lily		Threatened
Euphorbia purpurea	Darlington's Spurge		Endangered
Eurybia radula	Rough-leaved Aster		Endangered
Galium boreale	Northern Bedstraw		Endangered
Gentiana andrewsii	Finge-tip Closed Gentian		Threatened
Gentiana villosa	Striped Gentian		Endangered
Gentianopsis crinita	Fringed Gentian		Endangered
Haseola suaveolens	Sweet-scented Indian-plantain		Endangered
Helianthemum bicknellii	Hoary Frostweed		Endangered
Hydrastis canadensis	Goldenseal		Threatened
Iris prismatica	Slender Blue Flag		Endangered
Lathyrus palustris	Vetchling		Endangered
Limnobium spongia	American Frog's-bit		Endangered
Limosella australis	Mudwort		Endangered
Linum intercursum	Sandplain Flax		Threatened
Lithospermum latifolium	American Gromwell		Endangered
Lygodium palmatum	Climbing Fern		Threatened
Lysimachia hibrida	Lowland Loosestrife		Threatened
Matelea carolinensis	Anglepod		Endangered
Melanthium latifolium	Broad-leaved Bunchflower		Endangered
Minuartia michauxii	Rock Sandwort		Threatened
Pedicularis lanceolata	Swamp Lousewort		Endangered
Platanthera peramoena	Purple Fringeless Orchid		Threatened
Pluchea camphorata	Marsh Fleabane		Endangered
Polygala senega	Seneca Snakeroot		Threatened
Potamogeton zosteriformis	Flatstem Pondweed		Endangered
Purnus alleghaniensis	Alleghany Plum		Threatened
Pycnanthemum torrei	Torrey's Mountain-mint		Endangered
Pycnanthemum verticillatum	Whorled Mountain-mint		Endangered
Rhynchospora golbularis	Grass-like Beakrush		Endangered
Ruellia strepens	Rustling Wild-petunia		Endangered
Rumex altissimus	Tall Dock		Endangered
Salix exigua	Sandbar Willow		Endangered

Table 9-7. (contd)

Scientific Name	Common Name	Federal Status	State Status
Sanguisorba canadensis	Canada Burnet		Threatened
Scutellaria leonardii	Leonard's Skullcap		Threatened
Scutellaria nervosa	Veined Skullcap		Endangered
Sida hermaphrodita	Virginia Mallow		Endangered
Smilax pseudochina	Halberd-leaved Greenbrier		Threatened
Solidago speciosa	Showy Goldenrod		Threatened
Sphenopholis pensylvanica	Swamp-oats		Threatened
Spiranthes lucida	Wide-leaved Lady's' Tresses		Endangered
Sporobolus clandestinus	Rough Rushgrass		Threatened
Sporobolus heterolepis	Northern Dropseed		Endangered
Stachys aspera	Rough Hedge-nettle		Endangered
Stellaria alsine	Trailing Stitchwort		Endangered
Stenanthium gramineum	Featherbells		Threatened
Symphyotrichum depauperatum	Serpentine Aster		Endangered
Talinum teretifolium	Fameflower		Threatened
Thaspium trifoliatum	Purple Meadow-parsnip		Endangered
Triosteum angustifolium	Narrow-leaved Horse-gentian		Endangered
Triphora trianthophora	Nodding Pogonia		Endangered
Valeriana pauciflora	Valerian		Endangered

Source: Maryland DNR (MDNR 2007)

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The bald eagle (*Haliaeetus leucocephalus*~~), although not listed but~~) is protected by the Bald and Golden Eagle Protection Act~~,~~ and is also listed as threatened by the State of Maryland. There is no open water suitable for eagle foraging on the site. However, the section of the Susquehanna River where the Bainbridge site is located is a known bald eagle wintering area in Maryland ~~|Md DNR 2009: WEB_MdDNR Bald Eagle Fact Sheet.pdf|.~~(MDNR 2009b). Forest cover present on the bluff overlooking the Susquehanna River may be used by eagles for roosting or perching.

Ecologically important species that likely occur on the Bainbridge site include tulip poplar (*Liriodendron tulipifera*), chestnut oak (*Quercus prinus*), and mountain laurel (*Kalmia latifolia*). These three species are considered ecologically important because they are widespread, abundant, and contribute resources to many upland habitats.

Recreationally important species found on the Bainbridge site include white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallapavo*), ring-necked pheasant (*Phasianus colchicus*), and the northern bobwhite quail (~~*Latin name*~~*Colinus virginianus*). The white-tailed

deer and wild turkey can thrive in a habitat mosaic. The ring-necked pheasant and bobwhite quail prefer open habitats and would likely not be present in the local landscape without disturbance brought about by various land use practices, including agriculture.

Building and Operational Impacts

UniStar identified a representative 420-ac area within the Bainbridge site for the purposes of evaluating potential impacts of building a U.S. EPR nuclear power plant. If a plant were built within this footprint, ~~no~~mixed deciduous forest in various stages of succession, scrub-shrub, and recently disturbed grass-dominated habitats would be permanently lost. No onsite wetlands would be affected.~~; H~~~~however, 1557 linear feetft of stream, about 18 percent of the total on the Bainbridge site, would be affectedlikely be filled and graded~~ (UniStar 2009a). The water supply pipeline and intake structure would disturb approximately 1.32 ac of wetlands offsite. Also, a~~A~~pproximately 5.2 ac of ~~wetland and 3517 linear feetft of stream~~ wetlands would be affected by transmission line development.

The Bainbridge site is a Maryland CWMA that is open to deer hunting from September through January. A new reactor built on the Bainbridge site would necessitate closure of the CWMA on the site.

The Bainbridge site, although heavily vegetated, is mostly at an early to intermediate (seral) stage (in succession). The site does not provide suitable habitat for the Federally listed Puritan tiger beetle, bog turtle, and ~~the~~ swamp pink~~,~~ so these species would be affected little. The forests are not mature enough at this time to provide habitat for the Delmarva fox squirrel. However, if left to mature these forests may become suitable, so this species could lose potential future habitat. Installation of a cooling system pipeline to the Susquehanna River and transmission systems would ~~impact~~affect terrestrial resources, including wetlands and streams. ~~However, few if~~ Wintering bald eagles could be displaced during ~~construction and preconstruction~~building of these facilities. However, this displacement would be limited both spatially and temporally, and alternate roost and perch sites are likely along the lower Susquehanna River. Any disturbance of eagles is not expected to result in a decrease in eagle productivity. An extensive number of Maryland State-listed plants is found in Cecil County. Their distribution and abundance is unknown within the site and vicinity, and it is unknown to what extent any ~~high value~~of these species ~~c~~would be affected. Some are wetland specific, and as wetland impacts could be ~~somewhat limited~~avoided at this site, these species w~~c~~ould be expected to be affected less than upland species and habitat generalists. Because the site has experienced considerable disturbance in the past, State-listed species that occur in disturbed habitats, ~~are present.~~ such as the showy goldenrod (*Solidago speciosa*), could be noticeably affected. Populations of the three ecologically important species (tulip poplar, chestnut oak, mountain laurel), by their nature of being important due to abundance and distribution, would not be noticeably affected on the site and within the county. Recreationally important white-tailed deer, wild turkey, ring-necked pheasant, and bobwhite quail could lose some habitat from

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conversion to facilities~~,~~ but could also benefit from the temporary effects of disturbance to more mature habitats. However, these effects are not expected to be noticeable or destabilize even local populations of these animals.

Operational activities within the transmission corridors might include visual inspection and appropriate maintenance of transmission line corridors. Maintenance activities might include ~~re~~clearing vegetation and tree trimming or removal. For maintenance purposes, wooded sections of the corridors would be ~~re~~cleared to the full width through mechanical clearing, hand cutting, or herbicide application.~~ The Bainbridge site, although heavily vegetated, is mostly at an early seral stage and does not provide high quality habitat for~~

Terrestrial ecological impacts that may result from operation of a new nuclear unit at the Bainbridge alternative site include those associated with the cooling system and maintenance of transmission line corridors. ~~An evaluation of impacts resulting from operation of the cooling system, transmission lines, and transmission line corridor maintenance cannot be conducted in great detail because the type, number, and specific location of cooling towers at Bainbridge and locations of any Federal listed species. Wetlands are uncommon, and would not be extensively affected by new corridors that could result from transmission system upgrades has not been determined.~~ For impacts related to cooling system operations, the review team assumed ~~the number and type of~~one cooling tower as~~s~~ proposed for Unit 3 at the Calvert Cliffs site would be used at any of the alternative sites. In NUREG-1437 (NRC 1996), the NRC staff evaluated terrestrial ecological impacts resulting from operation of existing nuclear power plants and transmission line operation and maintenance. The types of terrestrial ecological impacts resulting from operation of a new nuclear unit would be similar to those of existing nuclear power plants. Conclusions in the NUREG-1437 (NRC 1996) were used to assess terrestrial impacts resulting from the operation of the cooling tower~~s~~ and impacts from transmission line corridor maintenance and operation where more specific information was not available. ~~Similarly~~Likewise, the effects of cooling tower drift~~ve~~, avian collisions, noise, and transmission lines would be similar to those described in Section 5.3.1.1 in which the operational impacts were determined to be undetectable at the population level.

Cooling Towers

The operation of a cooling tower results in the loss of water through evaporation and drift. Drift is described as small, unevaporated water droplets that are exhausted out the top of the tower. These droplets may carry minerals and chemicals that may impact crops, ornamental vegetation, and native plants. Adverse impacts from cooling tower drift cannot be evaluated in detail ~~in the absence~~without knowing the specific location of the cooling tower. However, general guidelines for predicting effects of drift deposition on plants suggest that many species have thresholds for visible leaf damage in the range of 9 to 18 lb/ac/mo of salt deposition on leaves during the growing season (NRC 1996). ~~The proposed Unit 3 cooling tower, which includes plume abatement, would be drawing salt/brackish water for cooling from the~~

~~Chesapeake Bay through a desalination facility.~~ The Susquehanna River would supply tidal freshwater to the Bainbridge site; therefore, the salt content in cooling water would be less at the Bainbridge site than at the proposed Calvert Cliffs site. Because the maximum salt deposition for the proposed Unit 3 is far below the level that could cause leaf damage in many common species, the impacts would be negligible both on the ~~Calvert Cliffs~~Bainbridge site and in the vicinity. One could expect even less impact at the Bainbridge site because the salt content in the cooling water source would be lower. In general, the impacts of drift on crops, ornamental vegetation, and native plants were evaluated for existing nuclear power plants and were found to be of minor significance (NRC 1996). ~~This determination also included nuclear power plants with more than one cooling tower.~~

Similarly, ~~detailed~~ predicting mortality from bird collisions with cooling towers depends on factors such as the height, location, lighting, and the number of cooling towers. In this case, a single, large mechanical draft cooling tower with plume abatement is proposed. The impacts of bird collisions for existing power plants were evaluated and found to be of minor significance for all operating nuclear plants, including those with various numbers and types of cooling towers (NRC 1996). On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling tower drift and bird collisions with the cooling tower resulting from operation of a new nuclear unit at Bainbridge would be minor.

Typical noise levels that can be expected at a distance of 1300 ft from the cooling tower are 65 dBA (UniStar 2009a). Noise from plant operation would also be quickly attenuated by surrounding forest cover, further limiting any impact. Local wildlife would likely adapt to noise levels, while cooling tower noise may also serve to limit the potential for avian collision. Consequently, the review team concludes the impacts of cooling tower noise on wildlife would be minimal at Bainbridge.

Transmission Lines

The impacts associated with transmission line operation consist of bird collisions with transmission lines and electromagnetic field (EMF) effects on flora and fauna. The impacts associated with building transmission lines and corridor maintenance activities~~. The potential for construction, preconstruction,~~ are alteration and/or ~~operation of a~~conversion of habitat due to tree cutting and herbicide application and similar related impacts such as use of temporary matting where corridors cross floodplains, wetlands, and other important habitats.

Direct mortality resulting from birds colliding with tall structures has been observed (Avatar 2004). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight by flocking birds during darkness has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play ~~a~~ roles in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be

particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). However, in NUREG-1437, the NRC staff concluded that the threat of avian collision as a biologically significant source of mortality is very low as only a small fraction of total bird mortality could be attributed to collision with nuclear power plant ~~to~~ structures, including transmission corridors with multiple transmission lines (NRC 1996). Although collision may contribute to local losses, thriving bird populations can withstand these losses without threat to their existence (Brown 1993). Although additional transmission lines would be required for a new nuclear unit at Bainbridge, increases in bird collisions would be minor, and these would likely not be expected to cause a measurable reduction in local bird populations. Consequently, the incremental direct mortality posed by the addition of new transmission lines for a new nuclear unit would be negligible at Bainbridge.

EMFs are unlike other agents that have an adverse impact ~~listed~~(e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). The impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines and lines energized at levels less than 765 ~~-~~kV (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by operation of existing transmission lines and the addition of new lines for a new nuclear unit would be negligible at the Bainbridge alternative site.

Existing roads providing access to the existing transmission line corridors at Bainbridge would likely be sufficient for use in any expanded corridors; however, new roads would be required during the development of new transmission line corridors. Transmission line corridor management activities (cutting and herbicide application) and related impacts to floodplains and wetlands in transmission line corridors are of minor significance at operating nuclear power plants, including those with transmission line corridors of variable widths (NRC 1996). Consequently, the incremental effects of transmission line corridor maintenance and associated impacts to floodplains and wetlands for a new nuclear unit would be negligible at Bainbridge.

For reasons discussed above, detectable impacts to important terrestrial species ~~is limited. Wintering bald eagles could be displaced during construction~~and habitat would be minimal, if any, at the Bainbridge site. Therefore, impacts to terrestrial resources, including wetlands, from ~~construction, preconstruction,~~building and ~~operation. However, this displacement would be limited both spatially and temporally and alternate roost and perch sites are likely along the lower Susquehanna River. Any disturbance of eagles is not expected to result in a decrease in eagle productivity of~~operation of a nuclear power plant at the Bainbridge site would be SMALL.

Other Projects (discussion to be provided):

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the ***Cumulative Impacts***

The geographic area of interest for the assessment of the potential cumulative aquatic ecology impacts of terrestrial and wetland resources of building and operating a new nuclear unit reactor at the Bainbridge site would be SMALL.

9.3.4.4 Aquatic Resources

The Susquehanna River, whichon terrestrial resources and wetlands is about 0.1 mi from the site, would provide the cooling water for a new nuclear plant at Bainbridge (UniStar 2009a). The lower Susquehanna River is classifieddefined as tidal freshwater from the river mouth to the Conowingo Dam with very little salt wedge intrusion from the Bay (MDE 2008) |MDE 2008 LowerSusquehanna WaterReport.pdf|. This part of the river and its tributaries located in Harford and Cecil Counties comprise the Lower Susquehanna River watershed. A new reactor on the Bainbridge site would require a new cooling water intake and discharge system.

The Susquehanna River is the largest and most important aquatic resource near the proposed new plant. Other aquatic communities within the site include at least two small, temporary streams and a small reservoir that was built as a drinking water source for previous tenants on the property. The onsite resources have not been characterized. However, during a site visit on 19 August 2009, it was observed that flow in the streams was very minimal or non-existent. The reservoir has not been studied but probably is inhabited by species typical for such small freshwater impoundments.

County, Maryland, because the extent of terrestrial impacts is mostly localized and the site is several miles from neighboring counties. The nearest managed area is the Susquehanna State Park, which is on the western shore of the Susquehanna River about 1 mi northwest of the Bainbridge site. The park is primarily a recreational area but also contains several historical sites. The primary impacts to the Susquehanna State Park would likely be exposure of wildlife to noise from building a new plant. The Bainbridge site is a Maryland Cooperative Wildlife Management Area (CWMA) that is open to deer hunting from September through January. The primary impacts to the Susquehanna State Park would likely be noise from building a new plant. A new reactor built on the Bainbridge site would necessitate closure of the CWMA on the site. The Port Deposit Chamber of Commerce co-sponsors a hydroplane race series on the Susquehanna River that has been held on Labor Day weekend. The race course is located just offshore along the river south of Port Deposit (PDCC 2009a) |CC Website Record Ragin on the River Race.pdf| and would be near potential locations for intake/discharge structures. No major development activities are proposed that would significantly contribute to the loss or degradation

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of terrestrial resources or wetlands within the foreseeable future in Cecil County. Construction of the Rock Springs Generation Facility in the early 1990's did not significantly ~~impact~~affect county terrestrial resources or wetlands. Continued urbanization and global warming have the potential to alter and reduce the amount of terrestrial habitat and wetlands available to flora and fauna, including Federally -listed species, and the building of a plant at the Bainbridge site would contribute to habitat modification and loss. However, since much of the impact resulting from building a power plant at Bainbridge would occur in recently disturbed habitats that are not occupied and likely would not be occupied by Federally listed species in the near future, the incremental impacts would not be noticeable and would not be expected to destabilize flora and fauna populations ~~at the county scale~~in the geographic region of interest.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative impacts to terrestrial and wetland resources of building and operating a new nuclear unit that would be attributable to permanent conversion of habitat for the facility footprint as well as operation of the cooling tower~~s~~, transmission lines, and transmission line corridors at the Bainbridge alternative site would be SMALL.

9.3.3.4 Aquatic Resources

The Susquehanna River, which is about 0.1 mi from the site, would provide the cooling water for a new nuclear plant at Bainbridge (UniStar 2009a). The lower Susquehanna River is classified as tidal freshwater from the river mouth to the Conowingo Dam with little salt wedge intrusion from the Bay (MDE 2008c). This part of the river and its tributaries located in Harford and Cecil Counties comprise the Lower Susquehanna River watershed. A new reactor on the Bainbridge site would require a new cooling water intake and discharge system.

The Susquehanna River is the largest and most important aquatic resource near the proposed new plant. The river is well known as a pathway for several species of migratory anadromous and catadromous fish, including striped bass (*Morone saxatilis*), white perch (*M. americana*), yellow perch (*Perca flavescens*), alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), hickory shad (*A. mediocris*), American shad (*A. sapidissima*), and American eel (*Anguilla americana*) (NMFS 2009). The area near Port Deposit is valued because it is good spawning habitat for species with eggs that are deposited on the bottom and historically has had dense beds of submerged aquatic vegetation (SAV) that may reach 100 ft toward the river channel (NMFS 2009).

Other aquatic communities within the site include at least two small, temporary streams and a small reservoir that was built as a drinking water source for previous tenants on the property. The onsite resources have not been characterized~~.~~, but the few small stream courses amount to 8654 linear ft (UniStar 2009f). However, during a site visit on 19 August 2009, it was observed that flow in the streams was minimal or non-existent. The reservoir has not been studied~~,~~ but probably is inhabited by species typical for such small freshwater impoundments.

The potential for impacts from building and operating of the proposed new reactor at Bainbridge to aquatic biota would be primarily to organisms inhabiting the streams and pond on the site and the Susquehanna River.

Commercially or Recreationally Important Species

The stretch of the Susquehanna River between the Conowingo Dam and Havre de Grace is a popular recreational fishing area. The primary species sought are shad, herring, and striped bass (locally called rockfish). However, the Port Deposit area of the Susquehanna River is upstream of designated essential fish habitat for Federally managed species (under the Magnuson-Stevens Fishery Conservation and Management Act [MSA]).

American Shad (*Alosa sapidissima*). The American shad, which is discussed in detail in Section 2.4.2, is an important part of the history of the Susquehanna River. The shad is an anadromous fish that enters the Susquehanna River to spawn. Shad fishing around Port Deposit, which is considered a "hot spot" for shad, begins in late spring (HPD 2009~~) |CC Website Record Port Deposit fishing.pdf|.~~). Shad also contribute ecologically by linking estuarine, freshwater, and terrestrial ecosystems.

River Herring (*Alosa pseudoharengus* and *A. aestivalis*). The alewife ~~(*A. pseudoharengus*)~~ and blueback herring ~~(*A. aestivalis*)~~ are closely related and together are called river herring. Both are discussed in detail in Section 2.4.2. Although river herring population levels have declined substantially during the last 30 years, there is still some recreational fishing for the species. ~~Near Port Deposit, fishers use dip nets to catch river herring (HPD 2009) |CC Website Record Port Deposit fishing.pdf|.~~ River herring occur nearshore in the Port Deposit area where they comprise a recreational dip-net fishery (HPD 2009). Both species were recorded during entrainment and impingement studies conducted at the CCNPP Units 1 and 2 (discussed in Section 5.3.2) and would be expected to be susceptible to both impacts by a cooling water system for a new reactor built at the Bainbridge site.

Striped Bass (*Morone saxatilis*). Striped bass, which is discussed in detail in Section 2.4.2, is a popular commercial and recreational species throughout the Chesapeake Bay region. Both fisheries are tightly regulated as the result of substantial population declines that occurred in the latter 1900s. Catch-and-release recreational fishing begins in mid s ~~S~~pring in the Port Deposit area (HPD 2009~~) |CC Website Record Port Deposit fishing.pdf|.~~). The Port Deposit Chamber of Commerce co-sponsors a rockfish tournament in the early summer (PDCC 2009b~~) |CC Website Record PD rockfish tournament.pdf|.~~). Striped bass spawn at the Susquehanna flats near Port Deposit (HPD 2009~~) |CC Website Record Port Deposit fishing.pdf|.~~).

Non-Native and Nuisance Species

The zebra mussel (*Dreissena polymorpha*), the Asian clam (*Corbicula fluminea*), and the rusty crayfish (*Orconectes rusticus*) are three introduced nuisance species that have been recorded in sections of the Susquehanna River, although not specifically near Port Deposit. The zebra mussel has been found at the Conowingo Dam (Vanesky 2009~~) |BB Website Record Mangan zebra mussel 1-6-09.pdf|.~~). The zebra mussel colonizes hard substrates and is capable of clogging intake water pipes. The Asian clam inhabits soft sediments and has been recorded from the Susquehanna River below the Conowingo Dam and at the river mouth near Havre de Grace (Foster et al.~~ 2009) |CC Website Record Foster 09 asian clam fact sheet.pdf|.~~ 2009). Large aggregations of Asian clams can foul power plant water systems. The rusty crayfish is native to the Ohio River basin but has been found in the stretch of the Susquehanna River at the mouth of Conowingo Creek, about 4 mi upriver from Port Deposit (MDNR ~~2007l) |CC Website Record MDNR 07 rusty crayfish.pdf|.~~2007l). Maryland banned the possession of any crayfish species in the Susquehanna River basin in 2008 (MDNR ~~2009 jj) |CC Website Record MD crayfish ban.pdf|.~~2009e).

~~Critical Habitats~~

~~There is one Federally threatened or endangered aquatic species, shortnose sturgeon (*Acipenser brevirostrum*), reported near the Bainbridge site (MDNR 2007j). However, no critical habitat has been designated by the FWS or National Oceanic and Atmospheric Administration (NOAA) for the species (FWS 2009) |CC Website Record shortnose sturgeon spp profile.pdf|.~~

Federally and State-Listed Species

One Federally listed endangered aquatic species, the shortnose sturgeon (*Acipenser brevirostrum*) ~~(*Acipenser brevirostrum*)~~ is reported for Cecil County (MDNR ~~2007k) |MD DNR Cecil County T-E animals-plants.pdf|.~~2007c), but no critical habitat has been designated for that species. River herring ~~(*Alosa pseudoharengus* and *A. aestivalis*)~~ are considered species of concern by the National Marine Fisheries Service (NMFS 2007~~) |NMFS 07 riverherring_detailed.pdf|.~~). State-listed aquatic vertebrates reported from Cecil County are the northern map turtle (*Graptemys geographica*), the hellbender (a salamander, *Cryptobranchus alleganiensis*), and the logperch (*Percina caprodes*) (MDNR 2007~~k~~c). State-listed freshwater mussel species reported from Cecil County are the eastern lampmussel (*Lampsilis radiata*), the tidewater mucket (*Leptodea ochracea*), and the creeper (*Strophitus undulatus*) (MDNR 2007~~k~~c).

Shortnose Sturgeon (*Acipenser brevirostrum*). The shortnose sturgeon is discussed in detail in Section 2.4.2 and in the BA prepared for this project (Appendix F). Shortnose sturgeons that might occur in the Susquehanna River near the Bainbridge site would most likely be part of the small population that remains in the Chesapeake Bay. NMFS considers the reach of the

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Susquehanna River downriver from the Conowingo dam as important shortnose sturgeon feeding habitat (NMFS 2009). Although recent shortnose sturgeon spawning has not been documented in the Chesapeake Bay or its tributaries (FWS 2009b), the area near Port Deposit may be suitable for spawning.

~~River Herring (*Alosa pseudoharengus* and *A. aestivalis*). River herring are discussed in detail in Section 2.4.2. River herring occur nearshore in the Port Deposit area where they comprise a recreational fishery. Both species were recorded during entrainment and impingement studies conducted at the CCNPP Units 1 and 2 (discussed in Section 5.3.2) and would be expected to be susceptible to both impacts by a cooling water system for a new reactor built at the Bainbridge site.~~

Northern Map Turtle (*Graptemys geographica*). The northern map turtle ranges predominantly from the central Midwest along the Mississippi and Ohio Rivers to southern Ontario, with scattered, disjunct populations in Pennsylvania, New Jersey, New York, and Maryland (Richards and Seigel 2009~~) |Richards 09 map turtle SQR.pdf|.~~). In Maryland, the northern map turtle population, which is listed as State endangered, is restricted to the Susquehanna River. Map turtles are sexually dimorphic with females reaching carapace lengths of about 10 in., which is almost twice as long as males (Roche 2002~~) |Roche 2002 northern map turtle status report COSEWIC.pdf|.~~). The map turtle lives in rivers and lakes, where there is relatively low water flow, muddy substrates, and places to bask (Roche 2002). Map turtles only leave the water for basking or egg laying (Roche 2002). Adult turtles tend to inhabit the deeper parts of rivers away from shore, whereas turtles smaller than 2.5 in. stay in shallow waters near shore. Female map turtles eat mainly large snails and clams, whereas males eat small mollusks, crayfish, and insects. Nesting in the lower Susquehanna River occurred in June and July (Richards and Seigel 2009). Map turtles typically do not migrate long distances.

Richards and Seigel (2009) found that turtles occurred throughout the small Maryland part of the Susquehanna River, but the most ~~that they~~ tracked were within an area next to several islands off the Susquehanna State Park, about 1.2 mi northwest of Port Deposit. These islands served as nesting habitat. This study tracked o~~O~~ne individual ~~was tracked~~ from the islands to the eastern shore of the river to an area about 1 mi past the marina at Port Deposit, which indicates that the area near the proposed intake at the Bainbridge site provides suitable habitat for a larger portion of the Maryland population of the northern map turtle. Six nesting sites were observed at unspecified locations along the eastern shore of the river near Port Deposit. Richards and Seigel (2009) reported that juvenile and hatchling map turtles frequently use the marina at Port Deposit.

Hellbender (*Cryptobranchus alleganiensis*). The eastern hellbender is a fully aquatic salamander listed as endangered by the State. The hellbender can reach a length of about 29 in., and may live as long as 30 years (Mayasich et al.~~ 2003) |Mayasich 2003 eastern hellbender status.pdf|.~~ 2003). Although the historical range of the hellbender includes the Susquehanna

River, it apparently no longer resides in portions of the river within Maryland (Mayasich et al. 2003, MDNR ~~2006) |CC Website Record MDNR 2006 Hellbender.pdf|.~~2006a).

Logperch (*Percina caprodes*). Maryland lists the logperch as State-threatened species (MDNR 2007~~a~~c). Logperches can reach a length of about 5 in. and live on muddy to rocky bottoms in large rivers, or in tributaries that flow into large rivers, generally occurring in water deeper than about 4 ft (Steiner 2000~~) |Pennsylvania Fishes book|.~~). Spawning occurs in shallow water during late spring to early summer. A study of streams in the lower Susquehanna River basin recorded logperches from only two sites, both small tributaries of the Susquehanna River at least 10 mi upriver from Port Deposit (Millard et al. 1999~~) |Millard 1999 MDNR lower Susquehanna River status.pdf|.~~). Neely and George (2006)~~ |Neely 06 greenside darter Susquehanna R.pdf|~~ made anecdotal reference to the occurrence of the species in Conowingo Creek, which joins the Susquehanna River about 4 miles upriver from Port Deposit. Near (2008)~~ |Near 2008 logperch synonymy.pdf|~~ presented evidence that the species inhabiting the lower Susquehanna River basin should be called the Chesapeake logperch (*P. bimaculata*), which has been considered a subspecies of logperch (*P. caprodes*). The removal of the Chesapeake logperch from synonymy with the logperch has important meaning for conservation of the species because the distribution of the Chesapeake logperch is much more restricted, and its populations are much smaller~~,~~ than those of the logperch. Near (2008) argued that the Chesapeake logperch should be considered for protection under the ~~ESA.~~Endangered Species Act (ESA). The possible occurrence of the Chesapeake logperch within the mainstem Susquehanna River near the Bainbridge site is not known but cannot be discounted.

Eastern Lampmussel (*Lampsilis radiata*). The eastern lampmussel, which occurs in coastal freshwaters from south Carolina to Nova Scotia, is a moderately large freshwater mussel that can reach a length of about 4 in. (PANHP 2009a~~) |PA NHP eastern lampmussel fact sheet.pdf|.~~). It typically occurs in streams and rivers with sand or gravel bottoms. Maryland ranks the eastern lampmussel as State Uncertain (MDNR 2007~~a~~c). Within Cecil County, the mussel is generally shown as occurring in piedmont streams, coastal plain streams, and piedmont rivers that are tributaries of the Susquehanna River (MDNR 2005~~) |MDNR 2005 WCDP_Chapter4_Part4_20050926.pdf|. Its~~). The eastern lampmussel's possible occurrence in the Susquehanna River near the Bainbridge site is not known.

Tidewater Mucket (*Leptodea ochracea*). The tidewater mucket occurs in coastal freshwaters from Georgia to Nova Scotia (ME DIFW 2003~~) |Maine 2003 tidewater_mucket.pdf|. This mussel can reach a length of about 3 in., and inhabits several types of substrates in low-flow stretches of rivers, lakes, and ponds. Maryland ranks the eastern lampmussel as Highly State Rare/State Rare (MDNR 2007a). Within Cecil County, the mussel is generally shown as occurring in coastal plain streams and piedmont rivers that are tributaries of the Susquehanna River (MDNR 2005) |MDNR 2005 WCDP_Chapter4_Part4_20050926.pdf|. Its possible occurrence in the Susquehanna River near the Bainbridge site is not known.~~

~~Tidewater Mucket (*Leptodea ochracea*). The tidewater mucket occurs in coastal freshwaters from Georgia to Nova Scotia (ME DIFW 2003) |Maine 2003 tidewater_mucket.pdf|.~~). This mussel can reach a length of about 3 in., and inhabits several types of substrates in low-flow stretches of rivers, lakes, and ponds. Maryland ranks the eastern lampmussel as Highly State Rare/State Rare (MDNR 2007~~,~~c). Within Cecil County, the mussel is generally shown as occurring in coastal plain streams and piedmont rivers that are tributaries of the Susquehanna River (MDNR 2005~~) |MDNR 2005 WCDP_Chapter4_Part4_20050926.pdf|.~~). Its possible occurrence in the Susquehanna River near the Bainbridge site is not known.

Creeper (*Strophitus undulatus*). The creeper is a freshwater mussel that occurs in the shallow waters of rivers and streams in the eastern half of the U.S. and Canada (Nedeau 2007~~) | |.~~). The species usually occurs on gravel and sand river bottoms where currents are low to moderate and many fish species are present (Nedeau 2007). Maryland ranks the species as State ~~i~~Imperiled (MDNR 2007~~,~~c), although elsewhere populations may be stable (Grabarkiewicz and Davis 2008~~) |EPA-260-R-08-015AnIntroductiontoFreshwaterMusselsasBioindicators.pdf|.~~).

~~Based on distributional records and life-history information, the staff concludes that building a new unit at the Bainbridge site could temporarily affect the State-listed northern map turtles that may be near the intake/discharge system location. The use of the nearshore habitat by smaller map turtles would make potential impingement within the CWS during the operation of a plant at the site a primary concern.~~

Building and Operation Impacts

Building a new reactor on the Bainbridge site would directly affect the two small streams~~, but not the reservoir~~. About 1557 linear ~~feet~~ft of stream channels would be affected by building a new plant on the site (UniStar 2009a). Assuming that the plant design would be similar to that proposed for CCNPP Unit 3, a new plant would permanently add about 130 ac of impervious surface to the Bainbridge site, which would increase runoff during storms potentially increasing erosion and adding pollutants to aquatic resources. The potential impacts of the proposed activities on the upland aquatic resources primarily would be loss of stream habitat, but building and operation~~it~~ would not adversely affect the overall upland aquatic resources in the region.

New cooling water intake and discharge structures would be required at the Bainbridge site. The intake and discharge structures are assumed to be designed like those at the proposed site having no return system at the intake pipe openings, which lead to a common forebay (see Chapter 3). Although the Bainbridge site is about 0.1 mi from the Susquehanna River, a pipeline for the cooling water system would be considerably longer because of the 142-ft high bluffs that border the western part of the site. An exact pipeline route has not been determined, but the pipeline would most likely cross one or more small streams ~~enroute~~en route to the river. ~~Building a new intake would result in the temporary displacement of aquatic biota within the vicinity of the intake. It is expected~~ UniStar (2009f) estimated that ~~these biota would return to~~

the area ~~after building is complete. Some silt runoff could occur during development and could impact local fish and benthic populations. However, the impacts on aquatic organisms would be temporary and largely be mitigated through the use of BMPs. The type of substrate on~~ of the river ~~bottom at possible intake/discharge locations is not known. The~~ below ordinary high water that would be affected by the installation of the ~~intake and discharge system in soft sediment areas would involve dredging, the potential impacts of which are discussed in Section 4.3.2.1.~~CWIS would be 0.23 ac. Historically, t~~T~~he river bottom in the Port Deposit area is ~~thought to be~~ hard bottom that supports SAV beds (NMFS 2009). Building a new intake could convert ~~the~~some river bottom to habitat that cannot support SAV, thus affecting reproductive habitat for anadromous species. Adverse effects on the reproductive potential of anadromous species would have indirect effects on Federally managed species (under MSA) that prey on such anadromous species (NMFS 2009). Installation of the intake/discharge structures on hard-bottom substrates could involve the use of cofferdams and dewatering, which would introduce pile-driving noise, ~~which is~~ discussed in Section 4.3.2.1, as a potential impact. Some silt runoff could occur as the intake is built and could affect local fish and benthic populations. However, the impacts on aquatic organisms would be temporary and largely be mitigated through the use of BMPs.

The eastern shore of the Susquehanna River south of Port Deposit, where the intake/discharge system might be placed, is frequented by the State-endangered northern map turtle, including hatchlings and juveniles, during the summer months. Building activities during those months could adversely affect the Maryland ~~species~~population. Based on distributional records and life-history information, the review team concludes that building a new unit at the Bainbridge site could ~~temporarily~~ affect the State-listed northern map turtles that may be near the intake/discharge system location. The use of the nearshore habitat by smaller map turtles would make potential impingement and entrapment within the CWS during the operation of a plant at the site a primary concern.

~~New transmission lines would be needed to connect a new reactor on the Bainbridge site to existing lines that are about 5 to 20 mi from the site (UniStar 2009a). A specific route for the new right-of-way has not been specified. The severity of impacts would depend on the characteristics of the aquatic resources within the corridor, but the use of BMPs during building and operation would lessen the potential impacts.~~

The most likely effects on aquatic populations from operation of a new nuclear unit at the Bainbridge site would be the impingement, ~~and~~ entrainment, and entrapment of organisms from the Susquehanna River. The potential entrainment and entrapment of anadromous fish eggs and larvae is of particular concern because of direct effects on the anadromous species and indirect effects on their Federally managed predators (NMFS 2009).

Assuming that a new reactor at the Bainbridge site would use a closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities (66 FR 65256), has a maximum

through-screen velocity of 0.5 ft/s (0.15 m/s) at the cooling water intake structure on the Susquehanna River, and meets the appropriate EPA intake flow-to-source water volume criterion, then adverse impacts at the population level of to most Susquehanna River aquatic species populations from entrainment and impingement, entrainment, and entrapment would not be anticipated. However, some migratory species, such as river herring and American shad, which have valuable reproductive and nursery habitat near the proposed intake area for the Bainbridge site and have been entrained or impinged at CCNPP Units 1 and 2, could be directly affected by losses at the intake structure in the tidal freshwater portion of the Susquehanna River. HowevertAdditionally, hatchling and juvenile northern map turtles are smaller than the spacing between the trash bars proposed for CCNPP Unit 3 and would be susceptible to impingement and impingemententrapment in the common forebay, which would not provide suitable habitat for the northern map turtle. To avoid adverse effects to the map turtle, the intake structure would likely have to be redesigned or sited elsewhere.Some migratory species, such as river herring and American shad, which are known to have been entrained or impinged at CCNPP Units 1 and 2, also could be affected by the intake structure for a plant on the Bainbridge site.

Although a discharge plume has not been modeled for the Bainbridge site, the Susquehanna River is a large and deep water body at that location, and the review team assumes the plume would bewould be similar in areal extent and depth to that modeled for the Calvert Cliffs site. Therefore, the plume would likely be relatively small compared to the river size in the area, and t here would not likely be a thermal barrier to fish passage. Additionally,and the potential for adverse impacts from cold shock or heat shock because of exposure to the thermal plume would smallminor. There would not be a thermal barrier to fish passage. Chemical concentrations in the effluents from the Bainbridge plantsite, which eventually could include a molluskicide to control zebra mussels, would be required to follow permitted guidelines.

New transmission lines would be needed to connect a new reactor on the Bainbridge site to existing lines that are about 5 to 20 mi from the site (UniStar 2009a). A specific route for the new right-of-way has not been specified, but approximately 3517 linear ft of streams would be affected by development of new transmission line corridors (UniStar 2009a). The severity of impacts would depend on the characteristics of the aquatic resources within the corridor, but the use of BMPs during building and operation would lessen the potential impacts.

Overall, the impact of construction building and operatingon of a new reactor on the Bainbridge site to most aquatic resources, including those in the Susquehanna River, would be SMALL.MODERATEsubstantial because of noticeable alterations to important reproductive habitat potential impacts to for migratory fish and SAV. HowevertAdditionally, the potential impact to the State e-eEndangered northern map turtle, primarily from the potential for impingement and entrapment of hatchlings and juveniles, would be MODERATE to LARGEnoticeable and possibly destabilizing to the Maryland population.

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Cumulative Impacts

The geographic area of interest for the assessment of the potential cumulative aquatic ecology impacts of building a new reactor at the Bainbridge site on aquatic resources is defined as the stretch of the Susquehanna River from the Conowingo Dam to the Chesapeake Bay, the tributaries that flow into the river below the dam, and the tidal freshwater part of the Bay where salinity ranges from 0 to 0.5 parts per thousand. The bayward extent of tidal freshwater varies seasonally, extending to near the mouth of the Sassafras River (CBP 200~~8~~9). Within this defined area, a new reactor on the Bainbridge site would add to the effects resulting from the operation of the Conowingo Hydroelectric ~~Station~~Plant, which is about 10 mi upriver. The Conowingo Dam affects aquatic resources in the Susquehanna River primarily by introducing variation in river water levels and flow, changing water quality, and directly ~~impacting~~ affecting aquatic biota, especially fish (Patty ~~1999) |Patty 99 MD power plant Chesapeake.pdf|.~~et al. 1999). The major impact to fish has been the interruption of the migration of anadromous fish, although that has been somewhat ameliorated by the installation of fish lifts and ladders, which has increased the number of fish passing the dam (NRC 2003~~) |Peach Bottom EIS sr1437s10.pdf|.~~). Low dissolved oxygen levels are the main water quality impact from the dam, which have been corrected by the implementation of turbine venting that mixes air with water passing through a turbine (Patty et al. 1999). Low water flow over the dam adversely affects benthic communities downstream and the operators of the dam are required to release water to maintain minimum flow rates, which can vary seasonally (SRBC 2006~~) |SRBC 06 ConowingoMngmtRpt_LR.pdf|.~~). The Mid-Atlantic Express Pipeline Project would build an 88-mi-long liquefied natural gas pipeline from Baltimore to Eagle, Pennsylvania. The pipeline would use horizontal directional drilling to cross the Susquehanna River upriver of the Conowingo Dam (AES no date) ~~|AES Brochure all 2ndround changes Mid-Atlantic_handout_Rev2a_final_email.pdf | and would not interact with a new reactor on the Bainbridge site.~~and would not interact with a new reactor on the Bainbridge site. Port Deposit has a small-boat marina located just upriver from the potential location of the intake and discharge system. Activities associated with operating boats in the marina and nearby waters could affect species that might be affected by the intake and discharge system. One such activity is the hydroplane race series on the Susquehanna River held on Labor Day weekend. The race course is located just offshore along the river south of Port Deposit (PDCC 2009a) and would be near potential locations for intake/discharge structures.

Urbanization and global climate change could change aquatic communities in the foreseeable future. Expansion of urban areas in the Susquehanna River drainage could adversely affect water quality through both point and nonpoint pollution. Degraded water quality would adversely affect aquatic recourses through a loss of suitable habitat. Global climate change could lead to more storm events with greater severity (Nielsen-Gammon 1995; Karl et al. 2009). Bank erosion and siltation of onsite water bodies from the increased precipitation could alter flows and result in the loss of aquatic habitat.

Summary

Based on the information provided by UniStar, information provided by NMFS, and the review team's independent evaluation, the review team concludes that the cumulative impacts of building and operating a new reactor on the Bainbridge site combined with other past, present, and future activities on most aquatic resources~~, including migratory fish~~ in the ~~geographic~~ area of interest would be MODERATE to LARGE. ~~be MODERATE with a MODERATE to LARGE, primarily because of the new plant's potential interaction with impact for the State endangered northern map turtle.~~ The incremental contribution of building and operating a new reactor at the Bainbridge site would likely be MODERATE but could be LARGE because of potential losses of hatchling and juvenile northern map turtles because they occur near the proposed intake structure.

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~~9.3.4.5~~9.3.3.5 Socioeconomics

In evaluating the socioeconomic impacts of site development and operation at the Bainbridge Naval Training Center site in Port Deposit, Maryland, within Cecil County, the review team undertook a ~~reconnaissance survey~~review of the site using ~~readily obtainable~~ data ~~from the Internet and published~~ sources~~.~~ discussed in Section 9.3.2. Impacts from both building and station operation are discussed.

Physical Impacts

~~Generic aspects of physical impacts are addressed in Section 9.3.2.2.~~

Many of the physical impacts of construction and operation would be similar regardless of the site. Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from building a new unit would be minimal.

Potential impacts from station operation include noise, odors, exhausts, emissions, and visual intrusions (aesthetics). A new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. By inference, this practice also would be expected to apply to all alternative sites. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the Bainbridge alternative site.

Any new unit at an alternative site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would confirm that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, a new unit would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

In summary, construction and preconstruction activities would be temporary and would occur mainly within the boundaries of the Bainbridge alternative site. Offsite impacts would represent minimal changes to offsite services supporting the building activities. During facility operations, noise levels would be managed by State and local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the physical impacts of building and operating a nuclear unit at the Bainbridge site would be minimal.

Demography

The Bainbridge site is located in the town of Port Deposit (2008 population 701), in Cecil County in northeastern ~~of~~ Maryland. The U.S. Census Bureau indicates that Cecil County had a 2008 population of 99,926 which was a 14 percent increase from 2000 (USCB ~~2009 |PortDeposit&CecilCountyPopulations.pdf|).~~2009a). By 2030, the population is expected to increase by an additional 60,000 people (Cecil County 2007). Baltimore is approximately 42 miles southwest and Wilmington, Delaware is 37 miles northeast. The population in the 50 mile region is 5.2 million people (UniStar 2009a).

At the peak of the site development period, UniStar expects an onsite workforce of 3950 construction workers (UniStar 2009a). Based on the analysis of impacts presented in Section 4.4.2, the ~~total~~ maximum number of construction workers migrating into the region (within 50 mi of the site) from outside of the region would be between 790-1383 workers (20 to 35 percent of the total workforce) at the peak of the ~~site development~~building period. Using an average household size of 2.61, the total in-migrating population would be between 2062 and 3608 people. The majority of impacts ~~are~~would be expected to occur in Cecil County because it contains the site. The impacts are more dispersed farther away from the site due to the large populations of the other counties within commuting distance of the Bainbridge site~~.~~ such as neighboring Harford County. Considering that the maximum estimation of in-migrating population would be less than four percent of the total population for Cecil County, the demographic impacts of ~~site development are expected to be SMALL. If the facility is built and commences operations, the operational workforce would number about 363 workers, all of whom may migrate into the region. The staff expects that the demographic impact during operation would be SMALL.~~building a new nuclear plant at the Bainbridge site are expected to be minimal.

~~Taxes and Economy~~

If the facility were built at the Bainbridge site and operations commenced, the operational workforce would number at least 363 workers, (half (182 workers) of whom may migrate into the region. At the Bainbridge site, a larger number of security and administrative workers would need to be hired, but because this is not specialized labor, they would likely already reside in the 50-mi region. Given the small number of in-migrating workers and the large population in the 50-mi region, the review team concludes that the demographic impact during operation would be minimal.

Economy and Taxes

According to the U.S. Census Bureau 2005-2007 American Community Survey, the labor force in Cecil County was 53,339 persons and, of these, 49,709 were employed. The four industries in Cecil County that accounted for ~~over~~more than 50 percent of employment were educational services, health care, and social assistance (18 percent~~),~~); manufacturing (12 percent~~),~~); retail trade (12 percent~~)~~); and construction (11 percent) (USCB ~~2009|CecilCountyEmployment.pdf|).~~2009c). The 2005~~-~~–2007 estimated unemployment rate for Cecil County was 6.7 percent, compared to 5.6 percent for the State of Maryland (USCB ~~2009 |MarylandEmployment.pdf|).~~2009b).

Economic impacts would be spread across the 50-mi region but would likely be the greatest in Cecil County. Impacts are generally considered ~~SMALL~~minimal if plant-related employment is less than 5 percent of the study area's total employment (NRC 1996). During the development of the new unit, up to 3950 construction workers would be required to build the plant (at the peak period). While some of these workers may need to in-migrate to the region, many would be drawn from the approximate 140~~-~~,000–150,000 construction workers in the workforce of ~~over~~more than 2.5 million in the greater Maryland and Washington, D.C. Metropolitan Statistical Area (MSA) (USBLS 2007~~b~~). The peak ~~site development~~construction workforce would represent less than 5 percent of the current workforce in the region. Therefore, the review team concludes that the impacts of ~~site development~~building a nuclear plant on the economy of the region ~~would be SMALL~~minimal and beneficial, but temporary.

The wages and salaries of the ~~site development~~construction and operating workforce would have a multiplier effect that could result in increases in business activity, particularly in the retail and service sectors. This would have a positive impact on the business community and could provide opportunities for new businesses to get started and increase~~d~~ job opportunities for local residents. During operations, approximately ~~363~~182 new operations jobs would be added to the local economy. ~~The staff assumed that all of these new operations workers would have to move to the region from outside the region.~~ Based on the analysis in Section 5.4.3.1 for the proposed Calvert Cliffs site, the staff concludes that the impact of these new jobs would constitute a small

percentage of the total number of jobs in Cecil County and would have a ~~SMALL,~~minimal and beneficial economic impact.

As with the new proposed unit at the Calvert Cliffs site, there would be some positive sales, use, income, and ~~corporate~~property tax revenue benefits that would be generated as a result of the ~~construction~~building and ~~operation of~~operating a new ~~units~~nuclear unit at the Bainbridge Naval Training Center site (Sections 4.4.2.2 and 5.4.3.2). Tax revenues would accrue to the State primarily from income and sales taxes~~,~~ and to local governments from taxes on property and income taxes (see Section 2.5.2.2~~ of this EIS~~). The primary tax impacts would occur once the new unit becomes valued as property and property tax revenues are collected by Cecil County according to the millage rate and the negotiated value of the plant. In fiscal year 2007 Cecil County tax revenues totaled $148.5 million. The tax revenues from a unit in Cecil County are unknown, but likely to be ~~substantial~~similar to the revenues estimated for the Calvert Cliffs site. Tax estimates for Unit 3 at the Calvert Cliffs site would be up to $71 million during construction and preconstruction and at $57 million once operations commenced. The review team concludes that the impact on tax revenues from building and operating a nuclear unit would be greatest in Cecil County, with a ~~SMALL~~LARGE and beneficial impact~~ during site development and a MODERATE beneficial impact during operation~~. The revenue impacts from building and operating a nuclear unit at the Bainbridge site for the remainder of the 50-mi region would be ~~SMALL~~minimal and beneficial~~ during both site development and operation.~~.

Transportation and Housing

Road access to the Bainbridge site is provided by MD State Highway 276, which runs north of the site and U.S. Highway 222 to the south. Interstate 95 is 3 ~~miles~~mi from the site, as are other state and local roads (see Figure 9-3~~Figure 9-3Figure 9-3Figure 9.3).~~). The site has barge access on the Susquehanna River, and a rail line runs along the western border (Uni~~s~~Star 2009a). The staff expects traffic impacts from ~~site development related traffic~~construction and preconstruction activities, including both construction workers and deliveries, would be ~~SMALL~~minimal for the region, but could be ~~MODERATE~~significant but not destabilizing on the local roads near the site during shift change when the construction workforce is at its peak~~ site development~~. During operations, impacts would be ~~SMALL~~minimal, except during outages when an additional 800 to 1000 workers would be employed onsite and impacts ~~c~~would be ~~MODERATE~~significant but not destabilizing.

Based on the analysis in Sections 4.4.2~~,~~ and 5.4.2, up to 1383 construction workers and 363 operations workers and their families would in-migrate to the 50-mi region during the building of a unit at the Bainbridge site and the subsequent operation. According to the 2005–2007 American Community Survey data, there are 3703 vacant housing units in Cecil County, which is adequate to accommodate the expected influx of construction workers. Workers could also find housing in other parts of the 50-mi region, which has approximately 243,587 vacant housing units (UniStar 2009a). The staff expects that the in-migrating construction and operations

workforce would have a ~~SMALL~~minimal impact on housing demand in Cecil County and the larger 50-mi region.

Public Services and Education

The influx of construction workers and plant operations staff in-migrating into the region could impact local municipal water and water treatment plants and other public services (police, fire and medical) in the region. These impacts would likely be in proportion with the demographic impacts, unless these resources have excess capacity or are particularly strained during building, which would decrease or increase the impact, respectively. There are approximately three hospitals, six police stations, and 17 fire stations located in Cecil County (UniStar 2009a). Cecil County has four public water systems and ~~5~~five wastewater treatment facilities. The average daily wastewater flow is 5.4 MGD with 3.1 MGD of additional capacity. ~~However, according to county plans~~ Excess capacity exists within the current systems to support the expected increase of 186,000 gpd to 325,000 gpd increase in water supply needs and wastewater treatment. Therefore, the review team concludes that the impacts from construction and preconstruction of a nuclear unit at the Bainbridge site would be minimal. The much smaller operations workforce is expected to also have a minimal impact on public services. However, according to county plans, the 2030 wastewater flows are expected to be approximately 10.5 MGD. Several system upgrades and expansions are planned to meet this 2 MGD deficit in capacity in 2030. Therefore, the ~~staff~~review team concludes that the impacts ~~of site development and operation~~operating a nuclear unit on public services in Cecil County and the larger 50-mi region would be ~~SMALL~~minimal.

Cecil County has one school district, which includes 29 schools and a 2006~~-~~–2007 student body population of 16,421 students. The average student/teacher ratio was 14.4 (NCES 2009 ~~|CecilCountySchools.pdf|). Site development and operations related students would represent a small percentage increase in the student body population.~~). As stated in Section 4.4.4.5, approximately 361 to 632 students are expected to in-migrate into the 50-mi region during construction and preconstruction activities. Though they could in-migrate anywhere within the 50-mi region, if they were to all crowd into Cecil County schools, it would only raise their student population less than 4 percent. Given the number of schools in Cecil County and the large student body populations, it is likely that ~~the~~ new students ~~will be~~ from building and operating a nuclear unit at the Bainbridge site would be absorbed easily, and education impacts would be ~~SMALL~~minimal for Cecil County and the larger 50-mi region.

Recreation and Aesthetics

In Cecil County there are 40 town parks that provide opportunities for hiking, biking, camping, horseback riding, hunting and fishing (CC~~M~~T 2009~~|CecilCountyRecreation.pdf|).~~). The Bainbridge site is currently used as a CWMA for hunters from September 15 through January 31 (MDNR ~~2009 |BainbridgeCWMA.pdf|).~~2009cThe Port Deposit Chamber of Commerce co-

sponsors a hydroplane race series on the Susquehanna River during Labor Day weekend. The race course is located just offshore along the river south of Port Deposit (PDCC 2009a) and would be near potential locations for intake/discharge structures. Recreational users in the vicinity of the site may be impacted by traffic near the plant during shift change. Wooded area at the site would provide some viewshed protection; however, the plume from Otherwise, impacts on recreation in the proposed facility, if plume abatement is not used, region would likely be visible from a considerable distance (Unistar 2009a). An undetermined number of miles of transmission lines would need to be built. Impacts on recreation would be SMALL; however, the aesthetic impacts during operation of a nuclear unit on the Bainbridge site could be [SMALL?] MODERATE. minimal.

Summary of Socioeconomic Impacts

UniStar's plume abatement technology and the wooded area at the site would provide some viewshed protection. An undetermined number of miles of transmission lines would need to be built. Impacts on aesthetics of a nuclear unit on the Bainbridge site would be minimal.

Cumulative Impacts

For the analysis of socioeconomic impacts at the Bainbridge Naval Training Center site, the geographic area of interest is considered to be the 50-mi region centered on the Bainbridge site with special consideration for Cecil County as that is where the review team expects socioeconomic impacts to be the greatest. Historically, Cecil County has been known as a generally rural area, but in recent years has become more suburban as it lies on the edge of both the Philadelphia and Baltimore metropolitan areas. Cecil County's population was 50,000 (150/square mile) in 1990 but by 2005 the population was near 100,000 (270/square mile) (Sage Policy Group 2007).

In addition to socioeconomic impacts from building and operating a nuclear unit at the Bainbridge site, the analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts. The projects identified in Table 9-6Table 9-6Table 9-6Table 9-5 have or would contribute to the demographics, economic climate, and community infrastructure of the region and generally result in increased urbanization and industrialization. However, many impacts such as those on housing or public services are able to adjust over time, particularly with increased tax revenues. Furthermore, State and county plans along with modeled demographic projections include forecasts of future development and population increases. Because the projects within the review area identified in Table 9-6Table 9-6Table 9-6Table 9-5 would be consistent with applicable land-use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts include impacts on workers and the general public, existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes,

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infrastructure, and community services. In summary, on the basis of information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative impacts of construction, preconstruction, and operation of a nuclear unit at the Bainbridge site on socioeconomics would be SMALL in terms of physical impacts (including workers and local public, noise, air quality, buildings and transportation), demography, housing, public service, educational, aesthetics and recreational impacts. MODERATE impacts are expected for transportation during construction, preconstruction, and operations. The impacts on the Cecil County economy and tax base with regard to construction, preconstruction, and operating a nuclear unit would be beneficial and LARGE.

~~In summary, on the basis of information provided by UniStar and the review team's independent evaluation, the review team concludes that the impacts of site development and operation of a nuclear unit at the Bainbridge site on socioeconomics would be SMALL in terms of housing, public service, educational, and recreational impacts during the preconstruction and construction phase, and [SMALL?] MODERATE for aesthetics during the operations phase. The impacts on the Cecil County economy and tax base during plant operation likely would be beneficial and MODERATE. A portion of the tax increase could be used to improve local transportation infrastructure and educational facilities to accommodate the population growth.~~

~~The review team has assessed the activities related to building a unit at the Bainbridge site and the potential socioeconomic impacts in the region. Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative socioeconomic impacts of constructing and operating a new nuclear generating unit at the Bainbridge site would be SMALL in the region and in the local area with the exception of transportation, which could have a MODERATE impact.~~

~~9.3.4.6~~9.3.3.6 Environmental Justice

The 2000 Census block groups were used for ascertaining minority and low-income populations in the region. There were a total of ~~3821~~3461 census blocks groups within the 50-mi region (which included portions of Delaware, Maryland, New Jersey, and Pennsylvania). ~~An aggregate of 808~~ Approximately 897 of these census block groups were classified as aggregate minority populations with ~~785~~817 of them African American, mostly in the Baltimore area. Cecil County did not have any block groups classified as minority populations. There are ~~73~~375 census block groups classified as low income in the 50-mi region, none of which are in Cecil County. Figure 9-5~~Figure 9-5Figure 9-5~~ shows the geographic locations of the minority populations of significance within the 50-mi radius, and Figure 9-6~~Figure 9-6Figure 9-6~~ shows the geographic locations of the low-income populations of significance within the 50-mi radius.

~~Site development~~Construction and preconstruction activities (noise, fugitive dust, air emissions, traffic) would not disproportionately adversely affect minority populations because of their distance from the Bainbridge site. The operation of the proposed project at Bainbridge site is also unlikely to have a disproportionate adverse impact on minority or low-income populations. See Sections 4.5 and 5.5 for more information about environmental justice criteria and impacts.

The projects identified in ,Table 9-6~~Table 9-6Table 9-6~~Table 9-5 likely did not or will not contribute to environmental justice impacts of the region. Housing rental rates can be an area of concern with regards to low-income populations. If projects commence that cause a rise in rental ~~rates that push low-income populations out of their homes~~, then there may be a disproportionate adverse impact on low-income populations. ~~Based~~ However, such impacts would be temporary, with rental prices returning to their original levels once the project was completed. Therefore, based on information provided by UniStar and the review team's independent evaluation, the review team concludes that there would ~~likely~~ not be any disproportionate and adverse environmental justice cumulative impacts from building and operating a new generating unit at the Bainbridge site~~—~~, and the environmental impacts of construction, preconstruction, and operations of a nuclear power plant at the Bainbridge site would be SMALL.

~~9.3.4.7~~9.3.3.7 Historic and Cultural Resources

The Bainbridge Naval Training Center served the United States during war and peace time from 1942 until 1976 and was then deactivated in 1976. Much of the site has been demolished, but several buildings remain today that were built in the early 1940s. The Tome ~~s~~School for ~~b~~Boys is located on the site property ~~and~~. It was built around the turn of the 20th century and is one of the oldest schools in the state of Maryland (USNTCB 2009). However, no archaeological and/or architectural surveys have been conducted to determine the significance of the resources.

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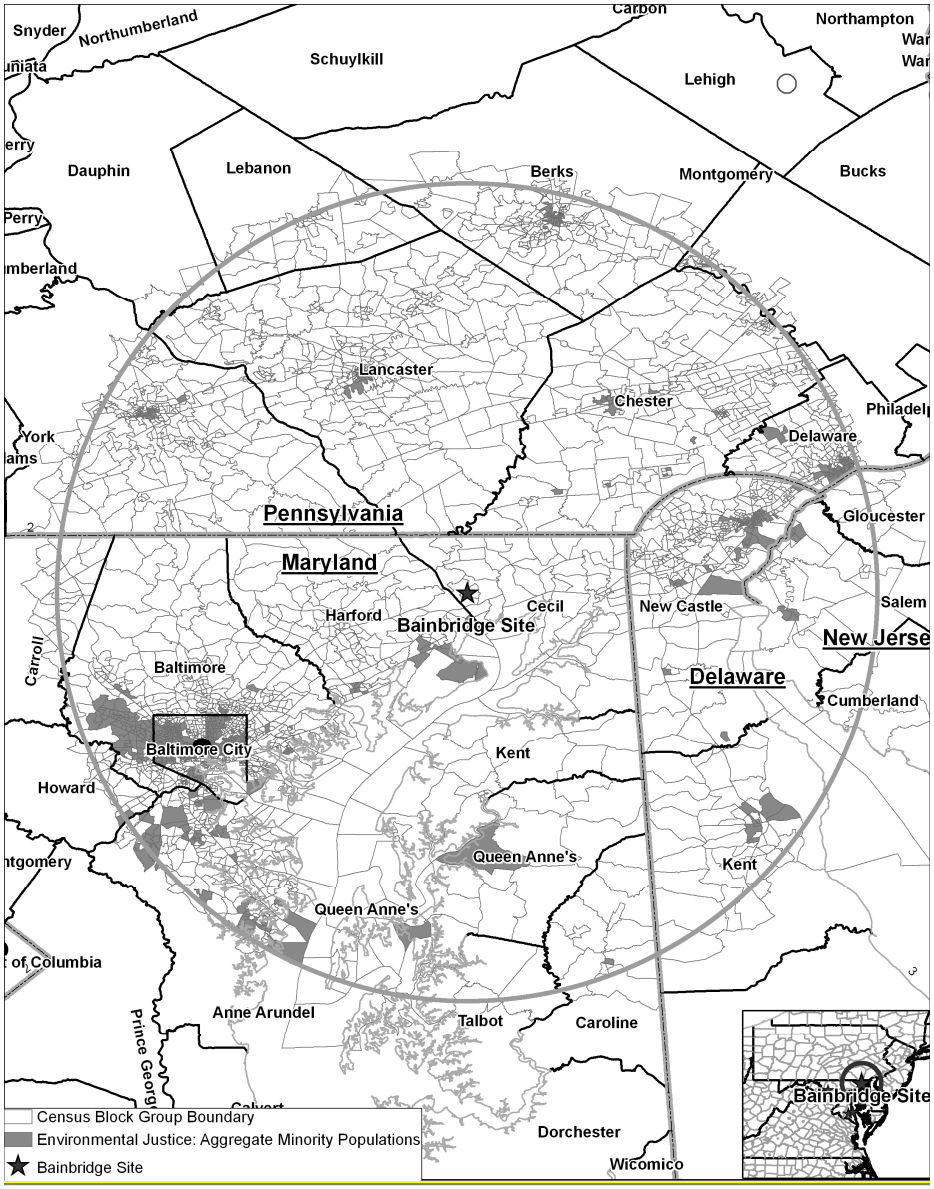

Figure 9-5. Distribution of Aggregate Minority Populations of Significance, 2000 (PNNL GIS)

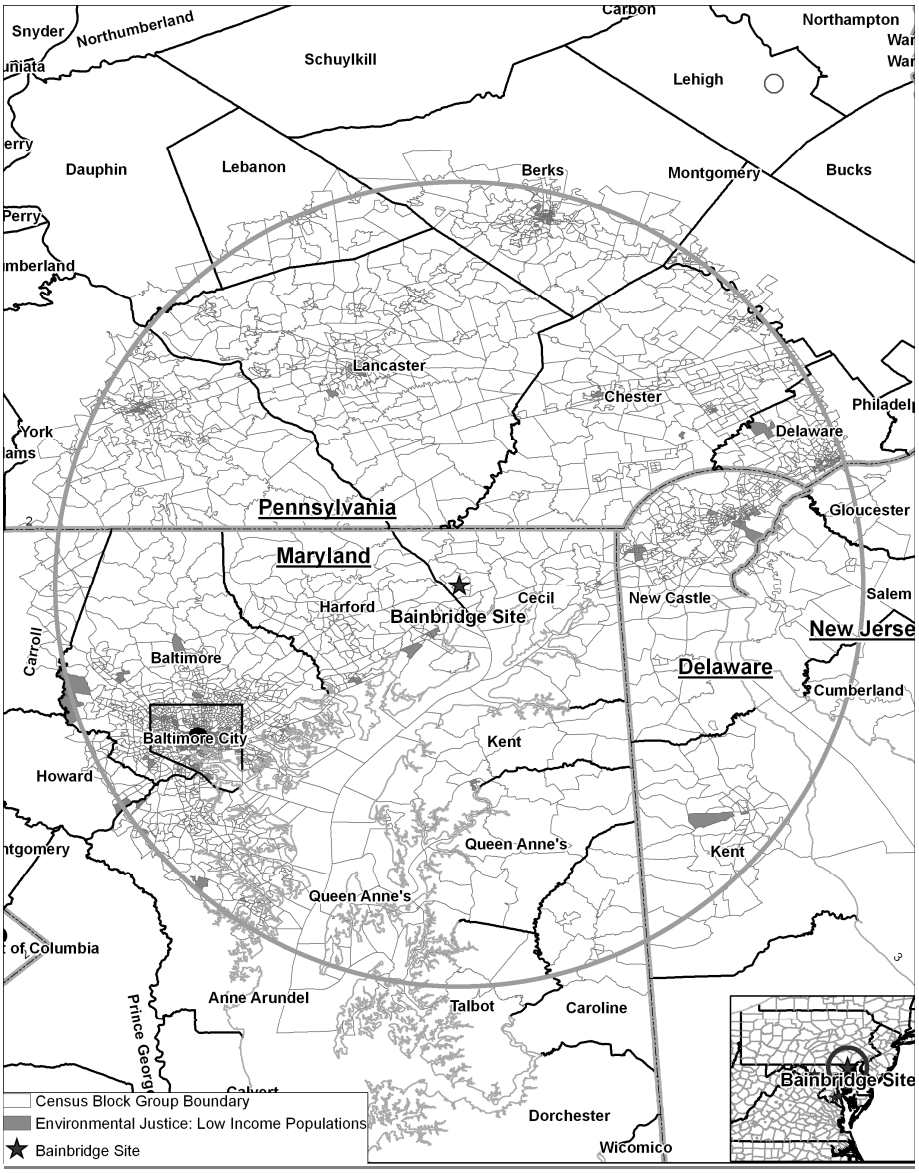

Figure 9-6. Distribution of Low-Income Populations of Significance, 2000 (PNNL GIS)

The area surrounding the Bainbridge site is rich in history. UniStar conducted a literature review at the Maryland Historical Trust and found 12 properties listed on the National Register of Historic Places within 5 mi of the site, with two of the properties ~~are~~ located within 1 mi of the site (UniStar 2009a). The project has the potential to affect some of these resources.

Consultation with the Maryland Historical Trust (MHT) would be necessary regarding the need for systematic archaeological and architectural surveys to identify historic and archaeological resources prior to any ground disturbing activities to address impacts to historic, cultural, and archaeological resources at this particular site. UniStar would be expected to put protective measures in place to protect discoveries in the event that historic or archaeological materials are found during building or operating of a new plant. In the event that an unanticipated discovery is made, site personnel should be instructed to notify the MHT and consult with them in conducting an assessment of the discovery to determine if additional work is needed.

No projects were identified in Table 9-6~~Table 9-6Table 9-6~~ that would contribute to cumulative impacts to historic and cultural resources.

Based on ~~the known~~ reconnaissance level ~~of~~ information ~~regarding historic and cultural resources at the site~~, specifically the ~~rich history in the area~~significant built environment and ~~the~~ history associated with the Naval Training Center, the review team concludes that the cumulative impacts on historic properties of constructing and operating a new generating unit at the Bainbridge site would be MODERATE to LARGE. Archaeological and/or architectural surveys would be necessary to determine the significance of the resources.

~~9.3.4.8~~9.3.3.8 Air Quality

The atmospheric emissions related to building and operating a nuclear power plant at the Calvert Cliffs Site in Calvert County, Maryland, were described in Chapters 4 and 5 of this EIS. The emissions were evaluated in detail because Calvert County is in non-attainment of the 8-hour ozone National Ambient Air Quality Standard ~~and [~~but~~?]~~ were ~~found to have a~~ below the threshold requiring mitigation and, therefore, the review team concluded that the environmental impacts were SMALL ~~impact.~~, and no further mitigation is warranted. In Chapter 7, the cumulative impacts of the emissions were evaluated and also determined to be SMALL.

The emissions related to construction and operation of a nuclear power plant at the Bainbridge Naval Training Center site in Cecil County would be similar to those at the Calvert Cliffs Site. Cecil County is ~~also~~ in ~~non-attainment of~~ the ~~8-hour ozone standard.~~East Shore Intrastate Air Quality Control Region (40 CFR 81.154). However, Harford County, which is across the Susquehanna River from the Bainbridge Naval Training Center Site, is in the Metropolitan Baltimore Intrastate Air Quality Control Region (40 CFR 81.28). The air quality attainment status for Cecil and Harford Counties as set forth in 40 CFR 81.321 reflects the effects of past and present emissions from all pollutant sources in the region. Cecil County is in non-

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attainment of the 8-hour ozone standard, and Harford County is in non-attainment of both the 8-hour ozone standard and the PM 2.5 (particulate matter with a diameter of less than 2.5 microns) standard.

Reflecting on the projects listed in Table 9-6Table 9-6Table 9-6, most of the effects on air quality would be to maintain the status quo. Any new industrial projects would either have *de minimis* effects or would be subject to regulation by the Maryland DNR. Given these institutional controls, it is unlikely that the air quality in the region would degrade significantly (i.e., degrade to the extent that the region is in nonattainment of national standards).

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The cooling tower for the power plant would be a significant source of small particles. As a result, although the air quality impacts of construction and operation of a nuclear power plant at the Bainbridge Naval Training Center Site would probably be SMALL, it is possible that the cumulative impacts of the cooling tower particulate emissions could be MODERATE.

Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6 for building and operating a nuclear power plant and for the fuel cycle, respectively. As described in Chapter 7, the impacts of greenhouse gas emissions are not sensitive to location of the source. Consequently, the discussions in the previous Chapters and in Section 9.2.5 are applicable to a nuclear power plant located at the Bainbridge Naval Training Center Site. The impacts of greenhouse gas emissions considered in isolation would be SMALL, but the cumulative impact of greenhouse gas emissions would be MODERATE.

9.3.3.9 Nonradiological Health Impacts

The following impact analysis includes nonradiological health impacts from construction and preconstruction activities and operations to the public and workers from a nuclear unit at the Bainbridge alternative site. The analysis also considers past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-6Table 9-6Table 9-6. The construction and preconstruction-related activities that have the potential to impact the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to impact the health of members of the public and workers includes exposure to etiological agents, noise, electromagnetic fields (EMFs), and impacts from the transport of workers to and from the site. For the analysis of nonradiological health impacts at the Bainbridge alternative site, the geographic area of interest is considered to include projects within a 5-mi radius from the site's center based on the localized nature of the impacts. For impacts associated with transmission lines, the geographic area of interest is the transmission line corridor.

Building Impacts

Nonradiological health impacts to construction workers and members of the public from building a new nuclear unit at the Bainbridge site would be similar to those evaluated in Section 4.8 for the Calvert Cliffs site. The impacts include noise, vehicle exhaust, dust, occupational injuries, and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied with during the site preparation and building phase. The incidence of construction worker accidents would not be expected to be different from the incidence of accidents estimated for the Calvert Cliffs site. The Bainbridge site is located in a rural area and building impacts would likely be minimal on the surrounding populations. Access routes to the site for construction workers would include I-95, which is approximately 3 mi south of the site. Local 2-lane roads provide access from I-95 to the site and from the north and east. The ER (UniStar 2009a) states that the local 2-lane roads may become congested as a result of the additional construction-related traffic. Mitigation may be necessary to ease congestion, thereby improving traffic flow and reducing non-radiological impacts (i.e., traffic accidents, injuries, and fatalities) during the construction period.

No past or current actions in the geographic areas of interest were identified that would impact the public or workers. Proposed future actions would include transmission line development and/or upgrading, and future urbanization, which would both occur throughout the designated geographical areas of interest.

Operational Impacts

Nonradiological health impacts from operation of a new nuclear unit on occupational health and members of the public at the Bainbridge site would be similar to those evaluated in Section 5.8 for the Calvert Cliffs site. Occupational health impacts to workers (e.g., falls, electric shock or exposure to other hazards) at the Bainbridge site would likely be the same as those evaluated for workers at the new unit at the Calvert Cliffs site. Based on the configuration of the proposed new unit at the Bainbridge site (closed-cycle, wet cooling system with mechanical draft cooling towers), etiological agents would not likely increase the incidence of water-borne diseases in the vicinity of the site. Noise and EMF exposure would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration regulations. Effects of EMF on human health would be controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria. Non-radiological impacts of traffic associated with the operations workforce would be less than the impacts during construction. Mitigation measures taken during construction to improve traffic flow would also minimize impacts during operation of a new unit.

Past and present actions in the geographic area of interest associated with existing transmission lines are the only nonradiological impacts from operations to the public and workers. Proposed future actions that would impact nonradiological health in a similar way to

operation activities at the Bainbridge site would include transmission line systems and future urbanization, which would both occur throughout the designated geographical areas of interest.

Cumulative Impacts

Based on the information provided by UniStar and the review team's independent evaluation, the review team expects that the impacts to nonradiological health from construction and operation of a new unit at the Bainbridge site would be similar to the impacts evaluated for the Calvert Cliffs site. Although there are past, present and future activities in the geographic area of interest that could affect nonradiological health in ways similar to the building and operation of a new unit at the Bainbridge site, those impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes, therefore, that the cumulative impacts of construction, preconstruction, and operation on nonradiological health would be SMALL.

9.3.3.10 Radiological Impacts of Normal Operations

As described in section 9.3.4, the Bainbridge site is a deactivated naval training site that currently has no nuclear facilities. The geographic area of interest is the area within a 50-mi radius of the Bainbridge site. Facilities potentially affecting radiological health within this area are the existing Peach Bottom Units 2 and 3 and Three Mile Island Unit 1 on the Susquehanna River, Limerick Units 1 and 2 on the Schuylkill River, and Salem Units 1 and 2, and Hope Creek Unit 1 on the Delaware River. In addition, the NRC anticipates an application for an early site permit for new nuclear power plants at the Salem/Hope Creek site in the near future. A number of hospitals within 50 mi of the Bainbridge site use nuclear materials for medical purposes.

The radiological impacts of building and operating the proposed U.S. EPR plant at the Bainbridge site include doses from direct radiation, and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite, well below regulatory limits. These impacts are expected to be similar to those estimated for the Calvert Cliffs Unit 3 site.

The radiological impacts of the other operating nuclear power plants listed above also include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite, well below regulatory limits as demonstrated by the ongoing radiological environmental monitoring programs around these plants. The proposed plants at the Salem/Hope Creek site would also result in radiological impacts from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite, well below regulatory limits. The NRC staff concludes that the dose from direct radiation and effluents from hospitals practicing nuclear medicine are an insignificant contribution to the cumulative impact around nuclear power plants based on data from the radiological environmental monitoring program (REMP) around currently operating nuclear power plants. Similarly, the radiological impacts of transporting fuel and waste to and

from the Bainbridge site during plant operations was shown to be a small fraction of natural background radiation and there are not significant differences among the alternative sites.

Based on the information provided by UniStar and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the proposed U.S. EPR unit and other existing and planned projects and actions in the geographic area of interest around the Bainbridge site would be expected to be SMALL.

9.3.3.11 Postulated Accidents

As described in above, the Bainbridge site currently has no nuclear facilities. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Bainbridge site. This includes the existing CCNPP (Units 1 and 2), Salem (Units 1 and 2), Hope Creek, Peach Bottom (Units 2 and 3), Three Mile Island, and Limerick (Units 1 and 2) nuclear generating stations. No other reactors have been proposed within the geographic area of interest. However, interest has been expressed in a site permit for a location in southern New Jersey.

Because the meteorology, population distribution, and land use for the Bainbridge alternative site are expected to be similar to the proposed Calvert Cliffs site, risks from a severe accident for a U.S. EPR reactor located at the Bainbridge alternative site are expected to be similar to those analyzed for the proposed Calvert Cliffs site. These risks for the proposed Calvert Cliffs site are presented in Table 5-16 and Table 5-17 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks provide a considerable safety margin because they are well below the Commission's safety goals (51 FR 30028). For existing plants within the geographic area of interest, including the CCNPP (Unit 1 and 2), Salem (Units 1 and 2), Hope Creek, Peach Bottom, Three Mile Island, and Limerick (Units 1 and 2) nuclear generating stations, the Commission has determined that the probability-weighted consequences of severe accidents are small (10 CFR 51, Appendix B, Table B-1). On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Bainbridge alternative site from the operation of a nuclear unit at Bainbridge or from nuclear plants listed above are expected to be SMALL.

~~9.3.5~~9.3.4 Eastalco Site

This section covers the ~~staff's~~review team's evaluation of the potential environmental impacts of siting a new nuclear unit at the Eastalco Aluminum Smelter (Eastalco) site in central Maryland. The Eastalco site is located within the Lowland Section of the Piedmont Plateau physiographic province in Frederick County, ~~MD |MD DNR 2001: WEBPhysiographic Provinces of~~ Maryland (Figure 9-7~~Figure 9-7Figure 9-7~~.pdf~~|~~.) (MDNR 2001). This province is described as rolling hills

and stream valleys covered with hardwood forests ¦US(FWS 2001: USFWS2001_MD-Piedmont[1].pdf¦.).

The Eastalco site is approximately 2,2002200 ac and contains an inactive aluminum production facility that was shut down in 2005. The facility is being maintained for possible future production. The site is industrial with agricultural fields (Figure 9-8Figure 9-8Figure 9-8.).

The following sections describe the cumulative impact assessment conducted for each resource area. The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographical area were assessed. This assessment includes the impacts of construction and operations and impacts of preconstruction activities. Also included are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. Other actions and projects considered in this cumulative analysis are described in Table 9-8Table 9-8Table 9-8.

Table -. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Eastalco Site Cumulative Analysis

Project Name or Other Action	Summary of Project	Location	Status
Energy Projects			
Dickerson Generating Plant	849 MW fossil-fuel powerplant. Draws water from the Potomac River.	Dickerson, MD (Montgomery County)	Operational. Currently upgrading air pollution control equipment; project expected to be completed by end of 2009.
Montgomery County Resource Facility	Burns solid waste to generate up to 55 MW.	Dickerson, MD (Montgomery County)	Operational
PPL Brunner Island	3-unit coal fired powerplant with 1483 MW capacity. Uses water from Susquehanna River.	York Haven, PA (York County)	Operational. Installing cooling towers to help reduce river temperatures; towers expected online in 2010.
R. Paul Smith Generating Station	2-unit coal fired plant with 109.5 MW total capacity.	Williamsport, MD (Washington County)	Operational. Recently completed upgrading electrostatic precipitators.
Potomac-Appalachian Transmission Highline (PATH) Project	765 kv transmission line proposed as a joint venture of American Electric Power and Allegheny Energy.	Southwestern West Virginia to central Maryland (~275 mi). Goes through Frederick County, MD	Regulatory approvals applied for in MD, VA, WV. Schedule calls for construction from mid-2010 through mid-2014, beginning service June 1, 2014.
National Institute of	National Bureau of Standards	Gaithersburg, MD	Currently licensed for operations through 20xx.

Project Name or Other Action	Summary of Project	Location	Status
Standards and Technology (NIST)	Reactor has a maximum power level of 20 MWt.	(Montgomery County)	
Proposed Point of Rocks Power Plant	Proposed natural gas fired power plant.	Point of Rocks, MD (Frederick County)	In 2001 Duke Energy filed an application to construct the plant. Duke cancelled the project in November 2002 but has retained property in the area.
Development			
Fort Detrick	BRAC expansion recommendations and construction of National Interagency Biodefense Campus facilities	Frederick, MD (Frederick County)	Installation includes the US Army Medical Research & Materiel Command, USDA Research Service, National Cancer Institute, among others. Construction completion expected in 2012.

Table 9-7. (contd)

Project Name or Other Action	Summary of Project	Location	Status
Fort Ritchie	Potential business and residential development.	Washington County, MD	Based on BRAC recommendations the military installation was essentially closed in 1998. In 2006, 500 acres were transferred to the PenMar Development Corp.
Transportation Projects			
Upgrades to US 15, MD85, I-70, I-270	Changes to improve access and traffic flow in the area.	Frederick, MD	Changes to US 15 to improve access to Ft. Detrick are city and county top transportation priority.
Water			
Potomac River	Maryland consumptive use regulations apply.	Maryland stretch of the Potomac River, including Frederick County, MD	
Monocacy River watershed/ Tuscarora Creek	A Watershed Restoration Action Strategy exists for both the lower and upper Monocacy River and its	Monocacy River watershed	Developed and administered by the Maryland DNR and

Project Name or Other Action	Summary of Project	Location	Status
	tributaries.		Frederick County
Parks & Related			
Chesapeake & Ohio Canal National Park		184.5 mi canal. Runs along the Potomac River near Eastalco.	
Monocacy National Battlefield		Frederick, MD (Frederick County)	DEIS published July 2008. Includes plans for developing and expanding trails, interpretative markers, and pedestrian deck over I-270.
Cactoctin Mountain Park		Approximately 20 miles north of the Eastalco site, near Thurmont, MD	The Camp David presidential retreat is located within the park. The park is administered by the National Park Service.

Table 9-7. (contd)

Project Name or Other Action	Summary of Project	Location	Status
Other parks, forests, and reserves	Numerous federal, state, and local parks, forests, reserves are located within a 50-mi region, including: Frederick Municipal Forest, Greenbrier State Park, Cunningham Falls State Park, Sugarloaf Mountain Park, Washington Monument State Park, South Mountain State Battlefield, Antietam National Battlefield. Class I areas include: Shenandoah National Park, Dolly Sods Wilderness Area, Otter Creek Wilderness Area	Throughout 50-mi region	Many Civil War engagements occurred in the surrounding area and there are many battlefield parks and monuments administered by Federal, State, and local agencies.
Future Urbanization	Development of housing units and associated commercial buildings; roads, bridges, and rail; develooment of water- and/or wastewater- treatment and distribution facilities and associated pipelines, as described in local land use planning documents.	Throughout region.	Development would occur in the future, as described in state and local land use planning documents

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
~~Regional air quality~~	~~Cumulative air quality status without proposed plant~~	~~Throughout the region~~	~~40 CFR 81 provides background status for evaluating potential impacts of plant construction and operation.~~
~~Global Warming/ natural environmental stressors~~	~~Short- or long-term changes in precipitation or temperature and stream flow.~~	~~Throughout region.~~	~~Impacts would occur in the future.~~

~~9.3.5.1~~9.3.4.1 Land Use and Transmission Line Corridors

Land Use

The Eastalco site is an approximately 2200 ac tract of land located in an unincorporated area of Frederick County, Maryland, approximately 10 mi southwest of the City of Frederick (UniStar 2009a). The site was used for aluminum production from 1970—2005. The structures associated with aluminum production are still on the site. The current owner of the site is Alcoa, Inc.

Of the 2200 ac, approximately 1320 ac are currently zoned industrial (Gazzette.Net 2009). Land in proximity to the site is used for agricultural, light industrial, and residential purposes. Corn and soybeans are the predominant crops in the region. The site is relatively level with an elevation change of approximately 33 ft.

If a new nuclear generating unit was developed on the site, some agricultural and forested land would be lost. In addition, offsite land would be impacted to build an approximately 5.8 mi pipeline to bring water for cooling to the site from the Potomac River. The pipeline would need to cross railroad tracks, local roads, and the Chesapeake and Ohio Canal towpath. The Chesapeake and Ohio Canal is a National Historical Park (see Section 9.3.~~5~~4.8). Until the mid-1990s, water was withdrawn from the Potomac River and piped to the site for use by the aluminum plant.

The Eastalco site includes a railroad spur, natural gas service, and an electrical substation. When operating, the aluminum plant was the largest industrial user of electricity in Maryland.

The nearest dedicated land (Federal, State, or Tribal) is the State-owned Monocacy Natural Resources Management Area located approximately 3.5 mi from the ~~site (UniStar ER Rev. 6|p. 9-60).~~Eastalco site (UniStar 2009a). The Monocacy National Battlefield, administered by the U.S. National Park Service, is located approximately 4 mi from the site.

There is a large transmission corridor leading to the Eastalco site. It is likely this corridor would be adequate to construct the necessary transmission lines associated with a new nuclear generating unit located at Eastalco (UniStar 2009a). In addition, there are seven existing 500-kV transmission lines within 5 mi of the site and a 345-kV transmission line about 12.7 mi northwest of the site. There are also nine 230-kV transmission lines available for interconnection: one line is about 0.5 mi from the site; another line is 1.8 mi; two lines are 2.2 mi; and another five lines are more than 4 mi from the site (UniStar 2009a). The transmission corridor for the PATH project (see Table 9-8) would pass approximately 2 mi south of the Eastalco site (PATH 2009a); the extent of the PATH project would result in noticeably altered land use in the area.

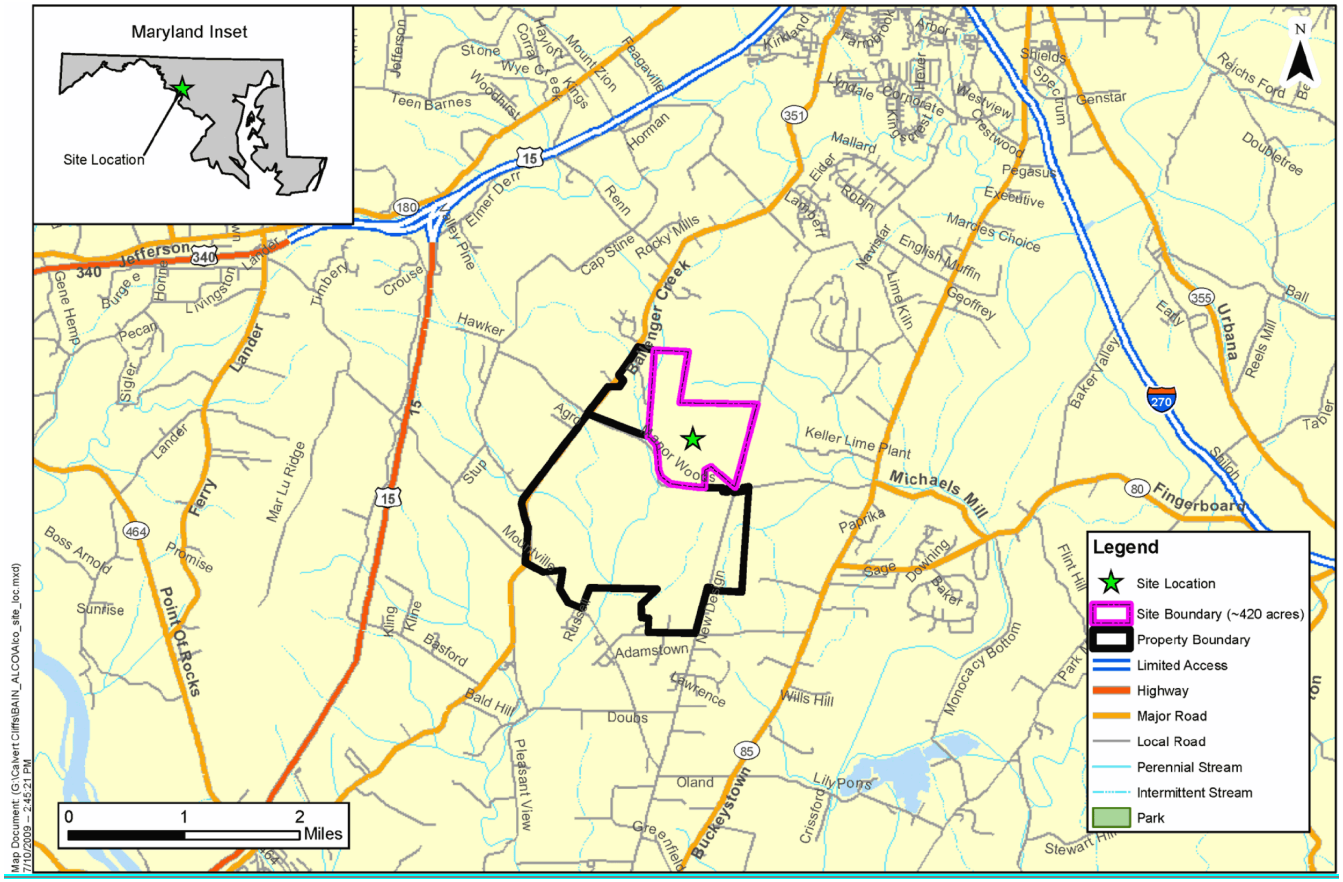

Figure 9-7. Eastalco Site Location (UniStar 2009a)

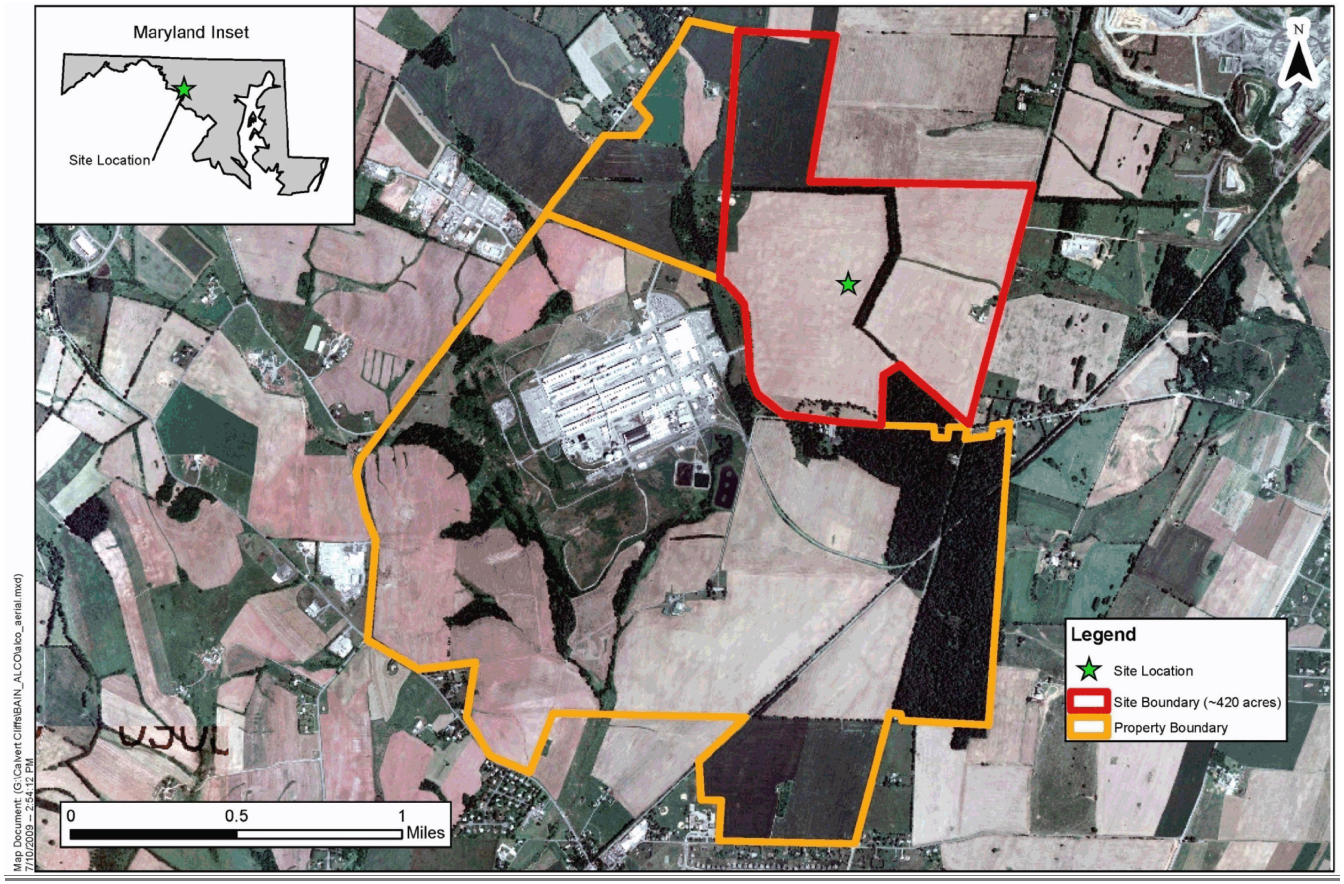

Figure 9-8. Eastalco Site Vicinity (UniStar 2009a)

Table 9-8. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Eastalco Site Cumulative Analysis

Comment [hln5]: This table should appear before the land use section like it did before the writing meeting

Project Name or Other Action	Summary of Project	Location	Status
Energy Projects			
Dickerson Generating Plant	Dickerson Generating Plant is a fossil-fuel power plant (849 MW).	Approximately 7 mi south of Eastalco site	Operational. Currently upgrading air pollution control equipment; project expected to be completed by end of 2009.[a]
Montgomery County Resource Facility	Montgomery County Resource Facility burns solid waste to generate up to 55 MW.	Approximately 7 mi south of Eastalco site	Operational. [b]
R. Paul Smith Generating Station	R. Paul Smith Generating Station consists of two coal-fired units (116 MW total capacity).	Approximately 26 mi northwest of Eastalco site	Operational. [c]
Potomac-Appalachian Transmission Highline (PATH) Project	PATH Project is a 765 kv transmission line proposed as a joint venture of American Electric Power and Allegheny Energy.	Southwestern West Virginia to central Maryland (~275 mi). Goes through Frederick County, MD	Proposed. Expected to be operational by 2014. [d]
National Institute of Standards and Technology (NIST)	NIST Reactor has a maximum power level of 20 MW(t).	Approximately 22 mi southeast of Eastalco site	Operational. Currently licensed for operations through 2029. [e]
Development			
Fort Detrick	BRAC expansion recommendations and construction of National Interagency Biodefense Campus facilities.	Approximately 10 mi northeast of Eastalco site	Ongoing. Schedule calls for construction completion in 2012. [f]
Fort Ritchie	Potential business and residential development.	Approximately 27 mi north of Eastalco site	Ongoing development. Based on BRAC recommendations, the military installation was essentially closed in 1998. In 2006, 500 ac were transferred to the PenMar Development Corp.[g]
Transportation Projects			
Upgrades to US 15, MD85, I-70, I-270	Changes to improve access and traffic flow in the area.	Frederick, MD; depending on location, could be within 2 mi of site	Planned. Changes to US 15 to improve access to Fort Detrick are City and County top transportation priority.[h]

Table 9-8. (contd)

Project Name or Other Action	Summary of Project	Location	Status
Upgrades to I-270, US 15 corridor	This is a multi-modal corridor study to consider highway and transit improvements in the I-270/US 15 corridor in Montgomery and Frederick counties from Shady Grove Metro Station to north of Biggs Ford Road (27.90 mi).	Montgomery and Frederick Counties, MD	Planned. Project is in the planning stage – developing a preferred alternative based on public comments.[i]
Other Actions/Projects			
Brunswick Wastewater Treatment Plant	Plant expansion and addition of enhanced nitrogen removal technology.	Approximately 6 mi west of Eastalco site	Completed in 2008.[j]
Future Urbanization	Development of housing units and associated commercial buildings; roads, bridges, and rail; development of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents.	Throughout region	Development would occur in the future, as described in state and local land-use planning documents.

(a) Source: Mirant 2009a
(b) Source: Montgomery County 2009
(c) Source: Allegheny Energy, Inc. 2009
(d) Source: Path 2009b
(e) Source: NRC 2009d
(f) Source: Fort Detrick 2009
(g) Source: EPA 2009b
(h) Source: MD SHA 2009a
(i) Source: MD SHA 2009b
(j) Source: City of Brunswick 2009

Cumulative Impacts

For this cumulative land-use analysis, the geographic area of interest is considered to be the 15-mi region surrounding the Eastalco site. This area of interest includes the primary communities (Adamstown, Buckeystown, and Frederick) that would be affected by the proposed project if it were located at the Eastalco site.

The project identified in Table 9-8~~Table 9-8Table 9-8~~ with the greatest likelihood of affecting land use in the geographic area of interest would be the Fort Detrick BRAC. The Fort Detrick BRAC would involve the construction and operation of new U.S. Army Medical Research Institute of Infectious Diseases facilities and the decommissioning and partial demolition of existing facilities (U.S. Army 2007b). Activities would take place on Fort Detrick. Some indirect

offsite land-use impacts may occur as a result of economic activity on the Fort Detrick site. The Fort Detrick BRAC project, and the other projects identified in Table 9-8Table 9-8Table 9-8The projects identified in Table 9-8, have or would contribute to decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas. Because the projects within the review area identified in Table 9-8Table 9-8Table 9-8Table 9-8 would be consistent with applicable land-use plans and control policies, the review team considers the cumulative land-use impacts from the projects to be manageable.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative land-use impacts of constructing and operating a new nuclear generating unit at the Eastalco site would be SMALL. Land-use impacts would be sufficiently minor to neither destabilize nor noticeably alter any important land-use attribute.

Transmission Line Corridors

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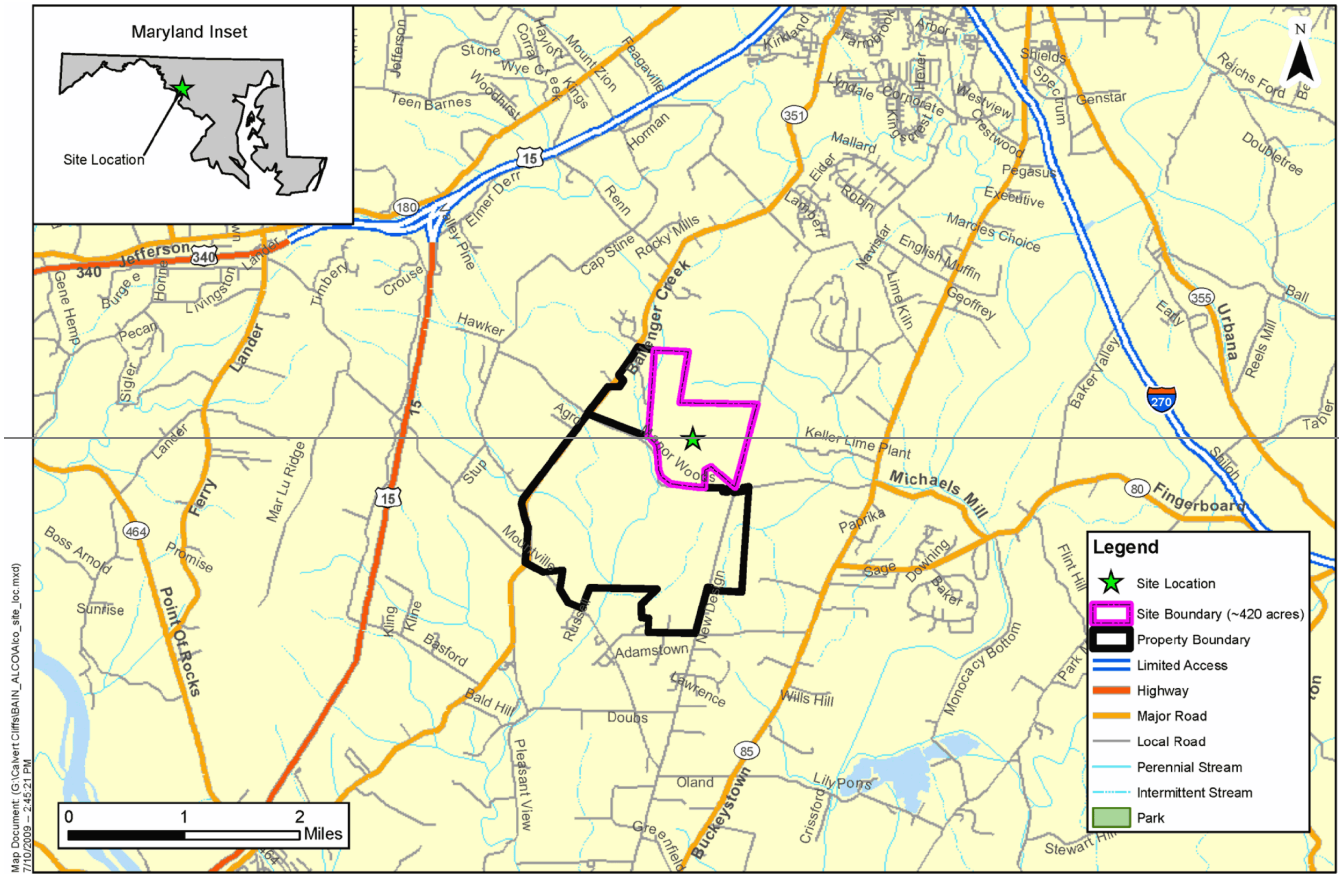
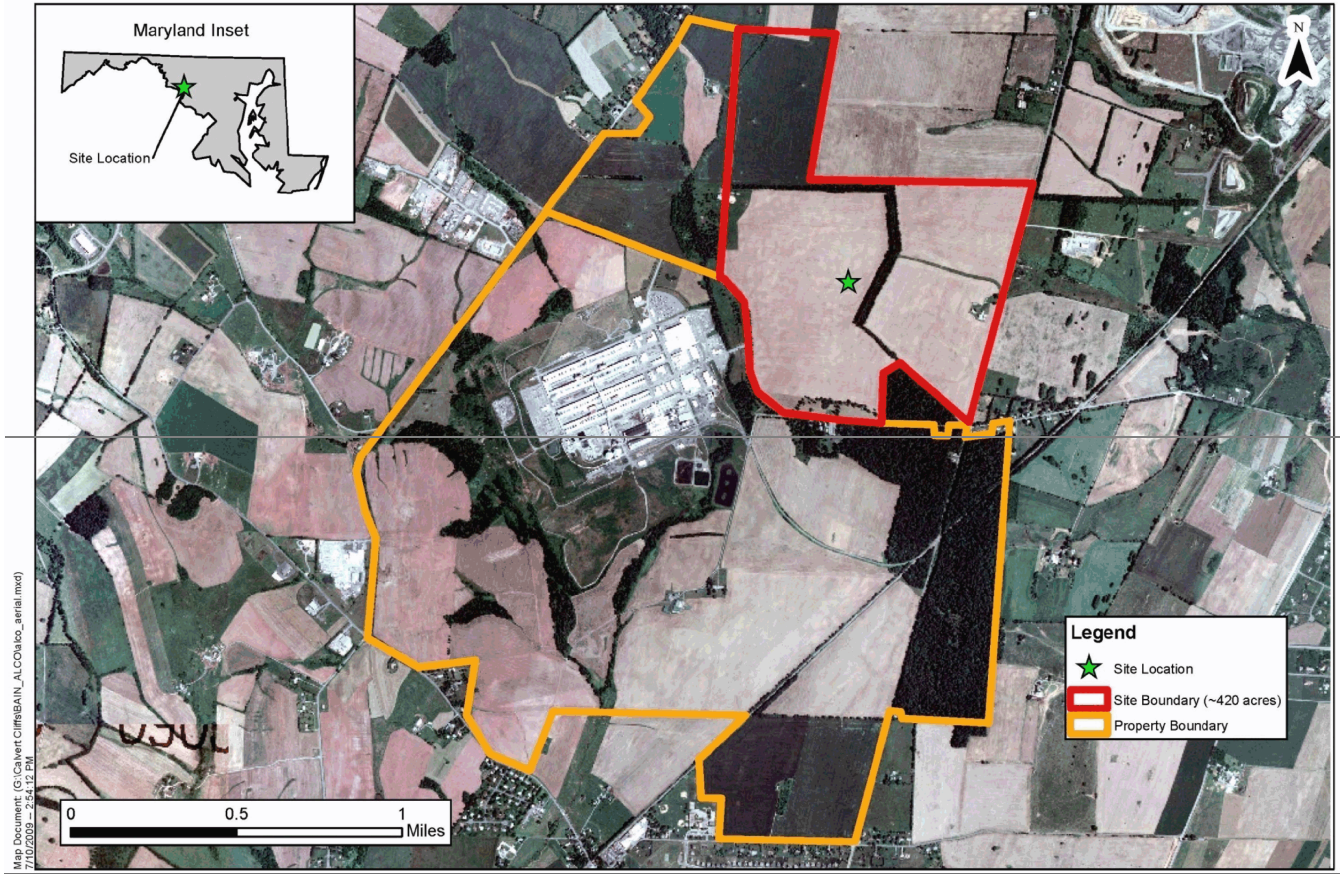
There is a large transmission corridor leading to the Eastalco site. It is likely that this corridor would be adequate to construct the necessary transmission lines associated with a new nuclear generating unit located at Eastalco (UniStar 2009a). In addition, there are seven existing 500Kv transmission lines within 5 mi of the site and a 345 kV transmission line about 12.7 mi northwest of the site. There are also nine 230 kV transmission lines available for interconnection: one line is about 0.5 mi from the site,; another line is 1.8 mi,; two lines 2.are 2.2 mi,; and another five lines are more than 4 mi from the site (UniStar 2009a).

The transmission corridor for the PATH project (see Table 9-8



~~**Figure** -. Eastalco Site Location (UniStar 2009a |ER p. 9-142|)~~



~~**Figure** -. Eastalco Site Vicinity (UniStar 2009a |ER p. 9-143|)~~

~~) would pass approximately 2 mi south of the Eastalco site (PATH 2009a).~~

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Based on the information from UniStar and the review team's independent evaluation, the review team concludes that the cumulative ~~transmission line~~ land-use impacts of ~~developing~~ building and operating a new nuclear generating unit and associated transmission lines at the Eastalco site would be SMALL~~.~~ to MODERATE. This conclusion reflects that the direct ~~transmission line~~ land-use impacts associated with siting the proposed project at the Eastalco site would be SMALL, but that cumulative impacts would be greater than SMALL because of the close proximity of the PATH transmission corridor.

~~9.3.5.2~~9.3.4.2 Water Use and Quality

Water for the Eastalco site would be obtained primarily from the Potomac River. The Eastalco site is about 5.5 ~~miles~~mi northeast of the Potomac River, where it passes Point of Rocks, Maryland ~~(UniStar 2008b).~~ According to UniStar (2009a), the proposed plant would require the withdrawal of about 50 MGD for cooling and other uses~~; of~~. Of that total, about 27 MGD would be consumed, and the remainder would be discharged back to the Potomac River. Uni~~s~~Star (2008b) states ~~that~~ the plant would use closed-cycle cooling with a cooling tower. The plant would have separate intake and discharge structures in the Potomac River. Discharge water would include cooling tower blowdown, treated process wastewater, treated sanitary wastewater, and some radioactive water. The discharge would be at an elevated temperature relative to the temperature of the Potomac River.

There are no major surface water bodies on the Eastalco site. There are two minor drainages along the edges of the alternative site footprint~~; one~~. One drainage is unnamed, and the other feeds ~~the~~ Tuscarora Creek.

The Eastalco site would require normal alterations, including grading, construction of roads, piers, jetties, and water intake and discharge structures in the Potomac River. Construction of the intake/discharge pipes would affect the pipe corridor from the site to the river, and it would affect the river bed in the vicinity of the intake and discharge structures. UniStar (200~~8b~~9a) identified the potential need to construct an onsite impoundment to provide an ultimate heat sink~~.~~ (UHS). UniStar estimates ~~that~~ the area and depth of such an impoundment would be approximately 4.7 ~~acres~~ac and 25 ft, respectively (UniStar 2009a).

~~UniStar (2008b) states that ground water would not be used for operations, but may be needed temporarily for building activities. UniStar has not yet determined the quantities of water needed for development of at this site.~~

The average flow of the Potomac River at Point of Rocks, Maryland, between 1895 and 2009 is ~~6,149~~6149 MGD (USGS 2009~~; accessed).~~). Water withdrawal for the alternative plant site would represent less than 1.0~~%~~ percent of average flow conditions at Point of Rocks. Although

there appears to be sufficient water during average flow conditions, low-flow conditions could have the potential to impact plant operations. UniStar (2009a) reported a 7Q10 value for the Potomac River of approximately 372 MGD for the gauge at Point of Rocks, Maryland. Total water withdrawal would represent almost 14% percent of the 7Q10 value;. c Consumptive use would be about half that value.

Withdrawals of water from the Potomac River require approval by the MDE Water Management Administration and compliance with the Low Flow Allocation Agreement (LFAA) signed by the Interstate Commission on the Potomac River Basin. The LFAA allows for water withdrawal restrictions during droughts to maintain sufficient flow to sustain aquatic resources. Maryland requires large consumptive water users, such as the proposed plant, to maintain storage for low-flow augmentation to meet the requirements of the LFAA. The amount of storage required is based on the amount of consumptive use and would be determined at the time of application. UniStar (2008b) believes that this may be a significant consideration for development of the Eastalco site. Because the amount of water consumed relative to the existing resource in the Potomac River is limited and because low-flow conditions would be monitored, controlled, and offset by flow augmentation (UniStar 2009a), the review team concludes that the hydrological alterations of impacts to the Potomac River from plant operations would be minor.

Water quality alterations to the both the surface water and groundwater would be regulated by NPDES discharge and stormwater permits. BMPs would prevent or mitigate spills from altering surface or groundwater resource's quality. The nutrient load from the plants sanitary effluent system would be a very minor contribution to the Chesapeake Bay's cumulative nutrient load.

UniStar (2009a) states that groundwater would not be used for operations, but may be needed temporarily for building activities. UniStar has not yet determined the quantities of water needed for development of this site. The geohydrology of the area is characterized as a regolith-fractured bedrock aquifer system. The regolith consists of soil, alluvium, and saprolite; thickness varies from 0 to more than 150 ft. Underlying the regolith is the Piedmont bedrock, which can be either crystalline or carbonate.

Building activities, including surface alterations and dewatering, have the potential to affect the local hydrology, but because the site has already been heavily developed, any impacts from building a nuclear power plant would be temporary and localized. Groundwater from deeper aquifers will be much less affected because this resource willwould not be used- during operations. The staff review team determined that, although the local hydrology wioulld be impacted, the impacts of construction, preconstruction, and operation on the regional surface and groundwater resources would be SMALLminor.

Activities with the potential to alter either surface water or groundwater quality would be regulated by NPDES discharge and stormwater permits. BMPs would prevent or mitigate spills from altering the quality of the surface water or groundwater resources. The nutrient load from the plant's sanitary effluent system would be a minor contribution to the Potomac River's cumulative nutrient load.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that although the local hydrology would be altered, the cumulative impacts on regional surface and groundwater resources of constructing and operating a new nuclear generating unit at the Eastalco site would be ~~SMALL~~minor.

Cumulative Impacts

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Eastalco site is considered to be the drainage basin of the Potomac River upstream and downstream of the site because this is the resource that would be impacted by the proposed project. Key actions that have past, present, and future potential impacts to water supply and water quality in the Potomac River basin include the operation the Dickerson Generating Station located 7 mi dow~~n~~nstream, the R. Paul Smith Power Station located 26 mi upstream, and other municipal and industrial activities in the Potomac River basin. For the cumulative analysis of impacts on groundwater, the geographic area of interest is the extent within Frederick County of the groundwater aquifers beneath the site.

Water Use. The surface water-use impacts of building and operating a nuclear power plant at this site are dominated by the higher demands that would occur under normal operation. The projected consumptive water use of a nuclear unit onsite is expected to be about 42 cfs or less than one percent of the average river discharge of 6149 cfs near the site. During extremely low-flow conditions, the water use is expected to be less than 8 percent of the river flow. These average river flow and extreme low flow values reflect cumulative consumptive uses of current users upstream of the site.

The review team is also aware of the potential climate changes that could affect the water resources available for cooling and the impacts of reactor operations on water resources for other users. The impact of climate change would be similar for all the freshwater alternative sites.

Increases in consumptive use of water in the Potomac River drainage is anticipated in the future. The impacts of the other operational projects listed in Table 9-8~~Table 9-8Table 9-8~~ are considered in the analysis included above or would have little or no impact on surface water use.

As indicated, groundwater would be used as a potable water source during construction, preconstruction, and operations. Due to the high yields for the aquifers in this region and demonstrated by past use at the Eastalco Site, no significant impact is anticipated to other nearby users of groundwater. Therefore, the review team concludes that the cumulative impacts from surface water and groundwater use for construction, preconstruction, and operation of the proposed project would be SMALL in normal years and MODERATE in drought years.

Water Quality. Point and non-point sources have impacted the water quality of the Potomac River upstream and downstream of the site. Water quality information presented for the impacts of building and operating a new unit at the Eastalco site would also apply to evaluation of cumulative impacts. As mentioned, an MDE-issued NPDES permit would be required to operate the nuclear project at this site. Effluent discharge through an NPDES-permitted outfall would confirm the discharges complied with the Clean Water Act. Such permits for other point source discharges into the Potomac River and its tributaries and EPA's Total Maximum Daily Load program for non-point sources are designed to protect water quality. The impacts of other projects listed in Table 9-8~~Table 9-8Table 9-8~~ are either considered in the included analysis or would have little or no impact on surface water quality. The review team also concludes that with the implementation of BMPs, the impacts on groundwater quality from building and operating a new nuclear unit at the Eastalco site would likely be minimal and, therefore, conclude the cumulative impact on surface and ground water quality would be SMALL.

~~9.3.5.3~~9.3.4.3 Terrestrial and Wetland Resources

The Eastalco site is an abandoned aluminum production site in Frederick County, MD, with existing structures that occupy about 400 ac. The ecological potential of this site had been drastically reduced during clearing for the construction of the aluminum production facility (MDNR 2006b). Primary cover types include agricultural fields, maintained grasslands, and forested woodlots. Most agricultural fields consist of row crops, including corn, soybeans, and winter wheat. Grasses ~~are the predominant cover type and~~ consist of meadow fescue (*Festuca pratensis*) and switchgrass (*Panicum virgatum*) (MDNR 2006b). Woodlots are deciduous and dominated by oaks (*Quercas* spp.), maples (*Acer* spp.), and tulip poplar ~~(*Liriodendron tulipifera*)~~. Man-made drainage ditches are present and are vegetated with grasses, weedy species, and a few black locust (*Robinia pseudoacacia*), cottonwood (*Populus deltoides*), and ash (*Fraxinus* sp.) trees. This site is surrounded primarily by agricultural lands. Eastalco contains ~~ten~~ten~~10~~ discrete wetlands totaling approximately 4.5 ~~acres~~ac (UniStar 2009a). ~~In addition, there are also approximately 33,000 linear feet of streams contained within the banks of Tuscarora Creek, its' tributaries, and Horsehead Run |UniStar 2009: Sep25 RAI Response ML092730188|. The nearest water source large enough to supply cooling water, the Potomac River, is approximately 5.8 miles from the site. A pipeline capable of supplying about 50 MGD would be required, as well as a reservoir to supply up to 2.5 billion gallons of water to the UHS.~~

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~~The primary cover type on Eastalco is row crop agriculture, including corn, soybeans, and winter wheat. There are small, forested areas along the stream courses as well as a forest stand bisected by two roads on the eastern boundary. Oak (*Quercus*), maple (*Acer*), and tulip poplar dominate the forest overstory (UniStar 2009a).~~

~~There are no Federal~~ No Federally listed threatened or endangered species are known to occur on ~~or in the immediate vicinity of~~ the Eastalco site or in Frederick County. The bald eagle ~~(*Haliaeetus leucocephalus*)~~, protected by the Bald and Golden Eagle Protection Act ~~and~~ , is listed as threatened by the State of Maryland (Table 9-9~~Table 9-9Table 9-9~~~~(Table A)~~.). Bald eagles may occur along the Potomac River and in the vicinity of the Eastalco site. ~~However~~The Potomac River is a primary bald eagle nesting area in Maryland (MDNR 2009b). In 2004, there were 43 active bald eagle nests along the Potomac River. However, it appears the eagles prefer to nest elsewhere as only three nests are known in Frederick County and only one was active (MDNR 2008). There is no open water at Eastalco suitable for eagle foraging on the site, and forest cover used for nesting, roosting, and perching is limited in distribution. Therefore, it is unlikely that bald eagles would occur on the Eastalco site. ~~The Potomac River is a primary bald eagle nesting area in Maryland |Md DNR 2009: WEB_MdDNR Bald Eagle Fact Sheet.pdf|. In 2004 there were 43 active bald eagle nests along the Potomac River. However it appears the eagles prefer to nest elsewhere as only three nests are known in Frederick County and only one was active |Md DNR 2008: Natural Heritage Program - Maryland 2004 Bald Eagle Nesting Summary.pdf|.~~

In addition to the bald eagle, the Maryland DNR Natural Heritage Program's list of rare, threatened, and endangered species for Frederick County, Maryland contains ~~seven~~7 terrestrial wildlife and 49 terrestrial plant species (Table 9-9~~Table 9-9Table 9-9~~). However, ~~none of these species~~no Federally listed ~~by FWS as threatened or endangered~~species are known to occur in ~~that~~Frederick County (MDNR 2007d). The upland sandpiper (*Bartramia longicauda*) is a shorebird that occupies grasslands exclusively and is commonly found nesting in airports in the northeastern United States (Houston and Bowen 2001). The Eastalco site contains grass habitats and croplands, but it is unknown if these habitat are suitable and used by the upland sandpiper. The green-patterned tiger beetle (*Cicindela patruela*) commonly occurs in open areas of dry, sandy soils within forests, such as abandoned roads, trails, sand pits, and bare slopes (USGS 2006; NatureServe 2009). UniStar stated this species may occur along the Potomac River where cooling water system structures would be located. The blackburnian warbler (*Dendroica fusca*) is a neotropical migrant that nests within the forest interior of mixed forests (Morse 2004). Forest stands on the Eastalco ~~sight~~site have been highly fragmented, and it is unlikely this species would nest on the site. The loggerhead shrike (*Lanius ludovicianus*) is an irregular resident of Maryland that prefers disturbed or open habitats (Reuven 1996), such as those located along streams and fence lines on the site. The Allegheny woodrat (*Neotoma magister*) occurs in rocky habitats (Chamblin et al 2004), which are not present on the site. Bewick's wren (*Thryomanes bewickii altus*) is a species that has benefitted

from the fragmentation of forested landscapes. It thrives in a landscape mosaic of early-successional habitats, such as forest edges, and has been associated with brushy areas around homes and backyards (James and Green 2009). The existence of the *altus* subspecies of Bewick's wren that occupies the Appalachian region has been called into question (James and Green 2009). It is believed the Bewick's wren may have been outcompeted and replaced by the house wren (*Troglodytes aedon*), a common backyard bird.

Table 9-9. ~~Federally and~~ State-Listed Terrestrial Species that Occur in Frederick County and May Occur on the Eastalco Site (MDNR 2007b)

Scientific Name	Common Name	State Status
Bartramia longicauda	Upland Sandpiper	Endangered
Cicindela patruela	Green-patterned Tiger Beetle	Endangered
Dendroica fusca	Blackburnian Warbler	Threatened
Haliaeetus leucocephalus	Bald Eagle	Threatened
Lanius ludovicianus	Loggerhead Shrike	Endangered
Neotoma magister	Allegheny Woodrat	Endangered
Thryomanes bewickii altus	Bewick's Wren	Endangered
Adlumia fungosa	Climbing Fumitory	Threatened
Agalinis auriculata	Auricled Gerardia	Endangered
Agastache scrophulariifolia	Purple Giant Hyssop	Threatened
Asplenium pinnatifidum	Lobed Spleenwort	Endangered
Botrychium oneidense	Blunt-lobe Grape-fern	Endangered
Calopogon tuberosus	Grass-pink	Endangered
Carex aestivalis	Summer Sedge	Endangered
Carex davisii	Davis' Sedge	Endangered
Carex shortiana	Short's Sedge	Endangered
Castilleja coccinea	Indian Paintbrush	Endangered
Chelone obliqua	Red Turtlehead	Threatened
Coeloglossum viride	Long-bracted Orchid	Endangered
Coptis trifolia	Goldthread	Endangered
Corallorhiza wisteriana	Wister's Coralroot	Endangered
Cornus rugosa	Round-leaved Dogwood	Endangered
Dirca palustris	Leatherwood	Threatened
Dryopteris campyloptera	Mountain Wood-fern	Endangered
Equisetum sylvaticum	Wood Horse~~es~~tail	Endangered
Erythronium albidum	White Trout Lily	Threatened
Euphorbia purpurea	Darlington's Spurge	Endangered

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Eurybia radula	Rough-leaved Aster	Endangered
Filipendula rubra	Queen-of-the-prairie	Endangered
Gentiana andrewsii	Fringe-tip Closed Gentian	Threatened
Glyceria acutiflora	Sharp-scaled Mannagrass	Endangered
Hasteola suaveolens	Sweet-scented Indian-plantain	Endangered
Helianthus microcephalus	Small-headed Sunflower	Endangered

Table 9-9~~Table 9-9Table 9-9~~. (contd)

Scientific Name	Common Name	State Status
Hydrastis canadensis	Goldenseal	Threatened
Krigia dendelion	Potato Dandelion	Endangered
Lythrum alatum	Winged Loosestrife	Endangered
Melanthium latifolium	Broad-leaved Bunchflower	Endangered
Minuartia glabra	Mountain Sandwort	Endangered
Nymphoides cordata	Floating-heart	Endangered
Oryzonpsis recemosa	Black-fruited Mountainrice	Threatened
Platanthera ciliaris	Yellow Fringed Orchid	Threatened
Platanthera grandiflora	Large Purple Fringed Orchid	Threatened
Platanthera permoena	Purple Fringeless Orchid	Threatened
Pycnanthemum torrei	Torrey's Mountain-mint	Endangered
Quercus shumardii	Shumard's Oak	Threatened
Rumex altissimus	Tall Dock	Endangered
Sagittaria rigida	Sessile-fruited Arrowhead	Endangered
Scutellaria leonardii	Leonard's Skullcap	Threatened
Scutellaria nervosa	Veined Skullcap	Endangered
Scutellaria saxatilis	Rock Skullcap	Endangered
Sida hermaphrodita	Virginia Mallow	Endangered
Smilacina stellata	Star-flowered False Solomon's-seal	Endangered
Spiranthes ochroleuca	Yellow Nodding Lady~~s~~'s Tresses	Endangered
Stenanthium gramineum	Featherbells	Threatened
Triosteum angustifolium	~~Narow-leaved~~Yellowfruit Horse-gentian	Endangered
Zanthoxylum americanum	Northern Prickly-ash	Endangered

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Of the 49 ~~s~~State-listed plant species found in Frederick County, 16 are wetland plants, 25 are found in uplands, and the remaining ~~eight~~8 may occur in both habitats. The distribution and abundance of these plant species on the Eastalco site is unknown. Because much of the site

has been previously converted to agriculture, it is doubtful many of these plants would occur on the site. UniStar stated that only three of the State-listed plant species – narrow-leavedyellowfruit horse--gentian (*Triosteum angustifolium*), potato dandelion (*Krigia dandelion*), and tall dock (*Rumex altissimus*) – could occur in highly disturbed habitats (UniStar 2009a). If any of these species did occur on the site, they would likely be limited to areas of existing natural vegetation, including forests, stream and wetland corridors, and grassy areas.

The ecologically important species, tTulip poplar, mountain laurel, chestnut oak, and New York fern, which were identified as ecologically important species for the Calvert Cliffs site, either do not occur on the Eastalco site or do not occur in sufficient numbers to contribute noticeably to the ecological integrity of the site. Therefore, these species are not considered important at the Eastalco site. The white-tailed deer, wild turkey, northern bobwhite, and ring-necked pheasant, all recreationally important species, would likely occur at this site. White-tailed deer are common in agricultural settings and were observed on the site during the site audit. Wild turkey would also be expected based on habitat types present and the known distribution in Maryland (UniStar 2009a). The Eastalco site appears to be well suited as habitat for the northern bobwhite and ring-necked pheasant. Both thrive in disturbed habitats and do particularly well in landscape mosaics that include agriculture.

9.3.5.49.3.4.4 Building and Operational Impacts

UniStar identified a representative 420-ac area within the Eastalco site for the purposes of this analysis. If a plant were built within this footprint, no wetlands would be affected. However, 1311 linear feet of stream, about 4 percent of the total on the Eastalco site, would be affected (UniStar 2009a). The water supply pipeline would disturb approximately 105 additional acresac, and the pond surface reservoir footprint would be about 10 ac. (UniStar 2009a).

The Eastalco site is highly disturbed and dominated by row crop production. High quality habitat exists in small, isolated hardwood stands and along stream courses. Woodlands, and wetlands , and streams are not extensive on the site., and these high-quality habitats exist in small, isolated patches. Adequate land area exists to avoid ecologically high-value lands during development of a nuclear plant at this site. Potential for building and operating a nuclear plant, limiting the existing potential to impact listedaffect most important species is limited. The Eastalco site does not contain suitable bald eagle habitat, and. The nearest water source large enough to supply cooling water, the Potomac River, is approximately 5.8 mi from the site. A pipeline capable of supplying about 50 MGD would be required, as well as a reservoir to supply up to 2.5 billion gallons of water to the UHS. Although bald eagles are known to nest along the Potomac River, only one active nest is known to occur in Frederick County [Md DNR 2008: Natural Heritage Program - Maryland 2004 Bald Eagle Nesting Summary.pdf].(MDNR 2008). Therefore, it is unlikely impacts related to the construction and operation of a nuclear power plant would result in significant impacts to bald eagles.

~~Installation~~Upland sandpipers may occur in grass-dominated habitats, but pre~~construction-~~ disturbance surveys, design modifications, and mitigation would be used to minimize the potential to affect this species (UniStar 2009a). Potential nesting habitat could be lost if fallow fields are converted to facilities. Distribution and abundance of the green-patterned tiger beetle is undetermined, but this species could be ~~impacted~~affected by building activities related to the cooling water system along the Potomac River (UniStar 2009a) or within suitable upland habitat. Surveys, design modifications, and mitigation could minimize the potential to affect these beetles (UniStar 2009a), and adequate agricultural land exists to avoid forested habitats. The blackburnian warbler is unlikely to nest on the site, but may occasionally use forested areas during migration. Avoidance of forest habitats would preclude impacts to this bird species. The loggerhead shrike, Bewick's wren, and most of the 49 State-listed plants would be found within forests, wetlands, and along streams and fence lines. Building a nuclear power plant within agricultural lands would also minimize the potential to affect these species as well. The ~~narrow-leaved~~yellowfruit horse~~-~~-gentian, potato dandelion, and tall dock may occur in disturbed habitats, but pre-disturbance ~~preconstruction~~ surveys and mitigation, if needed, would minimize effects to these species (UniStar 2009a). Habitat available to the white-tailed deer, wild turkey, northern bobwhite, and ring-necked pheasant would decrease, and individuals would be displaced. However, these effects are not expected to be noticeable beyond a very local scale and would not destabilize county-level populations.

Building a new unit at Eastalco and the installation of a cooling system pipeline to the Potomac River and transmission systems would ~~imp~~affect terrestrial resources, including wetlands~~ and streams~~. However, land use on the Eastalco site is typical of the region, with much of the surrounding land area already disturbed by agriculture. Few ecologically high-value habitats are likely present, and sufficient disturbed land area exists to avoid relatively undisturbed habitats during installation of a pipeline and transmission system. Route adjustments based on data from pre-disturbance ~~preconstruction~~ surveys and mitigation measures that would be implemented during and after building of a plant would minimize impacts (UniStar 2009a). Operational activities within the transmission corridors might include visual inspection and appropriate maintenance of transmission line corridors. Maintenance activities might include ~~re~~clearing vegetation and tree trimming or removal. For maintenance purposes, wooded sections of the corridors would be ~~re~~cleared to the full width through mechanical clearing, hand cutting, or herbicide application using industry standard BMPs and are not expected to substantially affect terrestrial resources.

~~For reasons previously discussed, detectable impacts to important terrestrial species and habitat would be minimal, if any, at the Eastalco site. Therefore, impacts to terrestrial resources, including wetlands and streamsimportant species, from construction, preconstruction, and operation of a nuclear power plant at the Eastalco site would be SMALL.~~

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~~**Other Projects (discussion to be provided)**~~

Terrestrial ecological impacts that may result from operation of a new nuclear unit at the Eastalco alternative site include those associated with the cooling system, transmission system structures, and maintenance of transmission line corridors. For impacts related to cooling system operations, the review team assumed the ~~number and type of~~same type of cooling tower~~s~~ proposed for Unit 3 at the Calvert Cliffs site would be used at any of the alternative sites. In NUREG-1437 (NRC 1996), the NRC staff evaluated terrestrial ecological impacts resulting from operation of existing nuclear power plants and transmission line operation and maintenance. The types of terrestrial ecological impacts resulting from operation of a new nuclear unit would be similar to those of existing nuclear power plants. When more specific information was not available, conclusions in the NUREG-1437 (NRC 1996) were used to assess terrestrial impacts resulting from the operation of the cooling tower~~s~~ and impacts from transmission line corridor maintenance and operation. Similarly, the effects of cooling tower ~~drive~~drift, avian collisions, noise, and transmission lines would be similar to those described in Section 5.3.1.1 in which the operational impacts were determined to be undetectable at the population level.

Cooling Towers

The operation of a cooling tower results in the loss of water through evaporative loss and drift. Drift is described as small, unevaporated water droplets that are exhausted out the top of the tower. These droplets may carry minerals, debris, microorganisms, and chemicals that may ~~impact~~affect crops, ornamental vegetation, and native plants. Adverse impacts from cooling tower drift cannot be evaluated in detail ~~in the absence of~~without knowing ~~information on the type (mechanical or natural draft), number, and~~the specific location of the cooling tower~~s~~ at each alternative site. However, g~~G~~eneral guidelines for predicting effects of drift deposition on plants suggest that many species have thresholds for visible leaf damage in the range of 9 to 18 lb/ac/mo of salt deposition on leaves during the growing season (NRC 1996). ~~The proposed Unit 3 cooling tower, which includes plume abatement, would be drawing salt/brackish water for cooling from the Chesapeake Bay through a desalination facility.~~ The Potomac River near the Eastalco site is a freshwater source; therefore, one could expect even less impact at the Eastalco site because the salt content in the cooling water source would be lower. ~~.~~ Because the maximum salt deposition for the proposed Unit 3 is far below the level that could cause leaf damage in many common species, the impacts would be negligible both on the ~~Calvert Cliffs~~East Alco site and in the vicinity. ~~Likewise, one could expect even less impact at the Eastalco site because the salt content in the cooling water source would be lower.~~ In general, the impacts of drift on crops, ornamental vegetation, and native plants were evaluated for existing nuclear power plants and were found to be of minor significance (NRC 1996). ~~This determination also included nuclear power plants with more than one cooling tower.~~

Similarly, ~~detailed~~predicting mortality from bird collisions with cooling towers depends on the type (mechanical or natural draft for a wet cooling system; dry for a dry system) and number of

cooling towers at each alternative site. In this case, a single, large mechanical draft cooling tower is proposed. The impacts of bird collisions for existing power plants were evaluated and found to be of minor significance for all operating nuclear plants, including those with various numbers and types of cooling towers (NRC 1996). On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of cooling tower drift and bird collisions with cooling towers resulting from operation of a new nuclear unit at Eastalco would be minor.

Typical noise levels that can be expected at a distance of 1300 ft from the cooling tower are 65 dBA (UniStar 2009a). Noise from plant operation would also be quickly attenuated by surrounding forest cover, further limiting ~~any~~its impact on wildlife. Local wildlife ~~will~~would likely adapt to noise levels, while cooling tower and transformer noise may also serve to limit the potential for avian collision. Consequently, the review team concludes the impacts of cooling tower noise on wildlife would be minimal at Eastalco.

Transmission Lines

The impacts associated with transmission line operation consist of bird collisions with transmission lines and electromagnetic field (EMF) effects on flora and fauna. The impacts associated with building transmission lines and corridor maintenance activities are alteration and/or conversion of habitat due to tree cutting and herbicide application and similar related impacts, such as use of temporary matting, where corridors cross floodplains, wetlands, and other important habitats.

Direct mortality resulting from birds colliding with tall structures has been observed (Avatar 2004). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight by flocking birds during darkness has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play ~~a~~ roles in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). However, in NUREG-1437, the staff concluded that the threat of avian collision as a biologically significant source of mortality is very low as only a small fraction of total bird mortality could be attributed to collision with nuclear power plant structures, including transmission corridors with multiple transmission lines (NRC 1996). Although collision may contribute to local losses, thriving bird populations can withstand these losses without threat to their existence (Brown 1993). Although additional transmission lines would be required for a new nuclear unit at Eastalco, increases in bird collisions would be minor and these would likely not be expected to cause a measurable reduction in local bird populations. Consequently, the incremental direct mortality posed by the addition of new transmission lines for a new nuclear unit would be negligible at the Eastalco alternative site.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). The impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines and lines energized at levels less than 765 -kV (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by operation of existing transmission lines and the addition of new lines for a new nuclear unit would be negligible at the Eastalco alternative site.

Existing roads providing access to the existing transmission line corridors at Eastalco would likely be sufficient for use in any expanded corridors; however, new roads would be required during the development of new transmission line corridors. Transmission line corridor management activities (cutting and herbicide application) and related impacts to floodplains and wetlands in transmission line corridors are of minor significance at operating nuclear power plants, including those with transmission line corridors of variable widths (NRC 1996). Consequently, the incremental effects of transmission line corridor maintenance and associated impacts to floodplains and wetlands for a new nuclear unit would be negligible at Eastalco.

For reasons discussed above, ~~detectable~~ impacts to important terrestrial species and habitat would be minimal, if any, at the Eastalco site. Therefore, impacts to terrestrial resources, including wetlands, from ~~construction, preconstruction,~~building and operation of a nuclear power plant at the Eastalco site would be minor.

Cumulative Impacts

The geographic area of interest for the assessment of the potential cumulative aquatic ecology impacts of building a new reactor at the Eastalco site on terrestrial resources and wetlands is defined as Frederick County, Maryland, because the extent of terrestrial impacts is mostly localized and the site is several miles from neighboring counties. Numerous projects, facilities, and activities could contribute to cumulative impacts on terrestrial resources and wetlands within the County. The PATH Project, a 280-mi long transmission line is proposed to pass through central Frederick County to the Kemptown substation near Frederick, Maryland. It is likely terrestrial habitats and wetlands within Frederick County would be affected by this project, but much of the route within the c~~C~~ounty is proposed to parallel or lie within existing transmission lines, limiting impacts to valuable resources (PATH 2009a). In 2001, Duke Energy applied for an application to build a natural gas-fired power plant north of Point of Rocks, Maryland. This project was cancelled in 2002, but land has been retained by Duke Energy and may be used for this purpose. If this land is eventually developed, impacts to terrestrial resources and wetlands

are likely, but the extent is unknown (MDNR 2006b). Expansion of Fort Detrick, which occupies more than 1200 ac near Frederick, and subsequent infrastructure upgrades could also contribute to cumulative impacts. It is unknown to what extent this activity would affect resources. This facility lies mainly within an urban landscape, so it is unlikely valuable terrestrial resources still persist. Continued urbanization and global warming have the potential to alter and reduce the amount of terrestrial habitat and wetlands available to flora and fauna, and the building of a plant at the Eastalco site would contribute to that potential. However, the Eastalco site lies within highly disturbed, highly fragmented agricultural landscape, and~~. Th~~ there are no known Federally listed species present within the County. ~~, and t~~The incremental contribution of building and operating a new unit at the Eastalco site to cumulative impacts ~~resulting from the building a nuclear power plant~~ would be inconsequential and ~~would not be expected to destabilize flora and fauna populations at the County scale~~undetectable in the area of interest.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes ~~***that***~~ the cumulative impacts ~~***on***~~to terrestrial and wetland resources ~~of~~that would be affected by ~~constructing~~ building and operating a new nuclear unit ~~***at the Eastalco***~~~~that would be attributable to cooling towers, transmission lines, and transmission line corridors~~ at the Eastalco alternative site would be SMALL.

~~9.3.5.5~~9.3.4.5 Aquatic Resources

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources. The Potomac River, which is about 5.8 ~~miles~~mi from the site, would provide the cooling water for a new nuclear power plant at Eastalco (UniStar 2009a). The Potomac River near the Eastalco site is non-tidal freshwater and is within the Upper Potomac River watershed~~.~~ upstream of Great Falls, which is a natural barrier to most anadromous fish migrations. A new reactor on the Eastalco site would require a new cooling water intake and discharge system, which would include a pipeline from the Potomac River to the plant that would be at least 5.8 ~~miles~~mi long.

The Potomac River is the largest and most important aquatic resource near the proposed new plant. During the site visit in August 2009, it was observed that water depth at that location is relatively shallow. Other aquatic communities within the site include wetlands areas, as discussed in Section 9.3.5.4, and two small streams, Tuscarora Creek and Horsehead Run. These streams are within the Monocacy River watershed. The onsite resources have not been characterized, but there are approximately 33,000 linear ft of streams contained within the banks of Tuscarora Creek, its tributaries, and Horsehead Run (UniStar 2009a).. However, during a site visit in August 2009, it was observed that flow in the streams was ~~very~~ low, banks were incised and undercut, and ~~that the streams have been affected by showed signs of anthropogenic activities.~~

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~~Several nearby sanctuaries or preserves could be affected by this alternative. The nearest managed areas are Sugarloaf Mountain Natural Area, which a National Natural Landmark about 5 mi south east of the Eastalco site, and the Monocacy Natural Resource Area, which provides for recreational fishing and hunting just south of Sugarloaf Mountain. The primary impacts to both parks would likely be noise from the building of a new plant. The Chesapeake and Ohio Canal (C&O) National Historical Park is located along the eastern shore of the Potomac River extending about 185 mi from Cumberland, Maryland to Washington, D.C. The location of the cooling water intake/discharge system on the Potomac River would affect the C&O Canal National Park.~~

~~The potential for impacts from building and operating a nuclear reactor at Eastalco to aquatic biota would be primarily to organisms inhabiting~~~~impacts, such as incised and undercut banks~~. ~~S~~some farm roads cross directly through the streams ~~on the site and the Potomac River.~~.

Recreationally Important Species

Recreational fishing on the Potomac River often targets the smallmouth bass (*Micropterus dolomieu*) and walleye (*Sander vitreus*), but also includes channel catfish (*Ictalurus punctatus*), and largemouth bass (*Micropterus salmoides*) (MDNR ~~2009f) |CC Website Record Potomac R fishing.pdf|.~~2009g).

Smallmouth Bass (*Micropterus dolomieu*). Smallmouth bass are not native to Maryland, but have become widespread in the ~~state (MDNR 2007aa) |CC Website Record MD Smallmouth bass.pdf|.~~State (MDNR 2007m). Smallmouth occur in streams and rivers with moderate currents, rocky substrates, shade, and pools. Smallmouth feed on fish, crayfish, and insects. Spawning occurs in late spring with adhesive eggs laid in nests built on the substrate nearshore.

Walleye (*Sander vitreus*). The walleye is a large perch that is common across the northern U.S. and Canada, but has been widely introduced in the U.S., including Maryland (MDNR ~~2007bb) |CC Website Record MD Walleye.pdf|.~~ 2007n). Walleye live in large waterbodies that are clear and have rocky substrates. Walleye are primarily predators on fish but also eat crayfish. Spawning occurs in early spring with adhesive eggs attaching to rocky substrates in shallower water.

Channel Catfish (*Ictalurus punctatus*). Channel catfish are large fish that have become established in non-tidal and tidal waters throughout Maryland, although the species is not native to the State (MDNR ~~2007cc) |CC Website Record MD channel catfish.pdf|.~~2007f). Catfish live in deep pools that are sheltered by large rocks and logs. These catfish feed at night on bottom-dwelling prey, such as crayfish, mollusks, and insects. They also eat plants. Spawning occurs in late spring with the eggs being deposited in nests that are protected within depressions, holes, or undercut banks.

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Largemouth Bass (*Micropterus salmoides*). Largemouth bass are widespread in Maryland, living in fresh and brackish waters (MDNR 2007dd) |CC Website Record MD largemouth bass.pdf|.2007g). Largemouth bass live in large rivers where flow is slow, and the bottom is soft. These bass are long-lived predators that primarily eat fish, but also occasionally eat frogs and snakes. Spawning occurs from March through June with eggs being deposited into nests that are guarded by males.

Non-Native and Nuisance Species

The zebra mussel (*D. polymorpha*) and Asian clam (*Corbicula fluminea*) are two introduced nuisance species that have not yet been recorded in the middle Potomac River near the Eastalco site. There is one record of the zebra mussel in the Potomac watershed in Prince William County, Virginia (MDNR 2009xx) |CC Website Record zebra mussel CBY.pdf|.2009a). Asian clams have been found in Potomac waters in Charles, Prince Georges, and Montgomery Counties, Maryland (Foster et al. 2009) |CC Website Record Foster 09 asian clam fact sheet.pdf|.). The rusty crayfish is native to the Ohio River basin, but has been found in Marsh Creek, a tributary of the upper Monocacy River (MDNR 2007k) |CC Website Record MDNR 07 rusty crayfish.pdf|.2007l). Maryland banned the possession of any crayfish species in the Middle Potomac River basin in 2008 (MDNR 2009 jj) |CC Website Record MD crayfish ban.pdf|.2009e).

Critical Habitats

There are no Federally threatened or endangered aquatic species near the Eastalco site (MDNR 2007k) |MD DNR Frederick County T-E animals-plants.pdf|.2007d). Therefore, no critical habitats have been designated by the FWS near the Eastalco site.

Federally and State-Listed Species

There are no Federally listed threatened or endangered aquatic species or critical habitat near the Eastalco site (MDNR 2007k) |MD DNR Frederick County T-E animals-plants.pdf|.2007d). Three State-listed fish species, – the State-threatened pearl dace (*Margariscus margarita*) and), comely shiner (*Notropis amoenus*),) and the highly state rare/state rareHighly State Rare/State Rare checkered sculpin (*Cottus* sp. 7),) – are reported for Frederick County (MDNR 2007kd). Seven State-listed freshwater mussel species are reported for Frederick County. These are the triangle floater (*Alasmidonta undulata*), brook floater (*A. varicosa*), yellow lance (*Elliptio lanceolata*), Atlantic spike (*E. producta*), yellow lampmussel (*Lampsilis cariosa*), green floater (*Lasmigona subviridis*), and creeper (*Strophitus undulatus*).

Pearl Dace (*Margariscus margarita*). The pearl dace is a moderately sized minnow that can reach a length of about 4 in. (Cunningham 2006) |Cunningham 06 pearl dace conservation USGS.pdf|.). The pearl dace generally occurs across Canada and the northern portion of the

U.S. from Montana to Maine, but its range also extends south through Pennsylvania to Virginia. The species is listed as threatened by the State of Maryland (MDNR 2007~~a~~d). Pearl dace generally live in slow moving, winding streams that have vegetated banks~~,~~ and many pool habitats (Cunningham 2006). Dace feed on zooplankton, benthic invertebrates, detritus, and plants. In Maryland, pearl dace occur only in limestone streams, which extend from the southern part of Frederick County near the Potomac River northeastward near the Eastalco site (MDNR 2005~~) |MDNR 2005 WCDP_Chapter4_Part4_20050926.pdf|.~~). The streams on the Eastalco site have not been characterized, and it is not known whether they are limestone streams. The occurrence of the pearl dace near or on the Eastalco site is uncertain.

Comely Shiner (*Notropis amoenus*). The comely shiner is a small minnow that reaches a length of about 4 in. It lives in moderate to large streams where the water is at least 2 ft deep (NYSDEC ~~2008a) |CC Website Record comely shiner NY.pdf|.~~2008b). It may occur in lakes and reservoirs. Spawning occurs in late spring and summer. Feeding habits are not known, but it is likely that the comely shiner feeds in the water column on aquatic and terrestrial arthropods (NYSDEC 2008~~k~~b). The comely shiner is listed as threatened in Maryland (MDNR 2007~~a~~d). Its possible occurrence near the Eastalco site is not known.

Checkered Sculpin (*Cottus* sp. 7). The checkered sculpin is an undescribed species, formerly assigned to the slimy sculpin (*C. cognatus*), that is known from Virginia, Maryland, West Virginia, and Pennsylvania (PANHP 2009b~~) |PANHP checkered sculpin.pdf|.~~). The species lives only in limestone streams (MDNR 2005, PANHP 2009b~~.~~). Maryland lists the species as ~~highly~~ Highly State ~~rare~~Rare/State ~~rare~~ Rare (MDNR 2007~~a~~d). During stream surveys conducted in 1995 to 2002, the checkered sculpin occurred at only two sites within Frederick County (MDNR ~~2009a) |CC Website Record MD checkered sculpin records.pdf|.~~2009d). Its possible occurrence near the Eastalco site is not known.

Freshwater Mussels (Family Unionidae). Maryland State-~~e~~Endangered mussels include the triangle floater ~~(*Alasmidonta undulata*),~~, brook floater ~~(*A. varicosa*),~~, and the green floater ~~(*Lasmigona subviridis*).~~. The Atlantic spike ~~(*Elliptio producta*)~~ and the creeper ~~(*Strophitus undulatus*)~~ are Maryland State-~~i~~Imperiled. The yellow lampmussel ~~(*Lampsilis cariosa*)~~ and yellow lance ~~(*E. lanceolata*)~~ are listed as State ~~u~~Uncertain (MDNR 2007~~a~~d). The creeper, triangle floater, brook floater, and green floater all inhabit highland and piedmont streams and rivers in Frederick County, many of which are near the Eastalco site (MDNR 2005). The Atlantic spike ranges from the Potomac River basin to the Savannah River (Bogan and Alderman 2008) ~~|Bogan Alderman 08 SC bivalve key.pdf|~~ and is poorly known. The species has been confused with *E. lanceolata* and several similar species (Price 2009~~) |Price 09 AtlanticSpike.pdf|.~~). These mussels are often considered as a mussel community that inhabits rivers and large streams (Walsh et al. 2007~~) |Walsh 07 PA aquatic community classification UsersManual.pdf; chapter 4|.~~). The yellow lampmussel inhabits highland and piedmont rivers, and the yellow lance lives in piedmont streams and rivers in Frederick County (MDNR 2005). Although the occurrence of

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these mussels in the Potomac River near the Eastalco site is uncertain, there are historical records that document the occurrence of all of the species, except the yellow lance, in the Middle Potomac River (Pearce and Evans 2008~~) |Bulletin of the Biological Society of Washington 15:20-30 (no pdf yet)|.~~). The possible occurrence of these mussels in the Potomac River near the Eastalco site or in the streams in the site is uncertain, but the possibility that they occur in either location cannot be discounted.

Building and Operational Impacts

Building a nuclear unit on the Eastalco site would affect about 1311 linear f~~oo~~t of streams ~~but would not affect other onsite wetlands~~ (UniStar 2009a). Assuming that the plant design would be similar to that proposed for CCNPP Unit 3, a new plant would permanently add about 130 ac of impervious surface to the Eastalco site, which would increase runoff during storms, potentially increasing erosion and adding pollutants to aquatic resources. The potential impacts of the construction on the onsite aquatic resources primarily would be loss of stream habitat, but it would not adversely affect the overall aquatic resources in the region.

New cooling water intake and discharge structures would be required for a new reactor located at the Eastalco site. The intake and discharge structures are assumed to be designed like those at the proposed site having no return system at the intake pipe openings, which lead to a common forebay (see Chapter 3). The structures would be built on the Potomac River and would require a new pipeline ~~that would be~~ at least 5.8 mi long. An exact pipeline route has not been determined, but the pipeline would most likely cross one or more small streams ~~enroute~~en route to the Potomac River. Construction of a new intake would result in the temporary displacement of aquatic biota within the vicinity of the intake. It is expected ~~that~~ these biota would return to the area after building is complete. Some silt runoff could occur during development and could ~~impact~~affect local fish and benthic populations. However, the impacts on aquatic organisms would be temporary and largely ~~be~~ mitigated through the use of BMPs. The type of substrate on the Potomac River bottom at possible intake/discharge locations is not known~~,~~ but, most likely, is substantially rocky. Installation of the intake/discharge structures on hard-bottom substrates could involve the use of cofferdams and dewatering, which would introduce pile-driving noise, ~~which is~~ discussed in Section 4.3.2.1, as a potential impact. The installation of the intake and discharge system in soft sediment areas would involve dredging, the potential impacts of which are discussed in Section 4.3.2.1.

New transmission lines would be needed to connect a new reactor on the Eastalco site to existing lines that are within 5 mi of the site (UniStar 2009a). A specific route for the new right-of-way has not been specified. The severity of impacts would depend on the characteristics of the aquatic resources within the corridor, but the use of BMPs during construction and operation would lessen the potential impacts.

The most likely effects on aquatic populations from operation of a new nuclear unit at the Eastalco site would be the impingement, ~~and~~ entrainment, and entrapment of organisms from the Potomac River.

~~Assuming~~ However, assuming that a new reactor at the Eastalco site would use a closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities (66 FR 65256), ~~has~~ would have a maximum through-screen velocity of 0.5 ft/s (0.15 m/s) at the cooling water intake, and would meet~~s~~ the appropriate EPA intake flow to source water volume criterion, then adverse impacts to most Potomac River aquatic populations from entrainment, ~~and~~ impingement, and entrapment would not be anticipated. Many of the aquatic species in the Potomac River have benthic eggs that are adhesive or laid in nests, which lessens the potential for entrainment of this life stage. The species most likely to be impinged, entrained, or entrapped at the Eastalco site ~~impinged~~ would be those affected by the Dickerson Generating Plant downstream from the Eastalco site. McLean et al. (2002) concluded that entrainment and impingement impacts at Dickerson were minor.

Although a discharge plume has not been modeled for the Eastalco site, the area plume would be relatively small compared to the river size ~~in the area~~unless the water depth is shallow enough to result in a plume with an areal extent greater than that modeled for the Calvert Cliffs site. Without a site-specific modeled thermal plume, the potential existence of a thermal barrier to fish passage cannot be evaluated. ~~, and t~~The potential for adverse impacts from cold shock or heat shock because of exposure to the thermal plume would ~~small.~~minor. ~~There would not be a thermal barrier to fish passage.~~ Chemical concentrations in the effluents from the Eastalco ~~plant~~ site would be required to follow permitted guidelines.

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Overall, the combined impact of construction, preconstruction, and operation of a new reactor on the Eastalco site to aquatic resources on the site and in the Potomac River would be minor but could be noticeable if State-listed species do occur in onsite water bodies. ~~be SMALL.~~

Cumulative Impacts

The geographic area of interest for the assessment of the potential cumulative impacts of building a new reactor at the Eastalco site on aquatic resources is defined as parts of the Upper and Middle Potomac River watersheds that extend~~s~~ through parts of Washington, Frederick, Montgomery, and Carroll Counties and includes the Lower Monocacy River watershed (MDNR ~~2007uu, 2007ww) |MDNR 07 UPRBasinSum8505FINAL07.pdf, MDNR 07 MidPotBasinSum8505FINAL07.pdf|.~~2007j, 2007h). Water quality in the Potomac River at Point of Rocks, near the possible location of the intake/discharge system, for 2003 to 2005 was rated poor (suspended solids) to fair (nitrogen, phosphorus) (MDNR ~~2007qq) |MDNR 07 UPRBasinSum8505FINAL07.pdf|.~~2007j). Streams in the Upper Potomac watershed were rated from fair to poor during Maryland Biological Stream Survey monitoring conducted in 2003 (MDNR ~~2003) |MDNR 03 upper_pot overview.pdf|.~~2003a). The main activities that could

interact with those related to a new reactor at the Eastalco site include the Dickerson Generating Plant, the ~~Potomac Appalachian Transmission Highline (~~PATH~~)~~ Project, and the Brunswick Wastewater Treatment Plant. The Dickerson Generating Plant, which is located on the Potomac River about 7 mi downriver from the Point of Rocks area, consumes about 1.5 ~~mgd~~MGD of water from the Potomac. The primary species entrained or impinged at the plant include spottail and spotfin shiners, channel catfish, and redbreast sunfish. The ecological impacts were estimated to be minor (McLean et al. 2002). Thermal discharges from the plant were found to have localized impacts on benthic communities, but these impacts did not result in adverse effects ~~on~~to fish populations that exploit benthic communities (PPRP 2008).

The PATH project would build a transmission line from Amos, West Virginia to Kemptown, Maryland. The route crosses the Potomac River upriver of Point of Rocks and proceeds through lower Frederick County south of the Eastalco site. The method of crossing the river is not available, but probably would avoid direct effects on the river. The Brunswick Treatment Plant, which is about 6 mi upriver from the Point of Rocks area, discharged about 0.6 ~~mgd~~MGD of effluent into the Potomac River in 2004 and 2005 with nitrogen and phosphorus being the primary nutrients in the discharge stream (MDNR 2007~~gg~~j). The plant has recently installed technologies to reduce the nutrient discharges. A new reactor on the Eastalco site would affect the Potomac River primarily by the entrainment and impingement of biota and the thermal discharge. These effects would not significantly add to those from the downriver Dickerson plant. A new reactor would not add significant discharges of nutrients to those discharged by the Brunswick Treatment Plant.

Urbanization and global climate change could change aquatic communities in the foreseeable future. Expansion of urban areas in the Potomac River drainage could adversely affect water quality through both point and nonpoint pollution. Degraded water quality would adversely affect aquatic recourses through a loss of suitable habitat. Global climate change could lead to more storm events with greater severity (Nielsen-Gammon 1995; Karl et al. 2009). Bank erosion and siltation of onsite water bodies from the increased precipitation could alter flows and result in the loss of aquatic habitat.

Based on the information from UniStar and the review team's independent evaluation, the review team concludes that the cumulative impacts of all past, present, and future activities, including building and operating a new reactor at the Eastalco site, on most aquatic resources in the area of interest would be ~~Based on the information from UniStar and the review team's independent evaluation, the review team concludes that the cumulative aquatic resources impacts of constructing and operating a nuclear generation unit at the Eastalco site would be~~ SMALL to MODERATE. The incremental contribution of building and operating a new reactor at the Eastalco site would likely be SMALL for most aquatic species but could be MODERATE for State-listed aquatic species if they occur onsite.

~~9.3.5.6~~9.3.4.6 Socioeconomics

In evaluating the socioeconomic impacts of development and operation at the ~~East ALCO~~Eastalco site in Frederick County, Maryland, the review team undertook a ~~reconnaissance survey~~review of the site using ~~readily obtainable~~ data ~~from the Internet and published~~ sources~~.~~ ~~Impacts from both building and station operation are~~ discussed~~.~~ in Section 9.3.2.

Physical Impacts

~~Generic aspects of physical impacts are addressed in Section 9.3.2.2.~~

Many of the physical impacts of construction and operation would be similar regardless of the site. Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from building a new nuclear unit would be minimal.

Potential impacts from station operation include noise, odors, exhausts, emissions, and visual intrusions (aesthetics). A new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. By inference, this practice also would be expected to apply to all alternative sites. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the alternative site.

Any new unit at an alternative site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would confirm that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, a new unit would not use a significant quantity of chemicals that could generate odors exceeding odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

Construction and preconstruction activities would be temporary and would occur mainly within the boundaries of the Eastalco site. Offsite impacts would represent minimal changes to offsite services supporting the building activities. During facility operations, noise levels would be managed to State and local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should limit odors. Based on the information provided by UniStar and the review team's independent evaluation, the review team

concludes that the physical impacts of building and operating a nuclear unit at the Eastalco site would be SMALL.

Demography

The Eastalco site is located near the town of Frederick (2008 population 59,213~~),~~) in Frederick County, central Maryland. The U.S. Census indicates that Frederick County had a 2008 population of 225,721, which was a 16 percent increase from 2000 (USCB ~~2009 |Frederick&FrederickCountyPopulations.pdf|).~~2009d). Baltimore is approximately 53 miles east, and Washington, D.C. is 54 miles southeast.

At the peak of the site development period, UniStar would expect an onsite workforce of 3950 construction workers (UniStar 2009a). Based on the analysis of impacts presented in Section 4.4.2, the total maximum number of construction workers migrating into the region (within 50 mi of the site) from outside of the region would be between 790 and 1383 workers (20 to 35 percent of the total workforce) at the peak of the ~~site development~~building period. Using an average household size of 2.61, the total in-migrating population would be between 2062 and 3608 people. The majority of impacts ~~are~~would be expected to occur in Frederick County because it contains the site. The impacts are more dispersed farther away from the site due to the large populations of the other ~~c~~Counties within commuting distance of the Eastalco site. Considering that the maximum estimation of in-migrating population would be less than 6 percent of the total population for Frederick County, the demographic impacts of ~~site development are expected to be SMALL. If the facility is built and commences operations, the operational workforce would number about 363 workers, all of whom may migrate into the region. The staff expects that the demographic impact during operation would be SMALL~~building a nuclear plant at the Eastalco are expected to be minimal.

If the facility were built and commenced operations, the operational workforce would number at least 363 workers, half (182 workers) of whom may migrate into the region. The Eastalco site would likely have a larger workforce than the Calvert Cliffs site because Calvert Cliffs has an existing security and administrative workforce. At the Eastalco site, a larger number of security and administrative workers would need to be hired, but because this is not specialized labor, they would likely already reside in the 50-mi region. Given the small number of in-migrating workers and the large population in the 50-mi region, the review team concludes that the demographic impact during operations would be minor.

Economy and Taxes

According to the U.S. Census Bureau 2005~~-~~–2007 American Community Survey, the labor force in Frederick County was 123,907 persons, and, of these, 118,721 were employed. The four industries in Frederick County that accounted for ~~over~~more than 50 percent of employment were educational services, health care, and social assistance (18 percent~~),~~); professional, scientific,

~~and~~ management, ~~and~~ administrative, and waste management services (15 percent~~),~~); retail trade (11 percent~~)~~); and construction (11 percent) (USCB ~~2009FrederickCountyEmployment.pdf|).~~2009e). The 2005-2007 estimated unemployment rate for Frederick County was 2.5 percent, compared to 5.6 percent for the State of Maryland (USCB ~~2009 |MarylandEmployment.pdf|).~~2009b).

Economic impacts would be spread across the 50-mi region, but would likely be the greatest in Frederick County. Impacts are generally considered ~~SMALL~~minimal if plant-related employment is less than 5 percent of the study area's total employment (NRC 1996). During~~ the site~~ development of the new unit, up to 3950 construction workers would be required to build the plant (at the peak period). While some of these workers may need to in-migrate to the region, many would be drawn from the approximate 140~~-~~,000–150,000 construction workers in the workforce of ~~over~~more than 2.5 million in the greater ~~Maryland and Washington, D.C. Metropolitan Statistical Area (~~MSA~~)~~ (USBLS 2007b). The peak site development workforce would represent less than 5 percent of the current workforce in the region. Therefore, the review team concludes that the impacts of ~~site development~~building a nuclear plant on the economy of the region would be ~~SMALL~~minimal and beneficial, but temporary.

The wages and salaries of the ~~site development and operating~~construction workforce would have a multiplier effect that could result in increases in business activity, particularly in the retail and service sectors. This would have a positive impact on the business community and could provide opportunities for new businesses to get started and increase~~d~~ job opportunities for local residents. During operations, approximately ~~363~~182 new operations jobs would be added to the local economy.~~ The staff assumed that all of these new operations workers would have to move to the region from outside the region.~~ Based on the analysis in Section 5.4.3.1 for the proposed Calvert Cliffs site, the ~~staff~~review team concludes~~ that~~ the impact of these new jobs would constitute a small percentage of the total number of jobs in Frederick County and would have a ~~SMALL,~~minimal and beneficial economic impact.

As with the new proposed unit at the Calvert Cliffs site, there would be some positive sales, use, income, and ~~corporate~~property tax revenue benefits that would be generated as a result of the building and operation of a new ~~units~~nuclear unit at the Eastalco site (Sections 4.4.2.2 and 5.4.3.2). Tax revenues would accrue to the State primarily from income and sales taxes~~,~~ and to local governments from taxes on property and income (see Section 2.5.2.2~~ of this EIS~~). The primary tax impacts would occur once the unit becomes valued as property and property tax revenues are collected by Frederick County according to the millage rate and the negotiated value of the plant. In fiscal year 2008, Frederick County tax revenues totaled ~~[$601,526 – Michelle notes that this number can't be correct]~~ ~~(UniStar 2009a).~~$395.2 million (FCBCB 2008). The tax revenues from a unit in Frederick County are unknown but likely to be ~~substantial~~similar to the revenues for the Calvert Cliffs site. Tax estimates for Unit 3 at the Calvert Cliffs site would be up to $71 million during construction and preconstruction and at $57 million once

operations commence. Impacts would not have as large an impact in Frederick County because of the County's already large tax base. The review team concludes that the impact on tax revenues would be greatest in Frederick County, with a ~~SMALL~~ significant but not destabilizing and beneficial impact during ~~site development and a MODERATE beneficial impact during~~construction, preconstruction, and operation of a nuclear unit. The revenue impacts from building and operating a nuclear unit at the Eastalco site for the remainder of the 50-mi region would be ~~SMALL~~minimal and beneficial ~~during both site development and operation~~.

Transportation and Housing

The local transportation network in Frederick County includes Interstate 70, which runs from Baltimore to Pennsylvania, and I-270, which runs from Frederick to Virginia by connecting to I-495. ~~There are other~~Other major roads ~~connecting~~ connected the region with Pennsylvania, Virginia, and West Virginia ~~(see Figure 9-?? |ER Figure 9.3-14|).~~. Roads in Frederick County can be congested with commuter traffic to Frederick and to Washington ~~DC~~D.C. and it suburbs (UniStar 2009a). A fairly developed system of roads already exists within the Eastalco site. The site does not have barge access, but the main line of the Baltimore and Ohio (B&O) railroad is located approximately 0.7 ~~miles~~mi from the site, while a rail spur runs 0.5 ~~miles~~mi from the site (Uni~~s~~Star 2009a). The review team expects traffic impacts from ~~site development related traffic~~construction and preconstruction activities, including both construction workers and deliveries, would be ~~SMALL~~minimal for the region, ~~buy~~et could be ~~MODERATE~~significant, but not destabilizing, on the local roads near the site during shift change when the construction workforce is at its peak ~~site development [and~~. During operations~~—~~, impacts would be minimal, except during outages~~?]. —~~ when an additional 800 to 1000 workers would be employed onsite and impacts would be significant but not destabilizing.

Based on the analysis in Section 4.4.2, and 5.4.2, up to 1383 construction workers and ~~363~~182 operations workers and their families would in-migrate to the 50-mi region during the building of a unit at the Eastalco site and the subsequent operation. According to the 2005~~-2007American~~–2007 American Community Survey data, there are 4386 vacant housing units in Frederick County alone, which is adequate to accommodate the expected influx of construction workers. Workers could also find housing in other parts of the 50-mi region. The review team expects that the in-migrating site development and operations workforce would have a ~~SMALL~~minimal impact on housing demand in Frederick County and the larger 50-mi region.

Public Services and Education

The influx of construction workers and plant operations staff in-migrating into the region could impact local municipal water and water treatment plants and other public services (police, fire, and medical) in the region. These impacts would likely be in proportion with the demographic impacts, unless these resources have excess capacity or are particularly strained at the time of development, which would decrease or increase the impact, respectively. There are

approximately five hospitals, five police stations, and 25 fire stations located in Frederick County (UniStar 2009a). There are 14 water treatment plants providing 1700 MGD and 14 wastewater treatment facilities with a capacity of 7.7 MGD. Excess capacity exists within the current systems to support the expected increase of 186,000 gpd to 325,000 gpd increase in water supply needs and wastewater treatment. Therefore, the review team concludes that the impacts of ~~site development~~building and ~~operation~~operating a nuclear unit on public services in Frederick County would be ~~SMALL~~minimal. The much smaller operations workforce is expected to also have a minimal impact on public services.

Frederick County has one school district, which includes 64 schools and a 2006~~-~~–2007 student body population of 40,224 students. The average student/teacher ratio was 15.6 (NCES 2009 ~~|FrederickCountySchools.pdf|). Site development and operations related students~~). As stated in Section 4.4.4.5, approximately 361 to 632 students are expected to in-migrate into the 50-mi region during construction and preconstruction activities. Though they could in-migrate anywhere within the 50-mi region, if they were to all crowd into Frederick County schools, it would only raise their student population less than 2 percent. Students related to construction, preconstruction, and operations activities would represent a small percentage increase in the student body population. Given the number of schools in Frederick County and the large student body populations, it is likely ~~that~~ the new students will be absorbed easily and education impacts would be ~~SMALL~~minimal for Cecil County and the larger 50-mi region.

Aesthetics and Recreation

~~There are 63~~Sixty-three parks and other recreational areas and one minor league baseball team (the Frederick Keys) are located within 10 mi of the site (UniStar 2009a). Multiple nationally protected areas are located within 25 mi of the site, including Monocacy National Battlefield, Chesapeake and Ohio Canal National Historical Park, Antietam National Battlefield, and Catoctin Mountain Park, which includes the presidential retreat Camp David. Recreational users in the vicinity of the site may be impacted by traffic near the plant during shift change. ~~The [reactor~~Impacts on recreation resulting from building and~~] cooling tower~~ operating a nuclear unit on the Eastalco site ~~would have an aesthetic impact; however, this~~ would be ~~somewhat minimized by the general landscape of the area.~~ minimal.

The site is also already visually altered by the Eastalco aluminum smelter facility. However, the reactor building and other associated structures may be visible to surrounding areas as most of the land is agricultural and does not provide much viewshed protection. An underdetermined number of miles of transmission lines would need to be ~~constructed~~added, but this likely would not require new corridors. Impacts on ~~recreation and~~ aesthetics resulting from building and operating a nuclear unit on the Eastalco site would ~~result from building and operating a nuclear unit on the Eastalco site~~be significant but not destabilizing.

Summary of Socioeconomics.

The ***Cumulative Impacts***

For the analysis of cumulative socioeconomic impacts at the Eastalco site, the geographic area of interest is considered to be the 50-mi region centered on the Eastalco site with special consideration for Frederick County, as it is where the review team expects socioeconomic impacts to be the greatest. Historically, Cecil County had an agricultural-based economy, and, although it still retains some of its agricultural base, it has diversified its economy recently. Frederick County's population was 150,208 in 2000, but, by 2005, the population was near 219,000 (MDBED 2009).

In addition to socioeconomic impacts from building and operating a nuclear unit at the Eastalco site, the analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts. The projects identified in Table 9-8Table 9-8Table 9-8 have or would contribute to the demographics, economic climate, and community infrastructure of the region and generally result in increased urbanization and industrialization. However, many impacts, such as those on housing or public services, are able to adjust over time, particularly with increased tax revenues. Furthermore, State and County plans, along with modeled demographic projections, include forecasts of future development and population increases. Because the projects within the review area identified in Table 9-8Table 9-8Table 9-8 would be consistent with applicable land-use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services.

In summary, on the basis of information provided by UniStar and the review team's independent evaluation, the review team concludes that the impacts of site development and operation of a new nuclear unit at the Eastalco site on socioeconomics would be SMALL for all impacts except for transportation which could see a MODERATE impact. The impacts on the Frederick County economy and tax base during plant operation likely would be beneficial and MODERATE. A portion of the tax increase could be used to improve local transportation infrastructure and educational facilities to accommodate the population growth.

The review team has assessed the proposed construction and preconstruction activities related to building a unit at the EASTALCO site and the potential socioeconomic impacts in the region. Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. BasedIn summary, based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative socioeconomic impacts of building

and operating a new nuclear unit at the Eastalco site would be SMALL in ~~the region and in the local area with the exception of transportation, which could have a MODERATE impact.~~ terms of physical impacts (including workers and local public, noise, air quality, buildings, and transportation), demography, housing, public service, educational, and recreational impacts – except for a SMALL to MODERATE impact on aesthetics and a possible MODERATE impact on transportation near the site. The cumulative impacts to Frederick County economy and tax base would be beneficial and LARGE.

~~9.3.5.7~~9.3.4.7 Environmental Justice

The 2000 Census block groups were used for ascertaining minority and low-income populations in the region. There were a total of ~~4533~~3622 census blocks groups within the 50-mi region (which included portions of Washington ~~DC,~~D.C., Maryland, Virginia, West Virginia, and Pennsylvania). Approximately ~~1484~~1028 of these census block groups were classified as aggregate minority populations with ~~1171~~878 of them African American mostly in the Washington ~~DC~~D.C. and Baltimore areas. Frederick County has ~~two~~12 census block groups with aggregate minority populations and ~~one~~seven African American classified block groups. There are ~~82~~132 census block groups classified as low income in the 50-mi region~~ none~~, two of which are in Frederick County. Figure 9-9~~Figure 9-9Figure 9-9~~ shows the geographic locations of the minority populations of significance within the 50-mi radius, and Figure 9-10~~Figure 9-10Figure 9-10~~ shows the geographic locations of the low-income populations of significance within the 50-mi radius.

~~Site development~~Construction and preconstruction activities (noise, fugitive dust, air emissions, traffic) would not disproportionately adversely affect minority populations because of their distance from the Eastalco site. The operation of the proposed project at Eastalco site is also unlikely to have a disproportionate adverse impact on minority or low-income populations. See Sections 4.5 and 5.5 for more information about environmental justice criteria and impacts.

The projects identified in Table 9-8~~Table 9-8Table 9-8~~ likely did not or will not contribute to environmental justice impacts of the region. Housing rental rates can be an area of concern with regards to low-income populations. If projects commence ~~that~~ and cause a rise in rental rates~~ that push low-income populations out of their homes, then~~, there may be a disproportionate adverse impact on low-income populations. ~~Based~~Therefore, based on information provided by UniStar and the review team's independent evaluation, the review team concludes ~~that~~ there would~~ likely~~ not be any disproportionate and adverse environmental justice cumulative impacts from construction and operation of a new generating unit at the ~~EASTALCO site~~Eastalco site, and the environmental justice impacts of construction, preconstruction, and operations of a nuclear power plant at the Eastalco site would be SMALL.

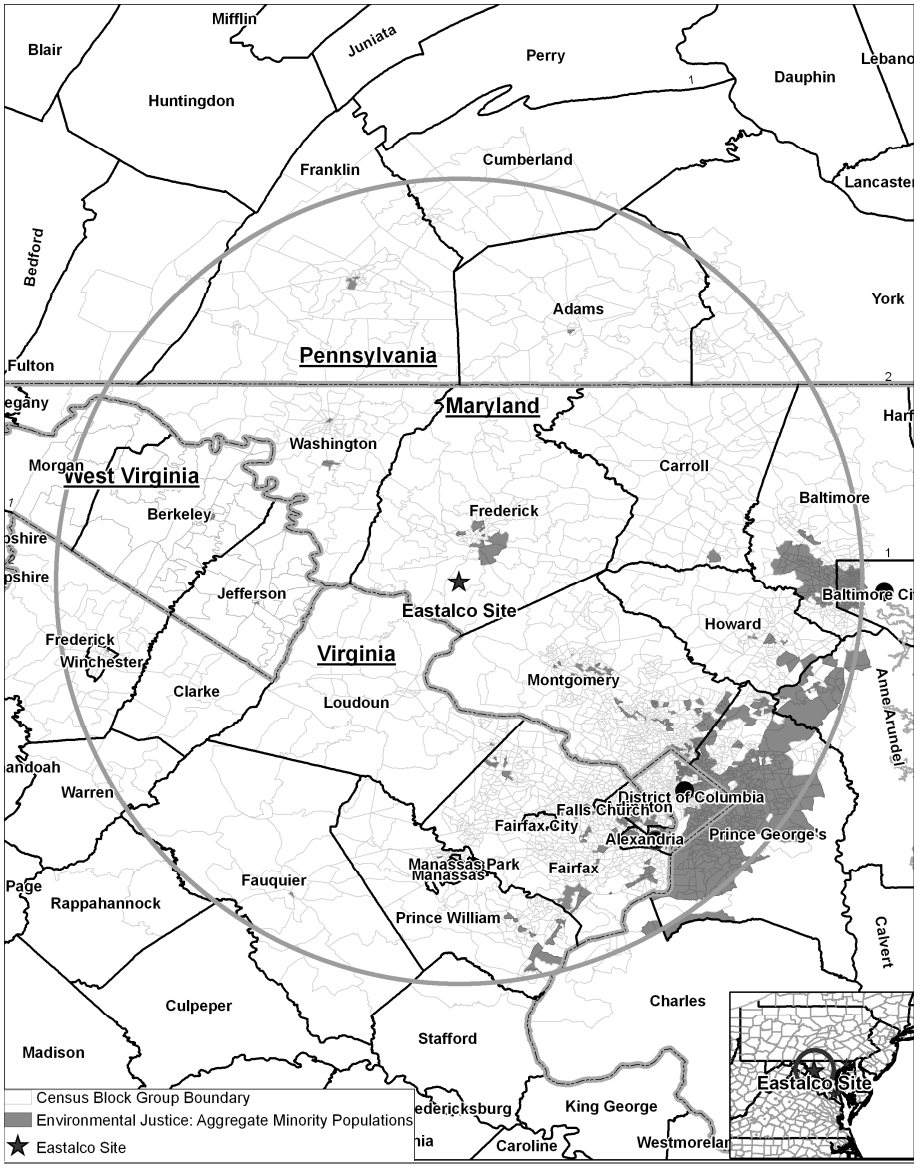

Figure 9-9. Distribution of Aggregate Minority Populations of Significance, 2000

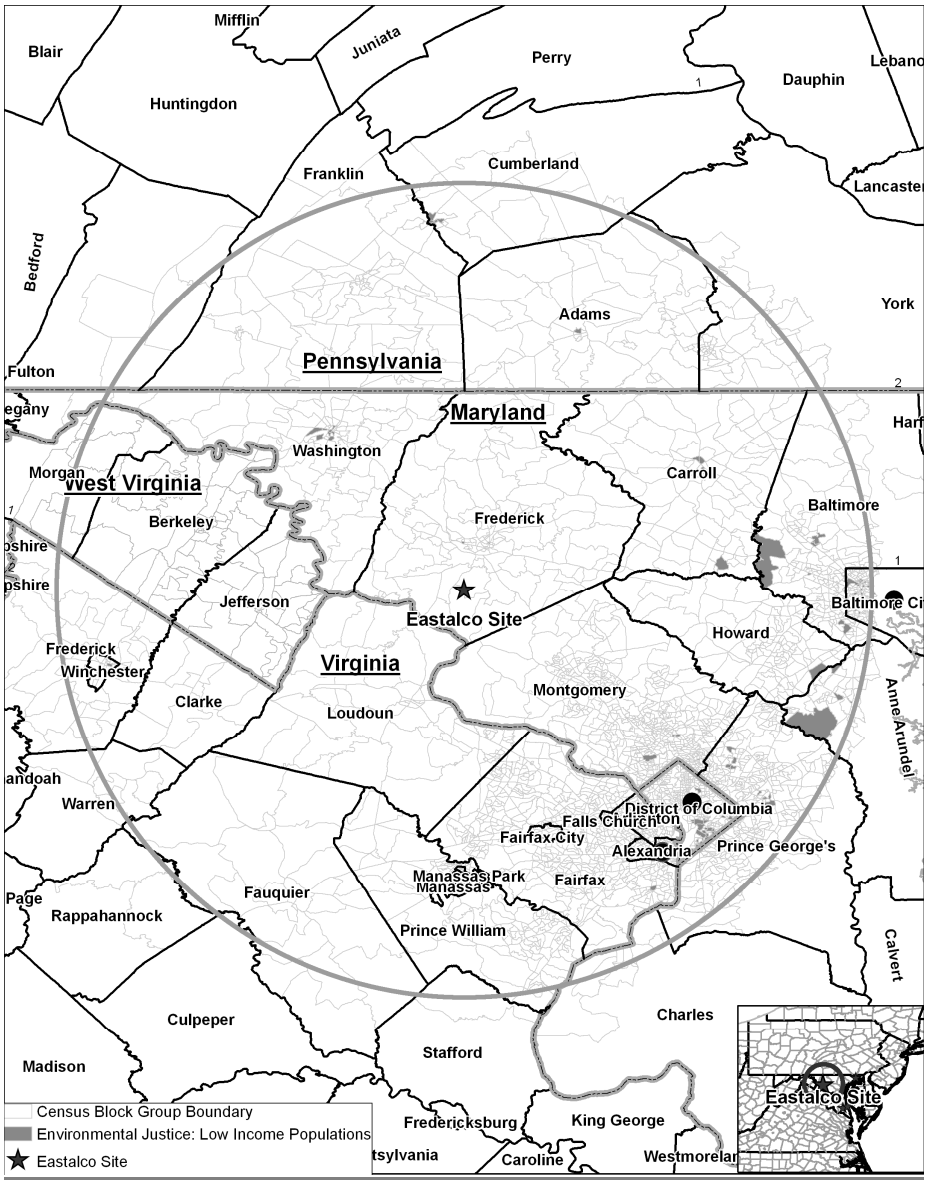

Figure 9-10. Distribution of Aggregate Low-Income Populations of Significance, 2000

~~9.3.5.8~~9.3.4.8 Historic and Cultural Resources

UniStar conducted a literature review at the Maryland Historical Trust (MHT) and found there are 16 properties and one historic district listed on the National Register of Historic Places within ~~five miles~~5 mi of the site (UniStar 2009a). One listed property, Carrollton Manor, is within 1 ~~mile~~ mi of the Eastalco site. The Carrollton Manor was the home of Charles Caroll, an American Revolutionary statesman and a signer of the Declaration of Independence.

Development of a pipeline to the Potomac River would cross the Chesapeake and Ohio Canal (C&O Canal), which is a historic linear resource and would require consultation with the MHT, as well as the National Park Service of the U.S. Department of the Interior. The C&O Canal has played a significant role in American history relative to western expansion, transportation engineering, the Civil War, immigration, industry, and commerce (NPS 2009).

Consultation with the MHT would be necessary regarding the need for systematic archaeological and architectural surveys to identify historic and archaeological resources prior to any ground-disturbing activities to address impacts to historic, cultural, and archaeological resources at this particular site. UniStar would be expected to put protective measures in place to ~~protect~~secure discoveries in the event that historic or archaeological materials are found during building or operating of a new plant. In the event that an unanticipated discovery is made, site personnel should be instructed to notify the MHT and consult with them in conducting an assessment of the discovery to determine if additional work is needed.

No projects were identified in Table 9-8~~Table 9-8Table 9-8~~ that would contribute to cumulative impacts to historic and cultural resources.

Based on ~~the known~~ reconnaissance-level ~~of~~ information regarding historic and cultural resources at the site, specifically the rich history in the area, the close proximity to Carrollton Manor, and the crossing of the C&O Canal, the review team concludes that the cumulative impacts on historic properties of building and operating a new generating unit at the Eastalco site would be MODERATE to LARGE. No archaeological and/or architectural surveys have been conducted.

~~9.3.5.9~~9.3.4.9 Air Quality

The atmospheric emissions related to building and operating a nuclear power plant at the Calvert Cliffs Site in Calvert County, Maryland~~,~~ were described in Chapters 4 and 5 of this EIS. The emissions were evaluated in detail because Calvert County is in non-attainment of the 8-hour ozone National Ambient Air Quality Standard ~~and~~, but below the threshold requiring mitigation. Therefore, the review team concluded that the environmental impacts were ~~found to have a~~ SMALL ~~impact~~. In Chapter 7, the cumulative impacts of the emissions were evaluated and also determined to be SMALL.

The emissions related to building and operating a nuclear power plant at the Eastalco Site in Fredrick County would be similar to those at the Calvert Cliffs site. However, Fredrick County is in the Central Maryland Intrastate Air Quality Control Region (40 CFR 81.155). The air quality attainment status for Fredrick County as set forth in 40 CFR 81.321 reflects the effects of past and present emissions from all pollutant sources in the region. Franklin County is in non-attainment of both the 8-hour ozone standard and the PM 2.5 (particulate matter with a diameter of less than 2.5 microns) standard.

Reflecting on the projects listed in Table 9-8~~Table 9-8Table 9-8~~, most of the effects on air quality would be to maintain the status quo. Any new industrial projects would either have de minimis impacts or would be subject to regulation by the Maryland DNR. Given these institutional controls, it is unlikely that the air quality in the region would degrade significantly (i.e., degrade to the extent that the region is in nonattainment of national standards).

The cooling tower for the power plant would be a significant source of small particles. As a result, although the air quality impacts of building and operating a nuclear power plant at the Eastalco Site would probably be SMALL, it is possible that the cumulative impacts of the cooling tower particulate emissions could be MODERATE.

Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6 for building and operating a nuclear power plant and for the fuel cycle, respectively. As described in Chapter 7, the impacts of greenhouse gas emissions are not sensitive to location of the source. Consequently, the discussions in the previous chapters and in Section 9.2.5 are applicable to a nuclear power plant located at the Eastalco Site. The impacts of greenhouse gas emissions considered in isolation would be SMALL, but the cumulative impact of greenhouse gas emissions would be MODERATE.

9.3.4.10 Nonradiological Health Impacts

The following impact analysis includes nonradiological health impacts from construction and preconstruction activities and operations to the public and workers from a nuclear unit at the Eastalco alternative site. The analysis also considers past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-8~~Table 9-8Table 9-8~~. The construction- and preconstruction-related activities that have the potential to impact the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to impact the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site. For the analysis of nonradiological health impacts at the Eastalco alternative site, the geographic area of interest is considered to include projects within a 5-mi radius from the site's center based on the localized nature of the impacts. For

impacts associated with transmission lines, the geographic area of interest is the transmission line corridor.

Building Impacts

Nonradiological health impacts to construction workers and members of the public from building a new nuclear unit at the Eastalco site would be similar to those evaluated in Section 4.8 for the Calvert Cliffs site. The impacts include noise; vehicle exhaust; dust; occupational injuries; and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied during the site preparation and building phase. The incidence of construction worker accidents would not be expected to be different from the incidence of accidents estimated for the Calvert Cliffs site. The Eastalco site is located in a rural area, and building impacts would likely be minimal on the surrounding area.

There are no past or current actions in the geographic areas of interest that have similarly impacted nonradiological health. Proposed future actions would include the Fort Detrick BRAC expansion recommendations and construction of the National Interagency Biodefense Campus; transportation upgrades to US 15, MD85, I-70, and I-270; and transmission line development and/or upgrading, including the PATH project. Future urbanization would also be expected to occur throughout the geographical area of interest.

Operational Impacts

Nonradiological health impacts from the operation of a new nuclear unit on occupational health and members of the public at the Eastalco site would be similar to those evaluated in Section 5.8 for the Calvert Cliffs site. Occupational health impacts to workers (e.g., falls, electric shock, or exposure to other hazards) at the Eastalco site would likely be the same as those evaluated for workers at a new unit at the Calvert Cliffs site. Based on the configuration of the proposed new unit at the Eastalco site (closed-cycle, wet cooling system with mechanical draft cooling towers), etiological agents would not likely increase the incidence of water-borne diseases in the vicinity of the site. Noise and EMF exposure would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations. Effects of EMF on human health would be controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria.

The nonradiological impacts from operations to the public and workers in the geographic area of interests would be associated with existing transmission lines. Proposed future actions that would impact nonradiological health in a similar way to operation activities at the Eastalco site would include transmission line systems and future urbanization, which would both occur throughout the designated geographical areas of interest.

Cumulative Impacts

Based on the information provided by UniStar and the review team's independent evaluation, the review team expects that the impacts to nonradiological health from construction and operation of a new unit at the Eastalco site would be similar to the impacts evaluated for the Calvert Cliffs site. Although there are past, present, and future activities in the geographic area of interest that could affect nonradiological health in ways similar to the building and operation of a new unit at the Eastalco site, those impacts would be localized and managed through adherence to existing regulatory requirements. Therefore, the review team concludes that the cumulative impacts of construction, preconstruction, and operation on nonradiological health would be SMALL.

9.3.4.11 Radiological Impacts of Normal Operations

As described in Section 9.3.4, the Eastalco site includes an inactive aluminum production facility that currently has no nuclear facilities. The geographic area of interest is the area within a 50-mi radius of the Eastalco site. A facility potentially affecting radiological health within this area is the existing National Institute of Standards and Technology (NIST) research reactor in Gaithersburg, Maryland. A number of hospitals within 50 mi of the Eastalco site use nuclear materials for medical purposes.

The radiological impacts of building and operating the proposed U.S. EPR plant at the Eastalco site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite – well below regulatory limits. These impacts are expected to be similar to those estimated for the Calvert Cliffs Unit 3 site.

The radiological impacts of the NIST reactor include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite (well below regulatory limits) as demonstrated by the ongoing radiological environmental monitoring program around this facility. The NRC staff concludes the dose from direct radiation and effluents from hospitals practicing nuclear medicine are an insignificant contribution to the cumulative impact around nuclear power plants based on data from the REMP around currently operating nuclear power plants. Similarly, the radiological impacts of transporting fuel and waste to and from the Eastalco site during plant operations was shown to be a small fraction of natural background radiation, and there are no significant differences among the alternative sites.

Based on the information provided by UniStar and the NRC staff's independent analysis, the NRC staff concludes the cumulative radiological impacts from building and operating the proposed U.S. EPR unit and other existing and planned projects and actions in the geographic area of interest around the Eastalco site would be SMALL.

9.3.4.12 Postulated Accidents

As described in Section 9.3.4, the Eastalco site currently has no nuclear facilities. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Eastalco site. This includes the existing CCNPP (Units 1 and 2), North Anna (Units 1 and 2), Peach Bottom (Units 2 and 3), and Three Mile Island nuclear generating stations. Other proposed reactors within the geographic area of interest include an additional reactor at the North Anna site.

Because the meteorology, population distribution, and land use for the Eastalco alternative site are expected to be similar to the proposed Calvert Cliffs site, risks from a severe accident for a U.S. EPR reactor located at the Eastalco alternative site are expected to be similar to those analyzed for the proposed Calvert Cliffs site. These risks for the proposed Calvert Cliffs site are presented in Table 5-16 and 5-17 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks provide a considerable safety margin because they are well below the Commission's safety goals (51 FR 30028). For existing plants within the geographic area of interest, including the Calvert Cliffs (Unit 1 and 2), North Anna (Units 1 and 2), Peach Bottom (Units 2 and 3), and Three Mile Island nuclear generating stations, the NRC has determined the probability-weighted consequences of severe accidents are SMALL (10 CFR 51, Appendix B, Table B-1). Finally, review of the North Anna Power Station Unit 3 EIS (NUREG-1917) shows that risks for the other proposed unit within the geographic area of interest are also well below current-generation reactors and meet the NRC's safety goals. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Eastalco alternative site from the operation of a nuclear unit at Eastalco or from previously mentioned nuclear plants will be SMALL.

~~9.3.6~~9.3.5 Former Thiokol Brownfield Site

This section covers the review team's evaluation of the potential environmental impacts of siting a new nuclear unit at a brownfield site once owned by Thiokol and referred to here as the former Thiokol brownfield site or simply the Thiokol site. The Thiokol site is located in southern Maryland~~,~~ across the Patuxent River from the Calvert Cliffs site.

The following sections describe the cumulative impact assessment conducted for each resource area. The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographical area were assessed. This assessment includes the impacts of construction and operations and impacts of preconstruction activities. Also included are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action.

Other actions and projects considered in this cumulative analysis are described in Table 9-10~~Table 9-10Table 9-10~~.

Table 9-10. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Thiokol Site Cumulative Analysis

Project Name or Other Action	Summary of Project	Location	Status
Energy Projects			
Operation and decommissioning of CCNPP Units 1 and 2	CCNPP consists of two existing nuclear generating units, Unit 1 [873 MW(e)] and Unit 2 [862 MW(e)].	Approximately 14 mi east-northeast from the Thiokol site.	Operational. In 2000, the NRC extended the license of Unit 1 to July 31, 2034 and the license of Unit 2 to August 31, 2036.[(a)]
Dominion Cove Point Liquefied Natural Gas (LNG) Facility	LNG is unloaded at an off-shore dock, then stored and transported onshore through a pipeline.	Approximately 11 mi east from the Thiokol site.	Operational. An expansion project, completed in 2009, increased storage and capacity by approximately 80%.[(b)]
Dominion Cove Point Pier Reinforcement Project	Upgrades and modifications to existing off shore pier to allow docking of larger-sized LNG vessels.	Approximately 11 mi east from the Thiokol site.	Planned. [(c) (d)] Original schedule called for project to be completed in spring 2011.
Operation of Chalk Point Generating Station	Chalk Point consists of 11 fossil fuel-based power-generating units with a listed capacity of 2413 MW.	Approximately 12 mi northwest from the Thiokol site.	Operational. [(e)]
Morgantown Generating Station	Morgantown Generating Station consists of six generating units. Two units are coal-fired and four are oil-fired with a listed capacity of 1486 MW.	Approximately 23 mi west from the Thiokol site.	Operational.[(f)]
Transportation Projects			
MD Route 4/Thomas Johnson Bridge Upgrade, Maryland SHA	Study to upgrade MD 4 between MD 2 and MD 235, including the Thomas Johnson Bridge and MD 235 intersection. Sidewalks will be provided (where appropriate) for pedestrians. Shoulders or wide curb lanes will accommodate bicycles.	Approximately 7 to 10 mi southeast from the Thiokol site, in Calvert and St Mary's County.	Planned. [(g)]

Project Name or Other Action	Summary of Project	Location	Status
MD Route 5 near Leonardtown, Maryland SHA	Study to upgrade MD 5 from MD 243 to MD 245, approximately 1.4 mi in length.	Approximately 6 mi south from the Thiokol site.	Planned. [h]

Table 9-10~~Table 9-10~~~~Table 9-10~~. (contd)

Project Name or Other Action	Summary of Project	Location	Status
~~Energy Projects~~			
~~Operation of CCNPP Units 1 and 2~~MD Route 237, Maryland SHA	~~CCNPP consists of two existing nuclear generating units (Units 1 and 2). Unit 1 began commercial operations in 1974. Unit 2 began commercial operations in 1976.~~Study to Upgrade and widen MD 237 to a multi-lane highway from Pegg Road to MD 235 (2.80 mi).	Approximately ~~0.5 miles northwest from proposed CCNPP Unit 3.~~ 10 to 12 mi southeast of the Thiokol site.	~~CCNPP Units 1 and 2 are currently operational. In 2000, the NRC extended the license of Unit 1 to 31 July 2034 and the license of Unit 1 to 13 August 2036 (NRC 2009a).~~Planned. [i]
~~Uprate at CCNPP Units 1 and 2~~	~~CCNPP Units 1 and 2 uprate, or increase in the maximum power level at which the nuclear power plant may operate.~~	~~Approximately 0.5 miles northwest from proposed CCNPP Unit 3.~~	~~The NRC approved an application to uprate Units 1 and 2 by 1.38% each in July 2009. The uprate is expected to be completed by December 2009 for Unit 2 and by the end of summer 2010 for Unit 1 (NRC 2009b).~~
~~Dominion Cove Point liquid natural gas (LNG) facility~~	~~LNG is unloaded at an off-shore dock, stored, and delivered into a pipeline.~~	~~Approximately 3 miles south from Proposed CCNPP Unit 3.~~	~~The facility is currently operational. An expansion project, completed in 2009, increased storage and capacity by approximately 80%.~~
~~Dominion Cove Point Pier Reinforcement Project~~	~~Upgrades and modifications to existing offshore pier to allow docking of larger-sized LNG vessels.~~	~~Approximately 3 miles south from proposed CCNPP Unit 3.~~	~~On 16 July 2009 the Federal Energy Regulatory Commission (FERC) authorized Dominion Cove Point to construct and operate facilities comprising the pier reinforcement project (FERC 2009a). On 16 September 2009 FERC granted a request for rehearing filed by~~

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Table 9-10~~Table 9-10~~~~Table 9-10~~. (contd)

Project Name or Other Action	Summary of Project	Location	Status
			~~Washington Gas Light Company (FERC 2009b). Original schedule called for project to be completed in the spring of 2011.~~

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~~**Table 9-8**. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
~~Operation of Chalk Point Generating Station~~	~~Chalk Point consists of eleven fossil-fuel-based power-generating units.~~	~~Approximately 15 miles northwest from proposed CCNPP Unit 3, near Eagle Harbor, MD.~~	~~Chalk Point Generating Station is currently operational with a listed capacity of 2413 MW.~~
~~Morgantown Generating Station~~	~~Morgantown Generating Station consists of six generating units. Two units are coal-fired and four are oil-fired.~~	~~Approximately 35 miles west from proposed CCNPP Unit 3, near Newburg, MD.~~	~~Morgantown Generating Station is currently operational with a listed capacity of 1,492 MW.~~
~~**Transportation Projects**~~			
~~MD Route 4/ Thomas Johnson Bridge Upgrade~~	~~Study to upgrade MD 4 between MD 2 and MD 235, including the Thomas Johnson Bridge and MD 235 intersection. Sidewalks will be provided where appropriate for pedestrians.~~	~~Approximately 5 to 10 miles southwest from proposed CCNPP Unit 3, in Calvert and St Mary's~~	~~Project is in planning phase by the Maryland State Highway Administration. It is not currently funded for construction (Maryland~~

~~Table 9-8. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
	~~Shoulders or wide curb lanes will accommodate bicycles.~~	~~County~~	~~SHA 2009).~~
~~Parks and Aquaculture Facilities~~			
~~Other parks~~	~~Additional state and local parks, forests, reserves, and other recreational areas are located within the 8 mile region, including the following: Cove Point Park, Jeff Patterson Park, and Greenwell State Park.~~	~~Throughout 8 mile region.??~~	~~Parks are currently being managed by state and/or local agencies.~~
~~Other parks, forests, and reserves~~	~~Numerous state and national parks, forests, reserves, and other recreational areas are located within a 50 mile region.~~	~~Throughout 50 mile region.~~	~~Parks are currently being managed by national, state, and/or local agencies.~~
~~Chesapeake Bay Critical Area (CBCA)~~	~~The CBCA Protection Act was enacted in 1984 by the Maryland General Assembly to help reverse the deterioration of the Chesapeake Bay and surrounding Environment (CAC2008a).~~	~~All land within 1000 ft of the mean high water line; all waters and lands under Chesapeake Bay and its tributaries~~	~~Mitigation actions for the proposed CCNPP Unit 3 include planting of 19.6 ac of mixed deciduous forest within the land area of the CBCA.~~
Other Actions/Projects			
Mid-Atlantic Power Pathway (MAPP) ~~transmission line project~~Transmission Line Project	~~Proposed new 500kV transmission line from Possum Point Substation in~~	From Possum Point Substati	Proposed. June 2014 in-service date proposed by

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~~Table 9-8. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
	~~Virginia to the Calvert Cliffs Substation, with subsequent lines constructed under Chesapeake Bay terminating at the Vienna Substation in Maryland and the Indian River Substation in Delaware.~~Proposed new 500-kV transmission line.	on in Virginia to the Calvert Cliffs Substation, with subsequent lines constructed under Chesapeake Bay terminating at the Vienna Substation in MD and the Indian River Substation in Delaware.	~~Potomac Electric Power Company (~~Pepco~~).~~. Under consideration by ~~the MD Public Service Commission~~MPSC as Case 9179.[i]
~~Federal, State and Local Governmental Facilities~~	~~Various Facilities such as: U.S Navy Patuxent River Naval Air Station; U.S DHS FLETC; U.S. Army Fort AP Hill Operations; U.S Navy Naval Support Facility at Indian Head; U.S. Marine Corps Base Quantico; USDA Beltsville Agricultural Research Center; U.S. Public Health Service National Institutes of Health; U.S Bureau of Alcohol Tobacco Firearms and~~	~~Throughout region~~	~~These facilities are operational.~~

~~Table 9-8. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
	~~Explosives; U.S. Fish and Wildlife Patuxent Research Refuge; U.S DHS James J. Rowley Training Center; and U.S. Army Fort Meade~~		
~~Concrete Block, Cement and Brick Manufacturing~~Leonardtown Wastewater Treatment Plant	~~Various ready-mix and other cement and brick manufacturing facilities throughout a 50 mile radius of Calvert Cliffs Unit 3 site.~~Expand capacity and upgrade facility with enhanced nutrient removal technology.	~~Throughout region.~~Approximately 6 mi south of Thiokol site.	~~Facilities are in operation but more could be developed as demand increases.~~Phased construction; expected completion in 2013. [k]
~~Chemical Manufacturing (including organic chemical, inorganic chemical; and other miscellaneous chemical product and preparation manufacturing~~	~~Various facilities throughout the region of Calvert Cliffs Unit 3.~~	~~Throughout region.~~	~~Facilities are in operation but more could be developed as demand increases.~~
~~Electronics Manufacturing~~	~~Various facilities throughout the region of Calvert Cliffs Unit 3.~~	~~Throughout region~~	~~Facilities are in operation but more could be develop as demand increases.~~
~~Petroleum Bulk Stations and Terminals~~	~~Various facilities throughout the region of Calvert Cliffs Unit 3.~~	~~Throughout region~~	~~Facilities are in operation but more could be develop as demand increases.~~
~~Food Processing Facilities~~	~~Various poultry processing facilities; fresh and frozen seafood processing~~	~~Throughout region.~~	~~These facilities are already in operation.~~

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~~Table 9-8. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
	~~facilities; dry, condensed and evaporated dairy product manufacturing; spice and extract manufacturing, bottled and canned soft drink facilities; fruit and vegetable canning; frozen fruit, juice and vegetable manufacturing; and other animal food manufacturing.~~		
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; ~~construction of~~and water~~-~~ and/or wastewater~~-~~ treatment and distribution facilities and associated pipelines~~,~~ as described in local land-use planning documents.	Through out region.	Construction would occur in the future, as described in ~~s~~State and local land-use planning documents
~~Regional air quality~~Waterfront development	~~Cumulative air quality status without proposed plant~~A variety of residential and commercial waterfront property development, including potential pier facilities, dredging, and shoreline erosion control structures;	Through out ~~the~~ region.	~~40 CFR 81 provides background status for evaluating potential impacts of plant construction and operation.~~Construction would occur in

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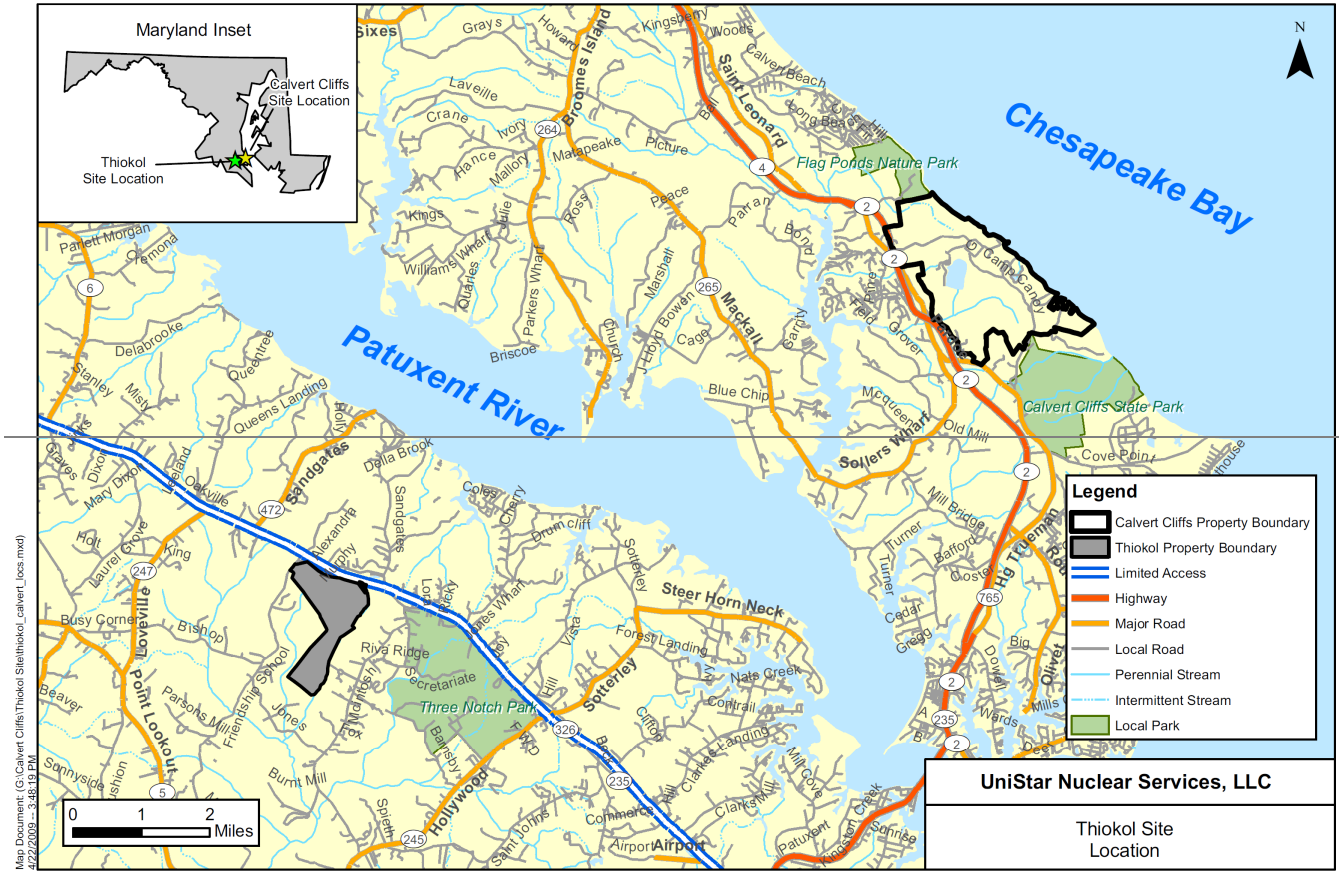
~~Table 9-8. (contd)~~

~~Project Name or Other Action~~	~~Summary of Project~~	~~Location~~	~~Status~~
	controlled commercial and residential development outside and within the limits of the town center designated areas of the various County master plans.		the future, as described in state and local land-use planning documents
(a) ~~Global Warming/ natural environmental stressors~~Source: NRC 2000b (b) Source: Dominion 2009 (c) Source: FERC 2009a (d) Source: FERC 2009b (e) Source: Mirant 2009b (f) Source: Mirant 2009c (g) Source: MD SHA 2009c (h) Source: MD SHA 2009d (i) Source: MD SHA 2009e (j) Source: MAPP 2009 ~~(a)~~(k) Source: MDE 2009a	~~Short- or long-term changes in precipitation or temperature.~~	~~Through out region.~~	~~Impacts would occur in the future.~~

~~9.3.6.1~~9.3.5.1 Land Use and Transmission Line Corridors

The Thiokol site is a 619-ac brownfield tract of land located about 1.5 mi northwest of Hillville, Maryland~~,~~ near Mechanicsville in St. Mary's County, Maryland. It is approximately 10 mi west-southwest of the Calvert Cliffs site across the Patuxent River (Figure 9-11~~Figure 9-11Figure 9-11~~). The site is bordered by MD State Route 235 to the north and Friendship School Road to the west (Figure 9-12~~Figure 9-12Figure 9-12~~) (UniStar 2008b). Rich Neck Creek and Tom Swamp Run and their tributaries flow through the property, generally to the south and southwest toward the Potomac River (MDE 200~~7~~9b). The current property owner is PB II, LLC (MDE 200~~7~~9b).

The Thiokol site was used in the early to mid-1950s as a manufacturing and testing facility for detonators and initiators for military ordnance (UniStar 2009a). Thiokol Corporation, now known as Cordant Technologies, purchased the site in 1959, but did not resume munitions production and sold the property in 1999. Buildings were removed from the site in the early 1980s, timber was harvested, and the site was reforested (MDE 2007). MDE placed the property on its list of potentially hazardous waste sites in 1985.



~~Figure~~ -. Thiokol Site Location

~~**Figure** . Thiokol Site Vicinity~~

Site remediation with a focus on finding and removing any unexploded ordnance and any other hazardous material was conducted ~~through a~~from 1992 to 1994 ~~geophysical study of the site to locate any buried debris~~ (MDE 2007). Nineteen of 26 areas with suspected explosives were unearthed, and the 1360 lb of explosives found were detonated onsite. Soil contaminated with explosive materials or fuel oil was removed from the site (MDE 2007). The remaining seven areas (about 22 ac) with suspected explosives were inspected between September 1999 and June 2000 (MDE 2007). These sites were excavated~~ and,~~ suspect soils were sifted with a mechanical sifter, and ground-penetrating radar was used to identify debris (UniStar 2009a). Eleven pounds of explosives were found and removed during this investigation. MDE confirmed ~~that~~ the areas sampled contained no significant chemical contamination.

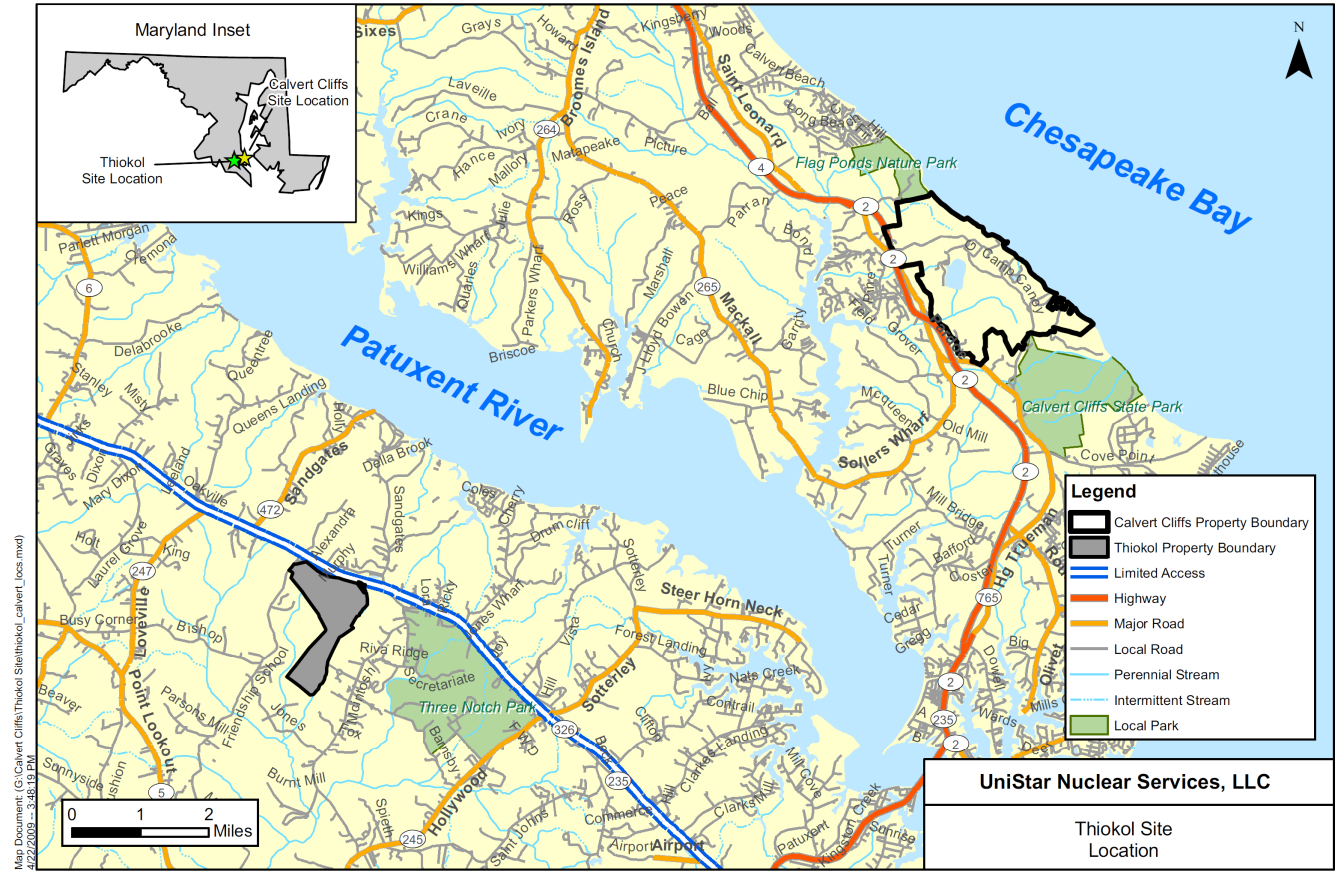


Figure 9-11. Thiokol Site Location (UniStar 2009a)

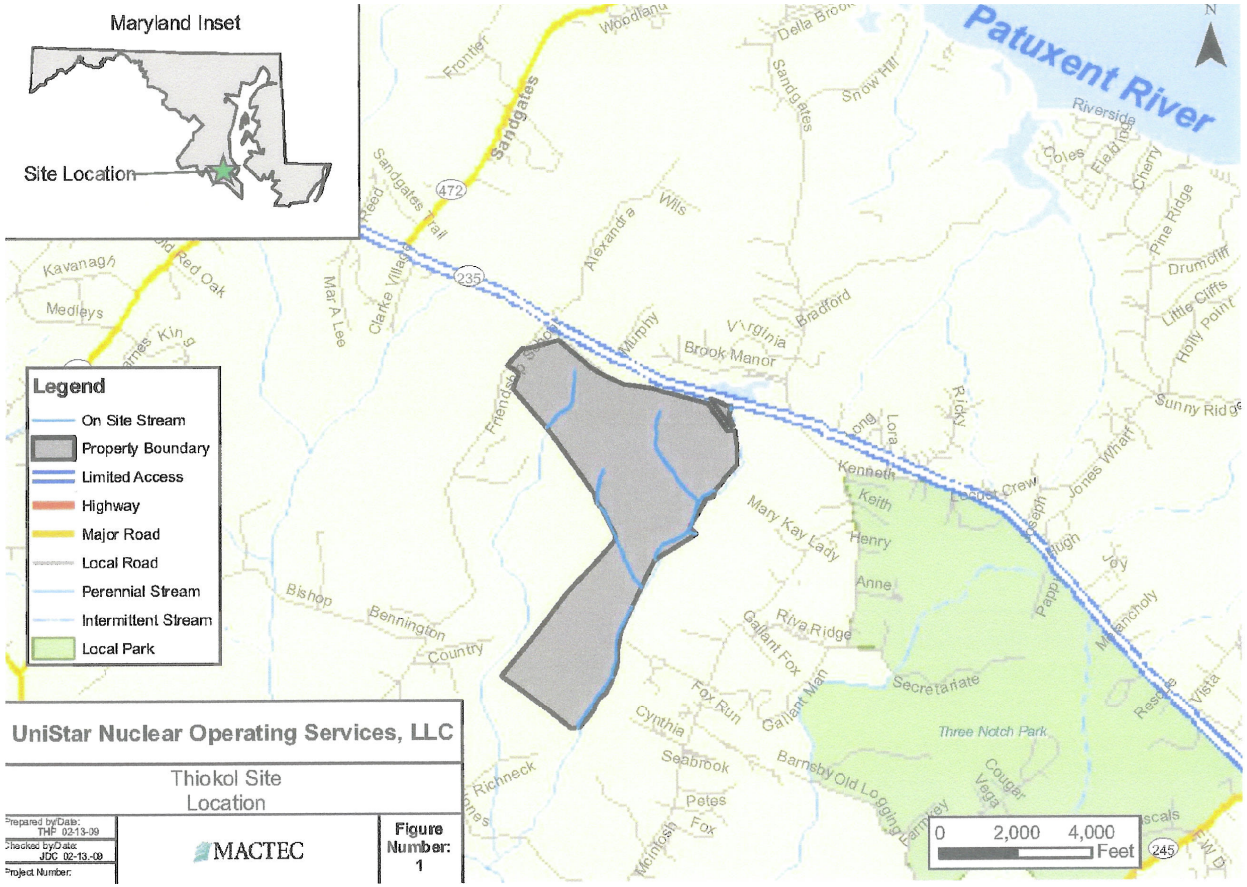


Figure 9-12. Thiokol Site Vicinity (UniStar 2009a)

The explosives were classified as "combat safe," meaning ~~that~~ they would not explode from shock ~~or~~, hammer, or bullet impact. During the cleanup phases, there was no evidence of live rounds or rounds outside of the suspected areas. In addition, no accidents occurred for explosives removal during any cleanup, suggesting that the level of hazard posed by any previously unrecovered explosive material is low.

~~As a result~~Most of ~~these surveys,~~ the ~~entire~~ site has been disturbed, much of it to 4 ft, but has since been reforested. Future property use has been designated as mixed residential and commercial (MDE 2007). The property contains covenants that restrict residential development, educational facilities, and day care in two areas totaling approximately 67 ac because of the possible presence of unexploded ordnances (UniStar 2008b). The site is currently being monitored by the MDE~~,~~ Land Restoration Program.

The area surrounding the Thiokol site is a mix of suburban and agricultural development. Land north and east of the site contains low-density residential development. Land west of the site is a mix of low-density residential development and agriculture. The area south of the site is generally undeveloped, but contains some low-density residential development (UniStar 2008b). The Patuxent River Naval Air Station (approximately 6500 ac) is about 10 mi southeast of the Thiokol site in St. Mary's County, and the Dominion Cove Point liquefied natural gas import facility (a little over 100 ac of industrial land use) is about 10 mi northeast of the Thiokol site in Calvert County (DOD? DON? 2010; Dominion 2009). Additionally, the Thiokol sites abuts or is very close to land and water portions of the Potomac Heritage National Scenic Trail, the Star-Spangled Banner National Historic Trail, and the Captain John Smith Chesapeak National Historic Trail (NPS XXXX). The National Park Service is still developing portions of the Star-Spangled Banner National Historic Trail and the Captain John Smith Chesapeake National Historic Trail. Therefore, the addition of a nuclear reactor at the Thiokol site would noticeably alter the land use to include an industrial area.

There are no existing transmission corridors connecting to the Thiokol site. A new transmission corridor would be needed to connect to an existing 500-kV transmission line located approximately 2 mi southeast of the site (UniStar 2009b). The corridor would pass through areas that are mostly rural with low population densities. Farmlands that would become part of a corridor could generally continue to be farmed (UniStar 2008b).

Cumulative Impacts

For this cumulative land use analysis, the geographic area of interest is considered to be the 15-mi region surrounding the Thiokol site. This area of interest includes the primary communities (Leonardtown, Lexington Park, and Solomons) that would be affected by the proposed project if it were located at the Thiokol site.

The ~~projects identified in~~ project with the greatest potential for affecting land use in the geographic area of interest would be the MAPP transmission line project. The MAPP project is discussed in Section 7.1 of this EIS. Since the transmission line would be ~~constructed~~built in an existing corridor, it would have limited impact on land use. Some of the other projects identified in Table 9-10~~Table 9-10~~~~Table 9-10~~ have or would contribute to decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas. Because the projects within the review area identified in Table 9-10~~Table 9-10~~~~Table 9-10~~~~Table 9-9~~ would have limited acreage impacts and would be consistent with applicable land-use plans and control policies, the review team considers the cumulative land-use impacts from the projects to be manageable.

~~Some~~If the proposed project were sited at the Thiokol site, some upland hardwood forest would be lost. In addition, some offsite land would likely be ~~impacted~~ affected to bring water for cooling to the site from the Patuxent River, which is approximately 3 mi north of the site. UniStar estimates that approximately 25 ac would be ~~impacted~~ affected by the water pipeline corridor and associated structures (UniStar 2009b). ~~Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the land-use impacts of constructing and operating a new nuclear generating unit at the Thiokol site would be MODERATE. [Land use at the Thiokol site would be altered noticeably, but the land use resource at the site and in the vicinity would not be destabilized.]~~

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the cumulative land-use impacts of ~~constructing~~building and operating a new nuclear generating unit and associated transmission lines at the Thiokol site would be SMALL to MODERATE. Because an industrial land use would be a new addition to the area of interest, building and operating a new unit at the Thiokol site would contribute substantially to the cumulative effects on land use.

~~***Transmission Line Corridors***~~

~~There are no existing transmission corridors connecting to the Thiokol site. A new transmission corridor would be needed to connect to an existing 500 kV transmission line located approximately 2 mi southeast of the site (UniStar 2009b). The corridor(s) would pass through areas that are mostly rural with low population densities. Farmlands that would become part of a corridor could generally continue to be farmed (UniStar 2008b).~~

~~Because detailed information concerning the routing of possible new transmission line corridor(s) is not known at this time, a complete evaluation of potential land-use impacts cannot be made. Based~~~~However, based~~ ~~on the information it has available, the review team concludes that the cumulative transmission line land-use impacts of building and operating a new nuclear~~

~~generating unit at the Thiokol site would be SMALL. [Land use impacts would be sufficiently minor to neither destabilize nor noticeably alter any important land use attribute.]MODERATE.~~

~~9.3.6.2~~9.3.5.2 Water Use and Quality

Water for the Thiokol Site would be obtained primarily from the Patuxent River. According to UniStar (2009a), the proposed plant would require the withdrawal of about 50 MGD for cooling and other uses~~; of~~. Of that total, about 27 MGD would be consumed, and the remainder would be discharged back to the Patuxent River. UniStar (2008b) states that the plant would use closed-cycle cooling with a cooling tower. The plant would have separate intake and discharge structures in the Patuxent River. Discharge water would include cooling tower blowdown, treated process wastewater, treated sanitary wastewater, and some radioactive water. The discharge would be at an elevated temperature relative to the temperature of the Patuxent River.

The site is about 3 mi southwest of the western Patuxent River shoreline and located along the western side of a watershed divide that is nominally aligned with MD State Route 235. The site is drained by Rich Neck Creek and Tom Swamp Run, both of which flow to the west toward Breton Bay on the Potomac River (MDNR 2002~~c~~a). Regionally, groundwater is pumped primarily from the Aquia aquifer for a variety of uses, including municipal water supplies (MDNR 2002~~c~~a).

According to UniStar (2008b), the Thiokol site would require significant alterations, including grading and watershed surface revision~~,~~; construction of roads, piers, jetties, and water intake and discharge structures~~,~~; and dredging in the Patuxent River. Development of the intake/discharge pipes would affect the 3-mi stretch from the site to the river, and it would affect the river bed in the vicinity of the intake and discharge structures. Because of the distance to the water source, UniStar (2008b) would need to construct an onsite impoundment to provide a secure ultimate heat sink~~.~~ (UHS). UniStar estimates that the area and depth would be approximately 4.7 ac and 25 ft, respectively (UniStar 2009a).

The average monthly flow of the Patuxent River measured about 60 mi upstream of the Thiokol site (USGS Station No.01594440 at Bowie, Maryland) is about 384.4 cfs (170,000 gpm) (USGS 2008). Between 1977 and 2007, flow in individual months ranged from 65.2 to 1358 cfs (29,262 and 609,470 gpm). Given that additional flow enters the river downstream of the measurement location and ~~that~~ the Patuxent River is a tidal system in the vicinity of the Thiokol site, the water consumed by the plant will be minor with respect to the existing resource.

The Chalk Point Generating ~~Plant~~ Station is a non-nuclear facility located on the Patuxent River about 10 mi north of the potential location for an intake structure for the Thiokol plant. Chalk Point has two once-through cooling units and two closed-cycle units (PPRP 2008). Water withdrawal in 2006 was ~~about~~approximately 419,400 gpm~~(~~, or 604 MGD~~,~~ (PPRP 2008). Total

water withdrawal by the Thiokol plant would be less than 10 percent of the withdrawal by the Chalk River Generating Plant. Given the small amount of withdrawal at the Thiokol site relative to the Chalk River Generating Plant and the small amount of water consumed relative to the existing resource in the tidal portion of the Patuxent River, the ~~staff~~review team concludes that the hydrological alterations to the Patuxent River from plant operations would be minor.

UniStar (2009a) would temporarily need water for construction, but the source and quantity of water are not known. If surface water or groundwater is used, permits would be required and the permitting process would ensure no adverse impacts from this limited and temporary withdrawal of water.

Water quality alterations to ~~the~~ both the surface water and groundwater would be regulated by NPDES discharge and stormwater permits. BMPs would prevent or mitigate spills from altering surface or groundwater resource's quality. ~~T he~~ The nutrient load from the plant's sanitary effluent system would be a ~~very~~ minor contribution to the ~~Chesapeake Bay's~~Patuxent River's cumulative nutrient load.

Building activities, including surface alterations and dewatering, have the potential to affect the local hydrology significantly because the available surface water and surficial aquifer resources are small; however, impacts would be temporary and localized. Groundwater from deeper aquifers would ~~be much less affected because this resource will not be used.~~not be affected.

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that, although the local hydrology would be ~~significantly~~ altered, the ~~cumulative~~ impacts on the regional surface water~~, the surficial aquifer groundwater resources, and the deeper aquifer~~ and groundwater resources of constructing and operating a ~~new~~ nuclear generating unit at the Thiokol site would be SMALL.

Cumulative Impacts

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Thiokol site is considered to be the drainage basin of the Patuxent River upstream and downstream of the site and the portion of Chesapeake Bay near the outlet of the Patuxent River because this is the resource that would be impacted by the proposed project. Key actions that have past, present, and future potential impacts to water supply and water quality in the Patuxent River basin include the operation of the Chalk Creek Generating Plant and other municipal and industrial activities in the Patuxent River basin. For the cumulative analysis of impacts on groundwater, the geographic area of interest is the extent within St. Mary's County of the confined aquifers beneath the site.

Water Use. The surface water-use impacts of building and operating a nuclear power plant at this site are dominated by the demands that would occur under normal operation. The

consumptive water use of proposed units is projected to be about 42 cfs, which would be approximately 11 percent of the average river discharge reported at the nearest gauge upstream on the Patuxent River. However, the intake would be located in the tidal portion of the Patuxent River, so water would controlled by the water level in the Chesapeake Bay. Based on the small volume of water consumed relative to the Bay's water volume and the Bay's freshwater inflow, the review team concludes the impact of withdrawing surface water to operate a nuclear unit at the Thiokol site would be SMALL.

The review team determined that the consumptive use of surface water by the operation of a nuclear reactor at the Thiokol site (surface water is not planned for construction and preconstruction activities) would remain undetectable within the geographic area of interest. The predominant surface water user within a 20-mi radius of the Calvert Cliffs site is CCNPP Units 1 and 2, but that withdrawal is not consumptive and does not impact surface water availability in the Patuxent River basin. The Chalk Point Generating Station, currently the largest power plant in Maryland, is a fossil fuel facility located on the Patuxent River about 15 mi upstream of the Thiokol site. Chalk Point is near the center of the Patuxent River estuary and experiences large tidal exchanges. The mean tidal range is about 1.6 ft and the maximum flood and ebb currents in mid-channel are about 1.0 and 1.25 ft per second.

The review team determined the consumptive use of water by the operation of a nuclear reactor at the Thiokol site and all other consumptive uses (existing or likely future uses) could not plausibly alter the volume of water in the Patuxent River in the vicinity of the Thiokol site. Based on its evaluation, the review team concludes that the cumulative impacts to surface water would be SMALL.

The review team is also aware of the potential climate changes that could affect the water resources available for cooling and the impacts of reactor operations on water resources for other users. The impact of climate change on the water available at the Thiokol site because of the availability of water from Chesapeake Bay.

Increases in consumptive use of water in the Patuxent River drainage is anticipated in the future. The impacts of the other operational projects listed in Table 9-10~~Table 9-10Table 9-10~~ are considered in the analysis included above or would have little or no impact on surface water use.

As indicated, groundwater could be used temporarily as a water source for construction and preconstruction needs at the Thiokol site. Given the high yields of the aquifers in this region, no significant impact is anticipated to regional users of groundwater. Regionally, the potentiometric surfaces in the Piney Point-Nanjemoy and Aquia aquifers have been declining due to increases in regional groundwater withdrawals. Because of the declining trend in groundwater potentiometric surfaces, the review team determined that the cumulative impact is MODERATE.

Water Quality. Point and non-point sources have impacted the water quality of the Patuxent River upstream and downstream of the site and the Chesapeake Bay at the mouth of the Patuxent River. Although nutrient loads have impaired the ability to support biota, they have not impaired water quality in a manner that limits the ability of the River and Bay to support other functions, including serving as a supply of cooling water. Based on its evaluation, the review team concludes that the cumulative surface water quality impacts would be SMALL

There are no reports of water quality issues in the regional Aquia aquifer, which is the primary aquifer in the region. There are no known contaminant plumes in the Aquia aquifer in the vicinity of the Thiokol site that might be affected by groundwater withdrawals at the site. The MDE regulates groundwater withdrawal rates in all aquifers to ensure aquifer stability and water quality. Because (1) there is no evidence of a decrease in groundwater quality as a result of the regional use of groundwater, (2) there are no known contaminant plumes, and (3) there would be no discharges to groundwater, the review team concludes that the cumulative groundwater quality impacts would be SMALL.

~~9.3.6.3~~9.3.5.3 Terrestrial and Wetland Resources

St. Mary's County, where the Thiokol site is located, is a mix of forest, agriculture, and residential development.

~~No formal biota sampling has been conducted at or around the Thiokol site. Flora and fauna inhabiting Thiokol are expected to be representative of those found regionally within similar habitat types. Most or all~~Most of the Thiokol site has been previously disturbed. Industrial use occurred on a portion of the site, and, during the 1980s, much of the forest was harvested. The site is currently dominated by upland hardwood forest~~ very~~ similar to the Mixed Deciduous Regeneration Forest found on the Calvert Cliffs site. Common tree species present include Virginia pine (*Pinus virgiana*), tulip poplar~~ (*Liriodendron tulipifera*)~~, sweetgum (*Liquidambar styraciflua*), red maple (*Acer* ~~*saccharum*~~*rubrum*), white ash (*Fraxinus americana*), quaking aspen (*Populus tremuloides*), and ~~oak (*Quercus spp.*)~~oaks. Some bottomland deciduous forest may be found in lowlands, likely containing more red maple and sweetgum than upland sites. Small Virginia pine stands are also present. Although harvested, forest ~~re-growth~~regrowth with limited development or fragmentation has resulted in a relatively large patch of unfragmented forest that provides ~~v~~suitable habitat ~~to~~for forest interior-dwelling species~~-~~ (FIDS). This suite of species has been identified as ecologically important in the region ~~(~~as discussed in Section 2.4.1 for the Calvert Cliffs site (Maryland CAC 2000).

Wetlands have not been delineated at the Thiokol site, but National Wetland Inventory data maintained by the FWS indicates that approximately 49 ac of forested wetlands and about 14,400 linear feet of stream channel are present (UniStar 2009b) (Figure 9-13~~Figure 9-13Figure 9-13~~). Most wetlands are associated with Rich Neck Creek and Tom Swamp Run that generally flow southward. Parts of both stream systems are intermittent.

No formal biota sampling has been conducted at or around the Thiokol site. Flora and fauna inhabiting Thiokol are expected to be representative of those found regionally within similar habitat types. Fauna inhabiting the site would include those common to upland and lowland forests in the region. The FWS does not list any Federally threatened or endangered ~~or threatened~~ species or candidate species as occurring in St. ~~Mary's County, Maryland~~ Mary's County, Maryland. ~~-~~ However, the State of Maryland lists the northeastern beach tiger beetle as a Federally -listed species that has been found in the county. It is highly unlikely this beetle would occur as no suitable habitat exists on the Thiokol site for this species, although suitable habitat may occur along the nearby Patuxent River.

~~State~~

~~Besides the northeastern beach tiger beetle~~Additionally, the Maryland DNR Natural Heritage Program's list of rare, threatened, and endangered species for St. Mary's County, Maryland, contains four terrestrial wildlife and 19 terrestrial plant species (Table 9-11~~Table 9-11Table 9-11~~). The sedge wren (*Cistothorus platensis*) is also unlikely to occur, as stands of tall, dense sedges that it prefers (Cornell Lab of Ornithology 2009) are not present on the site. These habitats may be present where water intake structures could be placed. The eastern narrow-mouthed toad (*Gastrophryne carolinensis*) breeds in still or very slow-~~-~~moving water and may utilize both temporary and permanent water sources (NatureServe 2007). This species also utilizes a variety of upland habitats, including those available on the Thiokol site and in the vicinity. Bald eagles prefer to nest in forested habitat near open water and likely occur along the Patuxent River. The least tern (*Sternula antillarum*) nests on open, sandy beaches (Thompson et al. 1997). This habitat is not found on the Thiokol site and was not observed along the Patuxent River in the vicinity of the site during the NRC staff's ~~site~~ visit. The distribution and abundance of the 19 State-listed plants within St. Mary's County and within the Thiokol site is unknown. Most occur exclusively in various wetland habitats. Wetland habitats are somewhat limited on the Thiokol site, and the occurrence of many of these species may also be limited.

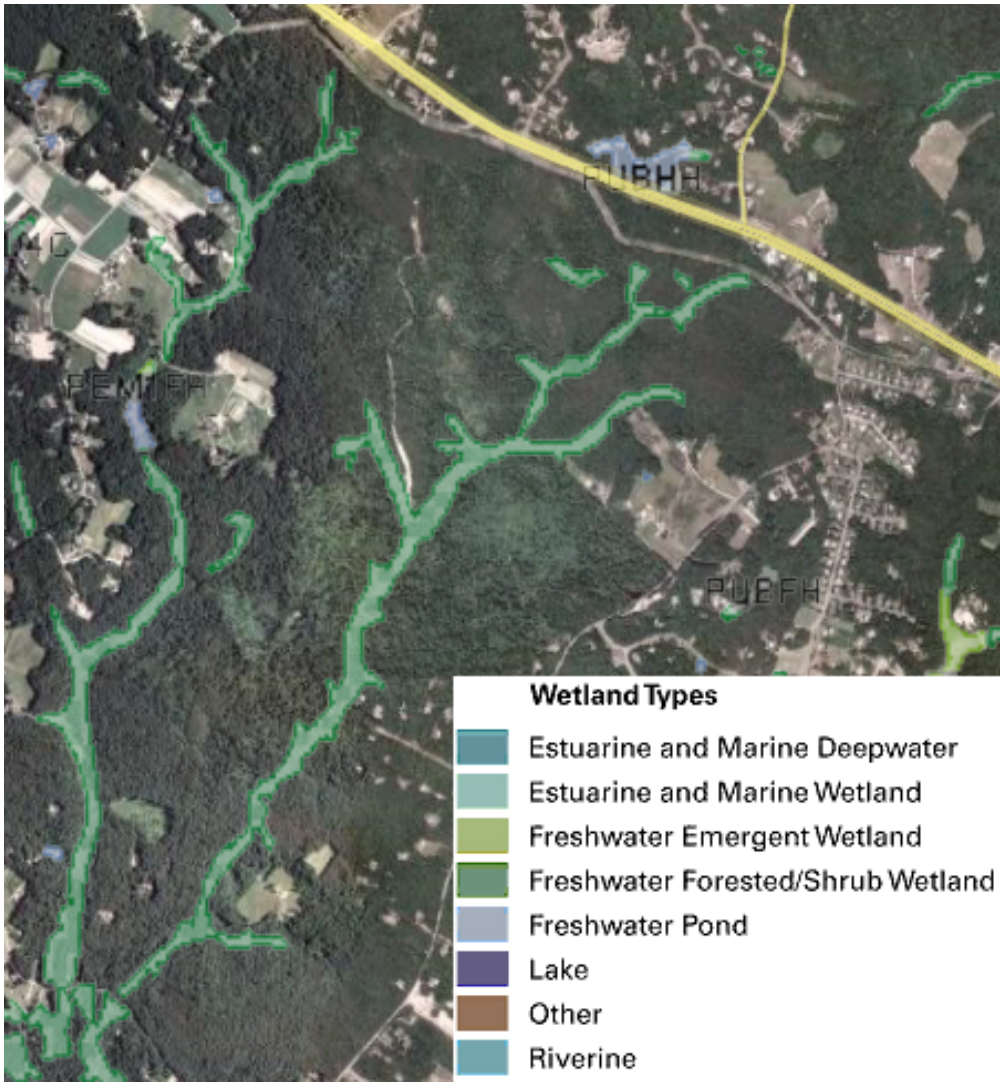


Figure 9-13. Distribution and Abundance of Wetlands Documented by the National Wetlands Inventory as Occurring On and Around the Thiokol Site (FWS 2008)

Table 9-11. Federally and State-Listed Terrestrial Species that Occur in St. Mary's County and May Occur on the Thiokol Site (MDNR 2007c)

Scientific Name	Common Name	Federal Status	State Status
Cicendela dorsalis dorsalis	Northeastern Beach Tiger Beetle	Threatened	Endangered
Cistothorus platensis	Sedge Wren		Endangered
Gastrophryne carolinensis	Eastern Narrow-mouthed Toad		Endangered
Haliaeetus leucocephalus	Bald Eagle		Threatened
Sternula antillarum	Least Tern		Threatened
Arnica acaulis	Leopard's-bane		Endangered
Carex buxbaumii	Buxbaum's Sedge		Threatened
Carex venusta	Dark Green Sedge		Threatened
Chelone obliqua	Red Turtlehead		Threatened
Desmodium pauciflorum	Few-flowered Tick-trefoil		Endangered
Drosera capillaris	Pink Sundew		Endangered
Eleocharis albida	White Spikerush		Threatened
Elephantopus tomentosus	Tobaccoweed		Endangered
Gratiola viscidula	Short's Hedge-hyssop		Endangered
Iris prismatica	Slender Blue Flag		Endangered
Kyllinga pumila	Thin-leaved Flatsedge		Endangered
Linum intercursum	Sandplain Flax		Threatened
Polygonum glaucum	Seaside Knotweed		Endangered
Prunus maritima	Beach Plum		Endangered
Sarrecenia purpurea	Northern Pitcher-plant		Threatened
Symphyotrichum concolor	Silvery Aster		Endangered
Torreyochloa pallida	Pale Mannagrass		Endangered
Trachelospermum difforme	Climbing Dogbane		Endangered
Utricularia inflata	Swollen Bladderwort		Endangered

Species identified by UniStar as ecologically important at the Thiokol site include mountain laurel, tulip poplar, chestnut oak, and New York fern (UniStar 2009a). As with the Calvert Cliffs site and the other alternative sites, these species are likely widespread and abundant in suitable habitat. Forest cover on the Thiokol site is fairly contiguous, providing interior forest that may contain FIDS. The recreationally important white-tail deer, wild turkey, and northern bobwhite are also likely present as habitat appears suitable.

Building and Operational Impacts

Although the placement of the project footprint has not been specified on this site, ~~*it is expected to be*~~ approximately ~~*257*~~420 ac ~~*[check—why not 420ac?].*~~would be ~~impacted~~affected by building a nuclear unit. Virtually the entire site is currently undeveloped and covered in forest. The forest appears contiguous and represents moderately valuable wildlife habitat, but most forest stands exist in an intermediate seral stage, thereby limiting their value to some species. Development and operation of a new nuclear unit would likely result in the loss of wildlife habitats including wetlands and forest. Clearing of forest would result in fragmentation and habitat loss for FIDS. In addition, the installation of a 3-mi-long water intake pipeline and construction of a 2-mi, 500-kV transmission corridor would increase the overall project footprint and likely affect other habitats and wetlands. ~~*Virtually the entire site is undeveloped and covered in forest, so building a new power plant would likely result in the loss of high-quality wildlife habitats.*~~ Approximately 30.1 ac of wetlands ~~*and 6500 linear feet of stream channel*~~ would be permanently ~~impacted~~ affected during construction of the plant, intake pipeline, and transmission corridor (UniStar ~~*2009b*~~2009g). Many of the listed species are not likely present at the site or in the vicinity, and impacts to these species would be limited. Eastern narrow-mouthed toads may be present, and individuals and habitat would be lost, but the extent cannot be determined. Bald eagles may lose habitat or be displaced by building-related activities, especially near the Patuxent River. Impacts to S~~s~~tate-listed plants may also occur, but the extent of impacts on these 19 plants cannot be determined. Wetlands are limited in distribution on the site, so impacts to ~~s~~State-listed wetland plants could also be limited. Individual mountain laurel, tulip poplar, chestnut oak, and New York fern plants would likely be lost, but populations are not expected to be destabilized. White-tailed deer, wild turkey, and northern bobwhite would also lose habitat during land clearing, but these species could benefit from disturbance and subsequent revegetation on the site as well as the maintenance of open habitats during operation

Terrestrial ecological impacts that may result from operation of a new nuclear unit at the Thiokol alternative site include those associated with the cooling system, transmission system structures, and maintenance of transmission line corridors. For impacts related to cooling system operations, the review team assumed the ~~number and~~same type of cooling tower~~s~~ proposed for Unit 3 at the Calvert Cliffs site would be used at any of the alternative sites. In NUREG-1437 (NRC 1996), the NRC staff evaluated terrestrial ecological impacts resulting from operation of existing nuclear power plants and transmission line operation and maintenance. The types of terrestrial ecological impacts resulting from operation of a new nuclear unit would be similar to those of existing nuclear power plants. When more specific information was not available, conclusions in the NUREG-1437 (NRC 1996) were used to assess terrestrial impacts resulting from the operation of the cooling tower~~s~~ and impacts from transmission line corridor maintenance and operation. Similarly, the effects of cooling tower ~~drive~~drift, avian collisions,

noise, and transmission lines would be similar to those described in Section 5.3.1.1 in which the operational impacts were determined to be undetectable at the population level.

Cooling Towers

The operation of a cooling tower results in the loss of water through evaporative loss and drift. Drift is described as small, unevaporated water droplets that are exhausted out the top of the tower. These droplets may carry minerals, debris, microorganisms, and chemicals that may ~~impact~~affect crops, ornamental vegetation, and native plants. Adverse impacts from cooling tower drift cannot be evaluated in detail ~~in the absence of information on the type (mechanical or natural draft), number, and~~without knowing specific location of the cooling tower~~s~~ at each alternative site. However, general guidelines for predicting effects of drift deposition on plants suggest that many species have thresholds for visible leaf damage in the range of 9 to 18 lb/ac/mo of salt deposition on leaves during the growing season (NRC 1996). The Unit 3 cooling tower at Calvert Cliffs, which includes plume abatement, would be drawing salt/brackish water for cooling from the Chesapeake Bay through a desalination facility. Thiokol would use brackish cooling water from the Patuxent River. Because the maximum deposition for the proposed unit is far below the level that could cause leaf damage in many common species, the impacts would be negligible both on the Thiokol site and in the vicinity. In general, the impacts of drift on crops, ornamental vegetation, and native plants were evaluated for existing nuclear power plants and found to be of minor significance (NRC 1996). ~~This determination also included nuclear power plants with more than one cooling tower.~~

Similarly, detailed mortality from bird collisions with cooling towers depend on factors such as height, location, and lighting at the Thiokol site. The impacts of bird collisions for existing power plants were evaluated and found to be of minor significance for all operating nuclear plants, including those with various numbers and types of cooling towers (NRC 1996). On this basis, the review team concludes, for the purpose of comparing the alternative sites, that the impacts of bird collisions with cooling towers resulting from operation of a new nuclear unit at Thiokol would be minor.

Typical noise levels that can be expected at a distance of 1300 ft from the cooling tower are 65 dBA (UniStar 2009a). Noise from plant operation would also be quickly attenuated by surrounding forest cover, further limiting any impact to wildlife. Local wildlife would likely adapt to noise levels, while cooling tower noise may also serve to limit the potential for avian collision. Consequently, the review team concludes the impacts of cooling tower noise on wildlife would be minimal at Thiokol.

Transmission Lines

The impacts associated with transmission line operation consist of bird collisions with transmission lines and electromagnetic field (EMF) effects on flora and fauna. The impacts

associated with building transmission lines and corridor maintenance activities are alteration and/or conversion of habitat due to cutting and herbicide application and similar related impacts, such as temporary matting, where corridors cross floodplains, wetlands, and other important habitats.

Direct mortality resulting from birds colliding with tall structures has been observed (Avatar 2004). Factors that appear to influence the rate of avian impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight by flocking birds during darkness has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in avian mortality. Weather, such as low cloud ceilings, advancing fronts, and fog also contribute to this phenomenon. Waterfowl may be particularly vulnerable due to low, fast flight and flocking behavior (Brown 1993). However, in NUREG-1437, the staff concluded that the threat of avian collision as a biologically significant source of mortality is very low as only a small fraction of total bird mortality could be attributed to collision with nuclear power plant structures, including transmission corridors with multiple transmission lines (NRC 1996). Although collision may contribute to local losses, thriving bird populations can withstand these losses without threat to their existence (Brown 1993). Although additional transmission lines would be required for a new nuclear unit at Thiokol, increases in bird collisions would be minor, and these would likely not be expected to cause a measurable reduction in local bird populations. Consequently, the incremental direct mortality posed by the addition of new transmission lines for a new nuclear unit would be negligible at Thiokol.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NRC 1996). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NRC 1996). The impacts of EMFs on terrestrial flora and fauna are of small significance at operating nuclear power plants, including transmission systems with variable numbers of power lines and lines energized at levels less than 765 kV (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals exposed to EMFs for all or most of their lives (Moulder 2003). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2003). Therefore, the incremental EMF impact posed by operation of existing transmission lines and the addition of lines for a new nuclear unit would be negligible at the Thiokol alternative site.

Existing roads providing access to the existing transmission line corridors at Thiokol would likely be sufficient for use in any expanded corridors; however, new roads would be required during the development of new transmission line corridors. Transmission line corridor management activities (cutting and herbicide application) and related impacts to floodplains and wetlands in transmission line corridors are of minor significance at operating nuclear power plants, including those with transmission line corridors of variable widths (NRC 1996). Consequently, the

incremental effects of transmission line corridor maintenance and associated impacts to floodplains and wetlands for a new nuclear unit would be negligible at the Thiokol alternative site.

Cumulative Impacts

The geographic area of interest for the assessment of the potential cumulative ~~aquatic ecology~~ impacts of building a new reactor at the Thiokol site on terrestrial resources and wetlands is defined as St. Mary's County, Maryland, because the extent of terrestrial impacts is mostly localized and the site is several miles from neighboring counties with the exception of Calvert County, which is closer but on the other side of the Patuxent River, which is a natural barrier isolating most terrestrial impacts. No major development activities are proposed that would significantly contribute to the loss or degradation of terrestrial resources or wetlands within the foreseeable future in St. Mary's County. Continued urbanization and global warming have the potential to alter and reduce the amount of terrestrial habitat and wetlands available to flora and fauna, and building a plant at the Thiokol site would contribute to that potential. Urbanization within the region has been identified as a contributing factor to forest fragmentation, and, like at the Calvert Cliffs site, building~~,~~ a power plant at this site would require the removal of relatively intact, albeit early-successional, forest cover. Unlike the Calvert Cliffs site, the Thiokol site is not located within the CBCA, but removal of forest cover would still contribute to cumulative forest fragmentation within St. Mary's County and the surrounding region.

~~Although the extent cannot be determined at this time, development~~Building and operation of a new nuclear unit would likely result in the loss of ~~high quality~~important plants, wildlife, and wildlife habitats including a large extent of interior forest.

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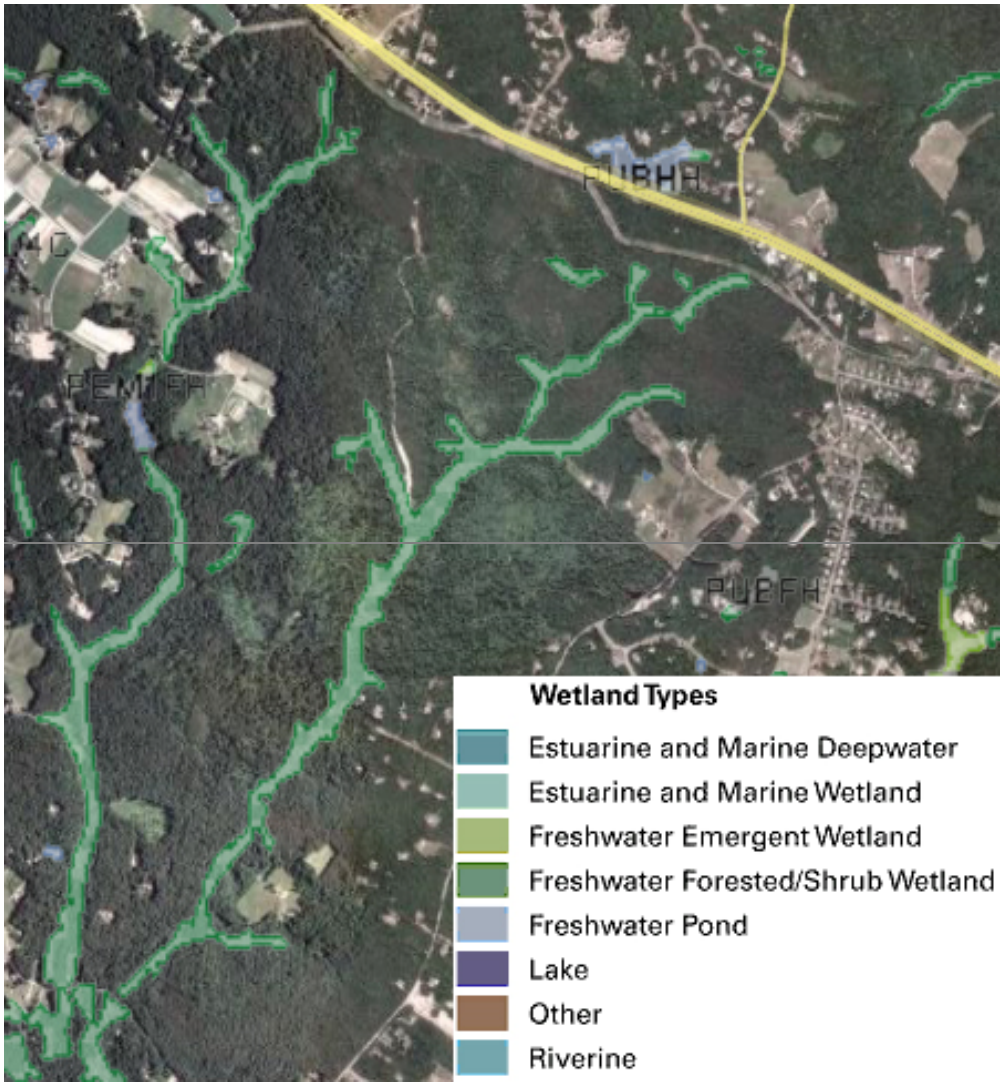

~~**Figure** -. Distribution and Abundance of Wetlands Documented by the National Wetlands Inventory as Occurring On and Around the Site (FWS 2008)~~

~~**Other Projects (to be developed)**~~

Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes ~~that~~ the cumulative impacts on terrestrial and wetland resources ~~of construction and operating a new nuclear unit at the Thiokol site would be MODERATE. As no Federally listed species are known to occur within St. Mary's County, Maryland, the review team concludes that adverse impacts to Federally listed species related to building and operating a new nuclear power plant, preconstruction, and operation of a new nuclear unit at the Thiokol site~~ affected by building and operating a new nuclear unit at the Thiokol site would be SMALL to MODERATE. Building and operating the new unit would be a significant contributor to the SMALL to MODERATE impacts.

~~9.3.6.4~~9.3.5.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources. ~~The construction of a power plant there would necessitate the construction of a cooling water system, which would be a closed-cycle system that uses a cooling tower (UniStar 2008b). The Patuxent River would be the main source of water for the new plant, which drains a 932-mi^2 area and is the largest river completely within Maryland (MDNR 2007) |MD DNR 07 Pax R trib strategy summary rpt.pdf|. A new nuclear generating unit would have separate intake and discharge structures located offshore in the river, and a screenwell and pumphouse structure located onshore (UniStar 2008b).~~

The Thiokol site is located about 3 mi from the western shore of the Patuxent River, which is the largest and most important aquatic resource in the vicinity. The Thiokol site is located within the Breton Bay watershed, which is part of the Lower Potomac River watershed. The location of the cooling water intake and discharge facilities would be in the Lower Patuxent River watershed.

Other aquatic resources on the Thiokol site include two small streams, Rich Neck Creek and Tom Swamp Run, that flow south and southwest through the property (MDE 2007). The two streams drain about 2565 ac within the Breton Bay watershed and join with Burnt Mill Creek to flow into McIntosh Run that empties into Breton Bay, which is a tidal bay on the Potomac River (MDNR 2002a). About 620 ac of the streams' area is listed as highly erodible. Tom Swamp Run has a small channel and ~~has~~ intermittent flow. Rich Neck Creek is larger and ~~is~~ probably perennial, but ~~very~~quite shallow. Flow in both ~~probably~~likely depends ~~strongly~~ on storms. Most of the length of each stream is within the Maryland's Sensitive Species Project Review Area within the Breton Bay watershed (MDNR 2002a). The sensitive species area also includes most of Burnt Mill Creek and McIntosh Run. McIntosh Run provides important habitat for the Federally endangered dwarf wedge-mussel ~~as~~(*Alasmidonta heterodon*), which is described later in this section. The lower reaches of Rich Neck Creek and Tom Swamp Run were included in the Maryland DNR nutrient synoptic survey conducted in April 2002 (MDNR 2002b). Characterization of the benthic invertebrate communities in the streams result~~s~~ed in Benthic

Index of Biotic Integrity (B-IBI) scores of 4.14, which the State rates as "good" (MDNR 2002b). The two onsite streams likely provide habitat for female American eels and are upstream of yellow perch (*Perca flavescens*) and white perch (*Morone americana*) spawning areas (~~Nichols~~NMFS 2009).

~~There are no sanctuaries or preserves at the Thiokol site that could be affected by the proposed action. The nearest managed area is Three Notch Park, a small St. Mary's County park. Jug Bay, a component of the Chesapeake Bay National Estuarine Research Reserve in Maryland, is a 722 ac tidal estuary in the upper Patuxent River (NOAA and Matlock 2007) |CC Website Record CB National Est Res Res.pdf| located about 30 mi upriver from the Thiokol area. The reserve is jointly managed by the Maryland DNR and NOAA and supports long-term estuary research, education, and stewardship.~~

The potential for impacts from building and operating a nuclear generating unit at Thiokol to aquatic biota would be primarily to organisms inhabiting Rich Neck Creek, Tom Swamp Run, and the Patuxent River.

Commercially or Recreationally Important Species

The important commercial or recreational species in the Patuxent River are generally among those included in the Chesapeake Bay. These are described in Section 2.4.2. One important commercial species is the eastern oyster (*Crassostrea virginica*). The Patuxent River has many historical and current oyster beds, including Natural Oyster Bars that stretch about 5.5 mi along the western shore where the new intake and discharge systems would likely be located (MDNR ~~2003, MDNR 2009~~) ~~|MD DNR 2003 Pax R watershed characterization.pdf, DNR52009OACpresentation.pdf|. The MDNR~~2003b, MDNR 2009h). The Maryland DNR is considering at least two areas in the Patuxent River that are near the Thiokol site as potential oyster Aquaculture Enterprise Zones designed to help restore oyster populations in the Bay (MDNR ~~2009~~) ~~|OysterrestorationplanJuly152009[1].pdf|.~~2009f). ~~Installation of the intake and discharge systems may affect these beds and aquaculture areas. Operation of the intake could affect establishment of oyster populations by entraining the oyster larvae (Nichols 2009).~~

The lower Patuxent watershed contains spawning and nursery areas for several anadromous fish species, including striped bass (*Morone saxatilis*), river herring (*Alosa* spp.), white perch ~~(*Morone americana*),~~, and yellow perch (~~*Perca flavescens*), although none is close to~~MDNR 2003b, ~~Nichols~~NMFS 2009). The area where the ~~Thiokol site (MDNR 2003).CWIS~~cooling water intake pipes would likely be located is downstream from the spawning areas ~~and~~but is within the migratory path of these fish (~~Nichols~~NMFS 2009).

Non-Native and Nuisance Species

The non-native and nuisance species most likely occurring in the Patuxent River include species such as those listed for the Chesapeake Bay near the Calvert Cliffs site. These are discussed in Section 2.4.2. Potential invasive estuarine invertebrate species of concern that eventually may occur in the Patuxent River are the green crab (*Carcinus maenas*) and the Chinese mitten crab (*Eriocheir sinensis*) (see Section 2.4.2). *Pfiesteria* (*Pfiesteria piscicida*) is a nuisance algaldinoflagellate species known to produce toxins. *Pfiesteria* is most commonly found low in the water column and close to bottom sediments but is not yet known in the Patuxent River (Bowers et al. 2006). Other potential nuisance species are sea nettles (*Chrysaora quinquecirrha*) and comb jellies (*Mnemiopsis leidyi*, *Beroe ovata*) (see Section 2.4.2).

Federally and State-Listed Species

Federally listed species that may occur in the Patuxent River include the shortnose sturgeon (*Acipenser brevirostrum*), loggerhead turtle (*Caretta caretta*), and Kemp's ridley turtle (*Lepidochelys kempii*). Federally listed species of concern that may occur in the river include the Atlantic sturgeon (*Acipenser oxyrinchus*), alewife (*Alosa pseudoharengus*), and blueback herring (*Alosa aestivalis*). Two other endangered marine turtles, the green turtle (*Chelonia mydas*) and the leatherback turtle (*Dermochelys coriacea*), may occur in Chesapeake Bay, but usually stay in the lower part of the bBay. These Federally protected species are discussed in Section 2.4.2.

One Federally endangered species, the dwarf wedge mussel (*Alasmidonta heterodon*), occurs in a creek near the Thiokol site (FWS 2007b). This species is also listed as endangered by the State of Maryland (MDNR 2007ee) |St Mary's County rte07stma.pdf|.2007f). No critical habitat has been designated by the FWS or NOAANMFS in the vicinity of the Thiokol site.

State-listed aquatic plants in St. Mary's County include the swollen bladderwort (*Utricularia inflata*) and the clasping-leavedclaspingleaf pondweed (*Potamogeton perfoliatus*) (MDNR 2007ee2007f). State-listed aquatic animals, in addition to the dwarf wedge mussel, listed for St. Mary's County that may occur near the Thiokol site include the Atlantic spike (*Elliptio producta*), the comely shiner (*Notropis amoenus*), the flier (*Centrarchus macropterus*), and the ironcolor shiner (*Notropis chalybaeus*) (MDNR 2007ee2007f). The spotfin killifish (*Fundulus luciae*) is listed by the State as State "rRare(?)," and the white catfish (*Ameiurus catus*) is listed as State uncertain (possibly rare). The spotfin killifish (*Fundulus luciae*) is discussed in Section 2.4.2.

Swollen Bladderwort (*Utricularia inflata*). The swollen bladderwort is a rootless, perennial aquatic plant that floats just above the bottom sediment (Urban et al. 2006). The species occurs from Texas to New York and is an introduced species in Washington State (USDA 2008a). It is endangered in several states, including Maryland. Bladderworts are carnivorous, trapping prey

with a suction trap comprised of a hollow bladder that has negative internal pressure and is anoxic (Peroutka et al. 2008). A recent study showed that microscopic algae are included in the bladderwort diet (Peroutka et al. 2008). Bladderworts typically inhabit small lakes and ponds.

~~Clasping Leaved~~Claspingleaf Pondweed (*Potamogeton perfoliatus*). The ~~clasping leaved~~claspingleaf pondweed is distributed primarily in northeastern North America with a scattered occurrence across the southeastern United States (USDA 2008b). It is listed as State rare in Maryland. This species ~~occurs in brackish waters within the Chesapeake Bay that~~ is found in brackish (oligohaline to mesohaline waters) within the Chesapeake Bay (Brush and Hilgartner 2000). Its occurrence in the Patuxent River is uncertain because no seeds were found in sediment cores that were dated from the early 1700s to the late 1980s, and plants were not seen in the ~~R~~river during the core collections in 1987 (Brush and Hilgartner 2000).

Dwarf Wedge~~m-M~~ussel (*Alasmidonta heterodon*). The dwarf wedge-mussel is a small freshwater clam that reaches a length of about 1.5 in. (FWS 2005). These mussels live in clear-water creeks and streams that have firm sand, clay, or gravel substrates. Mussel survival depends on the streams being silt free, having stable substrates, and having high dissolved oxygen content. The reproductive biology of the species involves the initial development of the fertilized eggs within the gills of the female mussel. The eggs mature into a larval stage that is released into the water and attaches to the gills of a fish. After a period of development, the larvae release from the fish and settle to the stream bottom. Dwarf wedge-mussels live as long as 10 years. The principal causes of the mussel's decline are habitat degradation from pollution and land-use changes that increase siltation in streams.

Dwarf wedge-mussels occur from North Carolina to New Hampshire and are becoming increasingly rare throughout the southern part of the region (FWS 2005). In Maryland, the species occurs in two creeks in Queen Anne's County, one creek in Charles County, and McIntosh Run in St. Mary's County (FWS 2007b). The mainstem portion of McIntosh Run, below its confluence with Burnt Mill Creek, contains a large population of dwarf wedge-mussels (CWP 2003). The mussel population in McIntosh Run is one of the three most viable populations in Maryland (FWS 2007b). A restoration strategy for the Breton Bay watershed suggested that any development affecting the tributaries that feed lower McIntosh Run has the potential to affect the Run, and appropriate precautions need to be taken (CWP 2003).

Atlantic Spike (*Elliptio producta*). The Atlantic spike is discussed in Section 9.3.~~xx~~5.5 (Eastalco). Because these mussels typically inhabit rivers and large streams, they are not likely to occur near the Thiokol site.

Flier (*Centrarchus macropterus*). The flier is a moderately sized sunfish that can reach a length of about 7.5 in. (USGS 2009~~) |CC Website Record Flier in Maryland.pdf|.~~). The flier is native to the southern Mississippi River area, the Gulf coastal area, and the southern Atlantic coastal plain (USGS 2009). The St. Mary's County area represents the northernmost part of the

species' known range on the coastal plain. There is one historical record of the flier, which is listed as threatened in Maryland, from a farm pond in St. Mary's County, and it is thought that the species may not be native to Maryland (Lee et al. 1981, USGS 2009) |Lee 1981 Freshwater Fishes of MD_DE.pdf|.).

Comely Shiner (*Notropis amoenus*). The comely shiner is a small minnow that reaches a length of about 4 in. It is discussed in Section 9.3.XX5.5 (Eastalco). Its possible occurrence near the Thiokol site is not known.

Ironcolor Shiner (*Notropis chalybaeus*). The ironcolor shiner only grows to about 2.5 in. in length and lives in deeper pools in creeks and streams (NYSDEC 2008la). It lives with aquatic plants, such as bladderwort and pondweed. Spawning occurs over sandy areas from spring to summer. Eggs are broadcast into the water column, where they are fertilized. Ironcolor shiners feed on aquatic and terrestrial insects. It is listed as endangered in Maryland.

White Catfish (*Ameiurus catus*). The white catfish is one of the smaller of the North American catfish, rarely growing larger than 24 in. long and 6 lb in weight (MDNR 2007bso). Although white catfish have been introduced in many regions, they are native to the Chesapeake Bay region. They live in slow-moving brackish waters that have mud substrates in small to large rivers. White catfish eat a variety of fish, crustaceans, and insects. Spawning occurs in early summer.

Based on the habitat information provided above, building or operating a new unit on the Thiokol site would not result in impacts to most of these Federally and State-listed species. However, building or operating a new unit on this site could impact affect an important population of the Federally endangered dwarf wedge-mussels, which occurs just downstream from the site.

Critical Habitats

No critical habitat has been designated by the FWS or NOAA in the vicinity of the Thiokol site.

Building and Operation Impacts

The main source of water for the new plant would be the Patuxent River, which drains a 932-mi^2 area and is the largest river completely within Maryland (MDNR 2007i). A new nuclear generating unit would have separate intake and discharge structures located offshore in the river and a screenwell and pumphouse structure located onshore (UniStar 2008b).

Building a new nuclear unit at the Thiokol site would be expected to affect about 420 ac. An additional 25.1 ac along the potential cooling water pipeline route would be affected (UniStar 2009a). Building the new unit would adversely affect about 3435 linear feet ft of stream channels and about 34.5 ac of wetlands on the site (UniStar 2009lg). Assuming that the plant

design would be similar to that proposed for CCNPP Unit 3, a new plant would permanently add about 130 ac of impervious surface to the Thiokol site, which would increase runoff during storms, potentially increasing erosion and adding pollutants to aquatic resources. The potential impacts of the building activities on the onsite aquatic resources primarily would be loss of stream habitat. Impacts on the two onsite streams could affect downstream populations of the endangered dwarf wedge-mussel ~~(*Alasmidonta heterodon*)~~. However, it is expected that FWS would require implementation of protective measures to minimize adverse effects on the dwarf wedgemussel if a new reactor is proposed at the Thiokol site.

The main source of water for the new plant would be the Patuxent River, which drains a 932-mi^2 area and is the largest river completely within Maryland (MDNR 2007i). A new nuclear generating unit would have separate intake and discharge structures located offshore in the river and a screenwell and pumphouse structure located onshore (UniStar 2008b). New cooling water -intake and discharge structures would be required for the Thiokol site. Building a new intake would result in the temporary displacement of aquatic biota within the vicinity of the intake. It is expected that these biota would return to the area after building was complete. UniStar (2009g) stated that a cooling water intake structure for a plant at the Thiokol site would need to be located about 1000 ft into the Patuxent River. Such an installation would affect about 2.25 ac of bottom on the river and would require the placement of about 8000 yds^3 of sediment. Installation of the intake and discharge systems, which most likely would involve dredging and the use of cofferdams (UniStar 2009a), would cause impacts similar to those discussed for Chesapeake Bay in Section 4.3.2.1 and could interrupt migratory pathways of anadromous fish. However, the impacts on aquatic organisms probably would be temporary, unless ~~rip-rap~~riprap was installed to protect the pipeline systems. Benthic invertebrates ~~very~~ likely would recolonize the disturbed sediments. Sedimentation from trenching or dredging can be mitigated through the use of appropriate BMPs. Installation of the intake and discharge systems may affect potential aquaculture and restoration of oyster beds. The severity of impacts on the aquatic ecology of the Patuxent River depends on the location of the intake and discharge structures in relation to location and resource values of the many oyster beds in the river near the Thiokol site.

A new 500-kV transmission line with a new transmission line corridor would be needed to connect the new plant to existing or proposed transmission lines. The new transmission corridor would extend from the southern portion of the Thiokol site to an existing 500-kV line located about 2 mi to the southeast (UniStar ~~2009a~~) ~~|2009.03.06_RAI_Response_writing_session_holes_ML0907101463.pdf| **{NOTE: This is not carried forward into ER Rev. 6}**~~.2009c). About ~~15.8 ac of wetlands and~~ 4201 linear f~~ee~~t of stream channel are included within this new corridor (UniStar ~~2009~~) ~~|ER Rev 6, p. 9-75|~~.2009a). The aquatic resources of this stream channel have not been characterized. The

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severity of impacts would depend on the characteristics of the aquatic resources within the corridor, but the use of BMPs during building and operation would lessen the potential impacts.

The most likely effect on aquatic populations from operation of a new nuclear unit at the Thiokol site would be impingement, ~~and~~ entrainment, and entrapment of organisms from the Patuxent River. Operation of the intake could affect establishment of oyster populations by entraining the oyster larvae (NMFS 2009). The review team examined the results of entrainment studies conducted at the nearby Chalk Point Generating Station to aid in the assessment of impacts to aquatic resources at the Thiokol site. ~~.~~

The Chalk Point Generating ~~Plant~~ Station is a non-nuclear facility located on Patuxent River about 10 mi north of the general Thiokol site area. Chalk Point has two once-through cooling units and two closed-cycle units (PPRP 2008). McLean et al. (2002) described the entrainment at Chalk Point as potentially affecting several forage fish in the Patuxent River, including the bay anchovy (*Anchoa mitchilli*), silversides (*Menidia* spp.), naked goby (*Gobiosoma bosc*), and hogchokers (*Trinectes maculatus*). However, the water withdrawal in 2006 for Chalk Point was about 604 MGD (PPRP 2008), which is ~~almost ten~~more than 10 times ~~that~~what would be withdrawn by the type of plant proposed by UniStar. Thus, the ~~incremental~~ effects of impingement, ~~and~~ entrainment, and entrapment at the Thiokol site would be smaller than those at Chalk Point. Several anadromous species that inhabit the Patuxent River are known to have been entrained or impinged by CCNPP Units 1 and 2 (Ringger 2000; EA Engineering 2008) and could be impinged, entrained, or entrapped by operating the cooling water system at the Thiokol site.

Although a discharge plume has not been modeled for the Thiokol site, the Patuxent River is a large and deep water body at that location, and the review team assumes the plume would be similar in areal extent and depth to that modeled for the Calvert Cliffs site. Therefore, the plume would likely be relatively small compared to the river size in the area, and there would not likely be a thermal barrier to fish passage. Additionally, the potential for adverse impacts from cold shock or heat shock because of exposure to the thermal plume would minor. Chemical concentrations in the effluents from the Thiokol site would be required to follow permitted guidelines.

~~The effects of the cooling water discharge in the Patuxent also are likely to be similar to those for the proposed Unit 3.~~

Overall, the impact of ~~construction~~~~development~~building and operation of a new reactor on the Thiokol site to most aquatic resources would be ~~SMALL to MODERATE~~substantial~~, depending~~ because of potential effects on ~~nature~~several important anadromous fish species, benthic impacts from installation of the ~~CWIS~~pipelines, ~~and~~ potential disruption of important oyster aquaculture and restoration ~~resource in the Patuxent River near the site.~~beds ~~and efforts to~~

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~~restore them~~, and adverse effects on the Federally endangered dwarf wedgemussel. ~~The potential impact to the Federally endangered dwarf wedge mussel would be MODERATE.~~

Cumulative Impacts

The geographic area of interest for the assessment of the potential cumulative impacts of building a new reactor at the Thiokol site on aquatic resources is defined as the Breton Bay and Lower Patuxent River watersheds, the mainstem of the Patuxent River, and the mesohaline (salinity ranges from about 5 to 19 parts per thousand) western portion of the Chesapeake Bay. The extent of the mesohaline zone in the Chesapeake Bay varies seasonally, but~~,~~ at its maximum, it includes the western ~~bay~~Bay shore from about the mouth of the Rappahannock River to Baltimore and includes the tidal Patuxent River (Maryland PPRP 2008~~,~~; CBP 2009). One concern with building and operating a new reactor on the Thiokol Site is the potential for the entrainment, ~~and~~ impingement, and entrapment of biota from the Patuxent River. Because the river in the area where the intake/discharge system would be located is mesohaline and contains biota similar to the Chesapeake Bay, the general entrainment, ~~and~~ impingement, and entrapment impacts would be similar to those from operating a new unit at the Calvert Cliffs site. However, the Patuxent River is a more restricted water body than the Chesapeake Bay and is a valuable spawning and nursery area. Historically, entrainment at the Chalk Point ~~power plant~~~~Power Plant~~Generating Station removed an estimated 20 to 30 percent of the bay anchovy population in the Patuxent estuary, but the losses could range as large as 50 percent (McLean ~~2002).~~et al. 2002). The bay anchovy is the most heavily entrained species at CCNPP Units 1 and 2 (see Table 5-2). The additional entrainment by a new reactor at Thiokol could exacerbate the losses from Chalk Point~~, if entrainment at Chalk Point has not been reduced.~~ and CCNPP Units 1 and 2. Some entrainment by ships that use the LNG facility at Cove Point would occur, but would likely be relatively small because of the comparatively small volumes withdrawn by the ships. Dominion proposes to reinforce the pier at the Cove Point LNG facility to allow for the docking larger tankers (USCG and USACE 2009). This project would primarily involve dredging of an area of Bay bottom near the present pier, the installation of mooring and breasting dolphins, and the disposal of the dredged material. The effects of these actions would not intersect with the building and operating of a new plant at the Thiokol site. Thermal impacts from existing plants in mesohaline waters, including Chalk Point and Calvert Cliffs, have not had significant effects on the Chesapeake Bay (PPRP 2008). The plume from the Thiokol discharge would likely be small and would not significantly add to the temperature regime in the Patuxent River.

The Breton Bay watershed is part of the Lower Potomac River watershed. Streams in the Breton Bay watershed drain into Breton Bay, which is affected by suspended sediments, nutrient loads, and high bacteria counts (MDNR ~~2002) |MD DNR 2002 breton bay_characterization.pdf|.~~2002a). Discharge from the Leonardtown Wastewater Treatment Plan was the main source of nutrient loads into Breton Bay, but discharge loads have

decreased since ~~about~~ 2003 after plant upgrades began (MDE ~~2009) |MDE 2009 Leonardtown.pdf|~~ 2009a). Building a new reactor at Thiokol would increase sediment loads in onsite streams, and those loads could be transferred to Breton Bay.

Urbanization and global climate change could change aquatic communities in the foreseeable future. Expansion of urban areas in the Chesapeake Bay drainage could adversely affect water quality through both point and nonpoint pollution. Degraded water quality would adversely affect aquatic recourses through a loss of suitable habitat. Global climate change could lead to more storm events with greater severity (Nielsen-Gammon 1995; Karl et al. 2009). Bank erosion and siltation of onsite water bodies from the increased precipitation could alter flows and result in the loss of aquatic habitat.

Based on the information from UniStar and the review team's independent evaluation, the review team concludes that the cumulative impacts of all of the past, present, and future activities, including building and operating a new reactor at the Thiokol site, on the aquatic resources in the area of interest would be MODERATE to LARGE primarily because of potential adverse effects on the dwarf wedge~~-~~mussel, oyster restoration efforts in the Patuxent River, and potential adverse effects on anadromous and other important forage fish. The incremental contribution of building and operating a new reactor at the Thiokol site would be MODERATE for most aquatic species but could be LARGE for the dwarf wedgemussel.

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~~9.3.6.5~~9.3.5.5 Socioeconomics

In evaluating the socioeconomic impacts of site development and operation at the Thiokol site near Mechanicsville, Maryland~~,~~ in St. Mary's County, the review team undertook a ~~reconnaissance survey~~review of the site using ~~readily obtainable~~ data ~~from the Internet and published~~ sources discussed in Section 9.3.2. Impacts from both building and station operation are discussed.

Physical Impacts

~~Generic aspects of physical impacts are addressed in Section 9.3.2.2.~~

Many of the physical impacts of construction and operation would be similar regardless of the site. Construction activities can cause temporary and localized physical impacts such as noise, odor, vehicle exhaust, vibration, shock from blasting (if used), and dust emissions. The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support construction activities (e.g., borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from building a new unit would be minimal.

Potential impacts from station operation include noise, odors, exhausts, emissions, and visual intrusions (aesthetics). A new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. By inference, this practice also would be expected to apply to all alternative sites. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the alternative site.

Any new unit at an alternative site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would confirm that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, a new unit would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Good access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

Construction and preconstruction activities would be temporary and would occur mainly within the boundaries of the Thiokol site. Offsite impacts would represent minimal changes to offsite services supporting the building activities. During facility operations, noise levels would be managed to State and local ordinances. Air quality permits would be required for the diesel generators, and chemical use would be limited, which should inhibit odors. Based on the information provided by UniStar and the review team's independent evaluation, the review team concludes that the physical impacts of building and operating a nuclear unit at the Thiokol site would be minimal.

Demography

The Thiokol site is located in St. Mary's County, near the towns of Hillville and Mechanicsville. The U.S. Census Bureau indicates that St. Mary's County had a 2008 population ~~of101~~of 101,568 people, which was a 16 percent increase from 2000. Washington, D.C~~,~~. (2008 population 591,833) is located 40 mi north of the Thiokol site (USCB ~~2009~~2009a, b). The population within the 50-mi region is approximately 3,702,936 people (UniStar 2009a).

At the peak of the site development period, UniStar would expect an onsite workforce of 3950 construction workers (UniStar 2009a). Based on the analysis of impacts presented in Section 4.4.2, the total maximum number of construction workers migrating into the region (within 50 mi of the site) from outside of the region would be between 790~~–~~–1383 (20 to 35 percent of the total workforce) workers at the peak of the ~~site development~~building period. Using an average household size of 2.61, the total in-migrating population would be between 2062 and 3608 people. The majority of impacts ~~are~~would be expected to occur in ~~Calvert and~~ St. Mary's Count~~ies~~y because ~~they are nearest to~~it contains the site. The impacts are more dispersed the farther away from the site due to the large populations of the other counties within

commuting distance of the Thiokol site. Many of the impacts for the Thiokol site would be ~~very~~ similar to those of the proposed Calvert Cliffs site due to their close proximity. Considering that the maximum estimation of in-migrating population would be less than ~~0.7~~ 2 percent of the total population for ~~Calvert and~~ St. Mary's Count~~ies~~y, the demographic impacts of building a nuclear unit at the Thiokol site ~~development~~ are expected to be ~~SMALL. If the facility were to be built and commenced operations, the operational workforce would number about 363 workers, all of whom may migrate into the region. The staff expects that the demographic impact during operation would be SMALL~~minimal.

If the facility were to be built and commenced operations, the operational workforce would number at least 363 workers, half (182 workers) of whom may migrate into the region. The Thiokol site would likely have a larger workforce then the Calvert Cliffs site because Calvert Cliffs has an existing security and administrative workforce. At the Thiokol site, a larger number of security and administrative workers would need to be hired, but because this is not specialized labor, they would likely already reside in the 50-mi region. Given the small number of in-migrating workers and the large population in the 50-mi region, the review team concludes that the demographic impact during operation would be minimal.

Taxes and Economy

In 2006, the labor force in St. Mary's County was 52,371 persons, and, of these, 49,794 were employed. The three industries in St. Mary's County that accounted for ~~over~~more than 50 percent of employment were public administration (19 percent); professional, scientific, ~~and~~ management, ~~and~~ administrative, and waste management services (18 percent); and educational services, ~~and~~ health care, and social assistance (16 percent~~);~~) followed by construction (11 percent) and retail trade (10 percent) (USCB 2006e). The unemployment rate for St. Mary's County in 2006 was 4.9 percent, compared to 5.6 percent for the State of Maryland (USCB 2006d, e).

Economic impacts would be spread across the 50-mi region but would be greatest in St Mary's County. Impacts are generally considered ~~SMALL~~minimal if plant-related employment is less than 5 percent of the study area's total employment (NRC 1996). During site development of a new unit, up to 3950 construction workers would be required to build the plant (at the peak building period). While some of these workers may need to in-migrate to the region, many would be drawn from the approximate 140~~-~~,000–150,000 construction workers in the workforce of ~~over~~more than 2.5 million in the greater ~~Maryland and Washington, D.C. Metropolitan Statistical Area (~~MSA~~)~~ (USBLS 2007b). The peak construction workforce would represent less than 5 percent of the current workforce in the region.~~ In addition, in the analyses of the impact of workforce for site development (Section 4.4.2.1) for the proposed Calvert Cliffs site, the staff determined the employment related impacts to be small.~~ Therefore, the ~~staff~~review team concludes that the impacts of site development on the economy of the region would be ~~SMALL~~minimal and beneficial, but temporary.

The wages and salaries of the ~~site development~~construction and operating~~ and~~ workforce would have a multiplier effect that could result in increases in business activity, particularly in the retail and service sectors. This would have a positive impact on the business community and could provide opportunities for new businesses to get started and increase~~d~~ job opportunities for local residents. During operations, approximately ~~363~~182 new operations jobs would be added to the local economy.~~ The staff assumed that all of these new operations workers would have to move to the region from outside the region.~~ Based on the analysis in Section 5.4.3.1 for the proposed Calvert Cliffs site, the ~~staff~~review team concludes that the impact of these new jobs would constitute a small percentage of the total number of jobs in St. Mary's County and would have a ~~SMALL,~~minimal and beneficial economic impact.

As with the new proposed unit at the Calvert Cliffs site, there would be some positive sales, use, income, and ~~corporate~~property tax revenue benefits that would be generated as a result of building and ~~construction~~operating a new nuclear unit at the Thiokol site (Sections 4.4.2.2 and 5.4.3.2). Tax revenues would accrue to the State primarily from income and sales taxes~~,~~ and to local governments from taxes on property and incomes (see Section 2.5.2.2~~ of this EIS~~). The primary tax impacts would occur once the new unit becomes valued as property and property tax revenues are collected by St. Mary's County according to the millage rate and the negotiated value of the plant. In fiscal year 2005, St. Mary's County tax revenues totaled $145.2 million. The tax revenues from a unit in St. Mary's County are unknown, but likely to be ~~substantial during~~similar to the revenues for the Calvert Cliffs site. Tax estimates for Unit 3 at the Calvert Cliffs site would be up to $71 million during construction and preconstruction and at $57 million once operations commence. The ~~staff~~review team concludes that the impact on tax revenues would be greatest in St. Mary's County, with a ~~SMALL~~ significant and beneficial impact during construction, preconstruction, and operations of a ~~MODERATE beneficial impact during operation~~nuclear unit. The revenue impacts from building and operating a nuclear unit at the Thiokol site for the remainder of the 50-mi region would be ~~SMALL and beneficial during both site development and operation.~~ minimal.

Transportation and Housing

Road access to the Thiokol site is provided by MD State Route 235, which runs on the north side of the Thiokol site. MD State Route 235 is a four-lane highway with unsignalized intersections~~ and~~, is the main transportation route in this area of the County, and provides the ~~main~~primary connection between many of the smaller communities. The transportation network in the 50-mi region also includes ~~s~~State highways and ~~c~~County roads (see Figure 2-16), as well as three major airports serving Baltimore and Washington, D.C~~,~~, and St. Mary's County Airport. The site does not have barge access and is 17 mi from the nearest rail line (UniStar 2008b). The ~~staff~~review team expects traffic impacts from ~~site development related traffic~~construction and preconstruction, including both construction workers and deliveries, would be ~~SMALL~~minimal for the region. However, it could be significant but ~~MODERATE~~not destabilizing

in the local vicinity during peak building. During operations, impacts would be ~~SMALL~~minimal except during outages when an additional 800 to 1000 workers would be employed onsite and impacts could be ~~MODERATE~~significant but not destabilizing.

Based on the analysis in Section 4.4.2~~,~~ and 5.4.2, up to 1383 construction workers and ~~363~~182 operations workers and their families would in-migrate to the 50-mi region during the building of a unit at the Thiokol site and the subsequent operation. According to the 2005–2007 American Community Survey data, there are 3808 vacant housing units ~~vacant units~~ in St. Mary's County alone, which is adequate to accommodate the expected influx of construction workers. Workers could also find housing in other parts of the 50-mi region, which has approximately 145,957 housing units available (UniStar 2009a). The ~~staff~~review team expects that the in-migrating construction and operations workforce would have a ~~SMALL~~minimal impact on housing demand in ~~Calvert and~~ St. Mary's ~~Counties~~County and the larger 50-mi region.

Public Services and Education

The influx of construction workers and plant operations staff in-migrating into the region could impact local municipal water and water treatment plants and other public services (police, fire, and medical) in the region. These impacts would likely be in proportion with the demographic impacts, unless these resources have excess capacity or are particularly strained at the time of site development, which would decrease or increase the impact, respectively. As discussed in Section 4.4.4.4 of this EIS, there is enough capacity within the public services sectors of ~~Calvert and~~ St. Mary's Count~~ies~~y to handle the influx of construction and operations workers. Therefore, the ~~staff~~review team concludes that the impacts of ~~site development~~building and ~~operation~~operating a nuclear unit on public services in ~~Calvert and~~ St. Mary's ~~Counties~~County and the larger 50-mi region would be ~~SMALL~~minimal.

St. Mary's County has one school district, which includes five high schools, four middle schools, 18 elementary schools and two special-needs schools ~~[187 schools?]~~ (SMCPS 2008 ~~|Same as 2.5.2.7 reference|).~~). The 2005–2006 student population was 16,649 students and had a student/teacher ratio range between 11 and 21 (MSDE 2005 ~~& GS 2008 |Same as 2.5.2.7 reference|). Calvert County has one school district which includes 4 high schools, six middle schools and 12 elementary schools (with an additional scheduled to begin operations in the 2008-2009 school year) (CCPS 2008 |Same reference as chapter2|). The student population for 2005-2006 was 17,468 and the student/teacher ratio range was 14 to 19 (MSDE 2005 & GS 2008 |Same as 2.5.2.7 reference|). Site development~~; GS 2008). Construction, preconstruction, and operations related students would represent a small percentage increase in the student body population. Given the number of schools in ~~the two counties~~St. Mary's County and the large student body populations, it is likely that the new students will be absorbed easily and education impacts would be ~~SMALL~~minimal for St. Mary's County and the large 50-mi region.

Aesthetics and Recreation

In St. Mary's County there are 4four state parks that provide summer camps and special events, horseback riding, camping, fishing, biking, hiking, and picnicking (SMTT 2008;, SMCBCC 2005 |Same as 2.5.2.4 reference|).). Calvert County's two main parks are Calvert Cliffs State Park and Flag Ponds Nature Park and, which provide hiking, swimming, picnicking, fishing, bird watching, and wildlife viewing opportunities (MDNR 2007 |Same as 2.5.2.4 reference| &2007a, UniStar 2008|9a). Recreational users may be impacted by traffic in the near vicinity of the plant during shift change. Some plant structures could be visible from nearby locations, and new transmission lines would be constructed. Impacts on recreation would be SMALL;. h However, the aesthetic impacts during developmentconstruction, preconstruction, and operation of a nuclear plant on the Thiokol site cwould be MODERATEminimal.

Summary of SocioeconomicCumulative Impacts

For the analysis of socioeconomic impacts at the Thiokol site, the geographic area of interest is considered to be the 50-mi region centered on the Thiokol site with special consideration for St. Mary's County as that is where the review team expects socioeconomic impacts to be the greatest. Historically, St. Mary's County's economy was based on tobacco and water-related jobs. Those have decreased significantly in recent years with the State tobacco buyout program and a shift to technology-oriented jobs. The Patuxent River Naval Air Station, built in the 1940s, has had long-lasting effects on the economy, and the County continues to build its defense industry jobs. St. Mary's is now designated a "Technology Corridor" by the State (SMCTD 2009).

In addition to socioeconomic impacts from building and operating a nuclear unit at the Thiokol site, this analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to the cumulative socioeconomic impacts. The projects identified in Table 9-10Table 9-10Table 9-10Table 9-8 have or would contribute to the demographics, economic climate, and community infrastructure of the region and generally result in increased urbanization and industrialization. However, many impactsresource areas, such as those on housing or public services, are able to adjust over time, particularly with increased tax revenues. Because the projects within the review area identified in Table 9-10Table 9-10Table 9-10Table 9-8 would be consistent with applicable land-use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services.

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. In summary, based on information provided by UniStar and the review team's independent evaluation, the

review team concludes that the cumulative impacts of ~~the~~ building and operating a new nuclear unit at the Thiokol site on socioeconomics would be SMALL ~~adverse~~ in terms of adverse physical impacts (including workers and local public, noise, air quality, buildings, and transportation), demography, housing, public service, educational, aesthetics, and ~~recreational impacts during the site development phase,~~recreation and MODERATE for transportation ~~and aesthetics.~~. The impacts on the St. Mary's County economy and tax base during plant operation likely would be beneficial and ~~MODERATE. A portion of the tax increase could be used to improve local transportation infrastructure and educational facilities to accommodate the population growth.~~LARGE.

~~9.3.6.6~~9.3.5.6 Environmental Justice

The 2000 Census block groups were used for ascertaining minority and low-income populations in the region. There were a total of ~~2385~~2477 census block groups within the 50-mi region (which includes portions of Washington ~~DC,~~D.C., Maryland, and Virginia). Approximately ~~873~~827 were classified as aggregate minority, ~~665~~725 African American and ~~116~~165 Hispanic. As discussed in Section 2.6, there are no minority block groups in Calvert County and ~~two~~four in St. Mary's County. There are ~~28~~71 census block groups classified as low income in the 50~~-mile~~-mi region, ~~n~~one of which ~~are~~is in ~~Calvert and~~ St. Mary's County. Figure 9-10~~Figure 9-10Figure 9-10~~ shows the geographic locations of the minority populations of significance within the 50-mi radius, and Figure 9-15~~Figure 9-15Figure 9-15Counties.~~ shows the geographic locations of the low-income populations of significance within the 50-mi radius.

~~Site development~~Construction and preconstruction activities (noise, fugitive dust, air emissions, traffic) would not disproportionately adversely affect minority populations because of their distance from the Thiokol site. The operation of the proposed project at Thiokol is also unlikely to have a disproportionate adverse impact on minority or low-income populations. See Sections 4.5 and 5.5 for more information about environmental justice criteria and impacts.

~~See Sections 4.5 and 5.5 for more information about environmental justice criteria and impacts.~~

The projects identified in Table 9-10~~Table 9-10Table 9-10~~Table 9-8 likely did not or will not contribute to environmental justice impacts of the region. Housing rental rates can be an area of concern with regards to low-income populations. If projects commence ~~that~~and cause a rise in rental rates ~~that push low-income populations out of their homes, then~~, there may be a disproportionate adverse impact on low-income populations. Further, the determinations reached for the Calvert Cliffs site (Sections 4.5 and 5.5) are believed to be generally applicable to the Thiokol site. ~~Based~~Therefore, based on information provided by UniStar and the review team's independent evaluation, the review team concludes that there would likely not be any disproportionate and adverse environmental justice cumulative impacts from building and operating a new ~~generating unit at the Thiokol site.~~ nuclear unit at the Thiokol site, and the cumulative environmental justice impacts, including construction, preconstruction, and operation of a nuclear power plant at the Thiokol site, would be SMALL.

Frederick
Carroll
Baltimore
Harford
Cecil
Baltimore
Baltimore City
Kent
Montgomery
Howard
Anne Arundel
Queen Anne's
Loudoun
Queen Anne's
Washington
District of Columbia
Falls Church
Fairfax City
Alexandria
Prince George's
Caroline
Talbot
Fairfax
Prince William
Charles
Calvert
Dorchester
Maryland
Stafford
Thiokol Site
St. Mary's
King George
Virginia
Westmoreland
Caroline
Essex
Richmond
Northumberland
Lancaster
King William
King and Queen
Hanover
Middlesex
Accomack
Henrico
New Kent
Gloucester
Mathews
Somerset
Wicomico
Thiokol Site
Census Block Group Boundary
Environmental Justice: Aggregate Minority Populations
Thiokol Site

1

Figure 9-14. Distribution of Aggregate Minority Populations of Significance, 2000

Figure 9-15. Distribution of Aggregate Low-Income Populations of Significance, 2000

~~9.3.6.7~~9.3.5.7 Historic and Cultural Resources

The former Thiokol site has a history of manufacturing munitions and burying some of them onsite. Prior to 1950, a company called the Federal Ordnance Corporation operated a munitions plant on the property. In the 1950s, a company ~~called~~, Hunter Manufacture, purchased the property and continued to produce munitions until the late 1950s (MDE 2007). When the factory was in operation in the 1950s, employees were directed to bury unexploded ordnances on the property. The locations of the buried ordnances were not recorded (MDE 2007). In 1959, Thiokol Corporation (today known as Cordant Technologies) purchased the property, but did not continue with the production of munitions. In the 1980s, Thiokol razed buildings, harvested timber, and later reforested parts of the property. In 1999, South Resource Management purchased the property from Cordant with a declaration of covenant prohibiting residential construction at two special reserve areas in suspected burial regions of the property. The 719~~-~~-ac property was split and 619 ac, along with the reserve areas, were sold to PB II, LLC in 2006 (MDE 2007).

UniStar conducted a literature review at the Maryland Historical Trust. One report on file was specific to Mechanicsville related to historic properties. There are no known National Register of Historic Properties in St. Mary's County (UniStar 2008b). No buildings remain on the Thiokol site. Due to the building removal, soil removal, and overall land disturbance associated with the production of munitions on the property, historical resources that may be encountered at the site would most likely be disturbed and located below surface, and the probability would be low of finding resources above ground (UniStar 2009a).

No projects were identified in Table 9-10~~Table 9-10Table 9-10Given the unique history of manufacturing munitions at this site, the SHPO would need to be consulted regarding the need for systematic surveys to identify historic and archaeological resources prior to any ground-disturbing activities and any additional work that may be needed to address historic, cultural, and archaeological resources at this particular site. [Or contrary to the above, if it is true that the whole property was dug up, the need for SHPO involvement may be limited to unexpected incidents of discovery.]~~

that would contribute to cumulative impacts to historic and cultural resources.

Based on ~~the known~~ reconnaissance-level ~~of~~ information regarding historic and cultural resources at the site and the overall land disturbance associated with the production of munitions at the site and the extensive remediation activities, the review team concludes that cumulative impacts on historic properties of building and operating a new nuclear generating unit at the Thiokol site are likely to be SMALL. No archaeological and/or architectural surveys have been conducted.

~~9.3.6.8~~9.3.5.8 Air Quality

The atmospheric emissions related to building and operating a nuclear power plant at the Calvert Cliffs site in Calvert County, Maryland~~,~~ were described in Chapters 4 and 5 of this EIS. The emissions were evaluated in detail because Calvert County is in non-attainment of the 8-hour ozone National Ambient Air Quality Standard~~ and~~, but below the threshold requiring mitigation. Therefore, the review team concluded that the environmental impacts were ~~found to have a~~ SMALL~~ impact~~. In Chapter 7, the cumulative impacts of the emissions were evaluated and also determined to be SMALL.

The emissions related to building and operating a nuclear power plant at the Thiokol Site in St Mary's County would be similar to those at the Calvert Cliffs site. St. Mary's County is ~~not in non-attainment~~in the Central Maryland Intrastate Air Quality Control Region (40 CFR81.155). It is not in nonattainment of any air quality standard.

Reflecting on the projects listed in Table 9-10~~Table 9-10Table 9-10~~, most of the effects on air quality would be to maintain the status quo. Any new industrial projects would either have de minimis impacts or would be subject to regulation by the Maryland DNR. Given these institutional controls, it is unlikely that the air quality in the region would degrade significantly (i.e., degrade to the extent that the region is in nonattainment of national standards). As a result, because the emissions ~~are similar~~would be the same as at the Calvert Cliffs site, the review team concludes that the air quality impacts of building and operating a nuclear power plant at the Thiokol Site would be SMALL and that the cumulative impacts would be SMALL.

Greenhouse gas emissions related to nuclear power are discussed in Chapters 4, 5, and 6 for building and operating a nuclear power plant and for the fuel cycle, respectively. As described in Chapter 7, the impacts of greenhouse gas emissions are not sensitive to location of the source. Consequently, the impacts of greenhouse gas emissions considered in isolation would be SMALL, but the cumulative impact of greenhouse gas emissions would be MODERATE.

9.3.5.9 Nonradiological Health Impacts

The following impact analysis includes nonradiological health impacts from construction and preconstruction activities and operations to the public and workers from a nuclear unit at the Thiokol alternative site. The analysis also considers past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-10~~Table 9-10Table 9-10~~. The construction- and preconstruction-related activities that have the potential to impact the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to impact the health of members of the public and workers includes exposure to etiological agents, noise, EMFs, and impacts from the transport of

workers to and from the site. For the analysis of nonradiological health impacts at the Thiokol alternative site, the geographic area of interest is considered to include projects within a 5-mi radius from the site's center based on the localized nature of the impacts. For impacts associated with transmission lines, the geographic area of interest is the transmission line corridor.

Building Impacts

Nonradiological health impacts to construction workers and members of the public from building a new nuclear unit at the Thiokol site would be similar to those evaluated in Section 4.8 for the Calvert Cliffs site. The impacts include noise; vehicle exhaust; dust; occupational injuries; and transportation accidents, injuries, and fatalities. Applicable Federal and State regulations on air quality and noise would be complied with during the site preparation and building phase. The incidence of construction worker accidents would not be expected to be different from the incidence of accidents estimated for the Calvert Cliffs site. Thiokol site is located in a rural area and building impacts would likely be minimal on the surrounding populations.

Past and present actions in the geographic area of interest that have similarly impacted nonradiological resources include the construction and operation of the Dominion Cove Point Liquid Natural Gas Facility. Proposed future actions would include the proposed Dominion Cove Point Pier Reinforcement Project, and transportation projects to upgrade MD Route 4 and the Thomas Johnson Bridge. Transmission line development and/or upgrading throughout the designated geographical area of interest and future urbanization would also be expected to occur.

Operational Impacts

Nonradiological health impacts from operation of a new nuclear unit on occupational health and members of the public at the Thiokol site would be similar to those evaluated in Section 5.8 for the Calvert Cliffs site. Occupational health impacts to workers (e.g., falls, electric shock, or exposure to other hazards) at the Thiokol site would likely be the same as those evaluated for workers at a new unit at the Calvert Cliffs site. Based on the configuration of the proposed new unit at the Thiokol site (closed-cycle, wet cooling system with mechanical draft cooling towers), etiological agents would not likely increase the incidence of water-borne diseases in the vicinity of the site. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Effects of EMF on human health would be controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria.

The nonradiological impacts from operations to the public and workers in the geographic areas of interest would be associated with cooling towers and existing transmission lines. The only past and current project in the geographical area of interest that has been identified for cumulative impacts is the operation of CCNPP Units 1 and 2. Proposed future actions that

would impact nonradiological health in a similar way to operation activities at the Thiokol site would include transmission line systems and future urbanization, which would both occur throughout the designated geographical areas of interest.

Cumulative Impacts

Based on the information provided by UniStar and the review team's independent evaluation, the review team expects that the impacts to nonradiological health from construction and operation of a new unit at the Thiokol site would be similar to the impacts evaluated for the CCNPP site. Although there are past, present, and future activities in the geographic area of interest that could affect nonradiological health in ways similar to the building and operation of a new unit at the Thiokol site, those impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes that the cumulative impacts from construction, preconstruction, and operation on nonradiological health would be SMALL.

9.3.5.10 Radiological Impacts of Normal Operations

As described in section 9.3.4, the Thiokol site is a brownfield test site that currently has no nuclear facilities. The geographic area of interest is the area within a 50-mi radius of the Thiokol site. Facilities potentially affecting radiological health within this area are the existing CCNPP Units 1 and 2 on the Chesapeake Bay. Additionally, CCNPP Units 1 and 2 are currently implementing a 1.38 percent power uprate. A number of hospitals within 50-mi of the Thiokol site use nuclear materials for medical purposes.

The radiological impacts of building and operating the proposed U.S. EPR plant at the Thiokol site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite – well below regulatory limits. These impacts are expected to be similar to those estimated for the Calvert Cliffs Unit 3 site.

The radiological impacts of the CCNPP Units 1 and 2 also include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite, well below regulatory limits, as demonstrated by the ongoing radiological environmental monitoring programs around these plants. The NRC staff concludes the dose from direct radiation and effluents from hospitals practicing nuclear medicine are an insignificant contribution to the cumulative impact around nuclear power plants based on data from the REMP around currently operating nuclear power plants. Similarly, the radiological impacts of transporting fuel and waste to and from the Thiokol site during plant operations was shown to be a small fraction of natural background radiation, and there are no significant differences among the alternative sites (Section 6.2).

Based on the information provided by UniStar and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the

proposed U.S. EPR unit and other existing and planned projects and actions in the geographic area of interest around the Thiokol site would be SMALL.

9.3.5.11 Postulated Accidents

As described in Section 9.3.5, the Thiokol site currently has no nuclear facilities. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Thiokol site. This includes the existing CCNPP (Units 1 and 2), North Anna (Units 1 and 2), Surry (Units 1 and 2), Salem (Units 1 and 2), Hope Creek, and Peach Bottom (Units 2 and 3) nuclear generating stations. Other proposed reactors within the geographic area of interest include an additional reactor at the North Anna site. In addition, interest has been expressed in a site permit for a location in southern New Jersey.

Because the meteorology, population distribution, and land use for the Thiokol alternative site are expected to be similar to the proposed Calvert Cliffs site, risks from a severe accident for a U.S. EPR reactor located at the Thiokol alternative site are expected to be similar to those analyzed for the proposed Calvert Cliffs site. These risks for the proposed Calvert Cliffs site are presented in Table 5-16 and Table 5-17 and are well below the median value for current-generation reactors. In addition, estimates of average individual early fatality and latent cancer fatality risks provide a considerable safety margin because they are well below the NRC's safety goals (51 FR 30028).

For existing plants within the geographic area of interest, including the CCNPP (Unit 1 and 2), North Anna (Units 1 and 2), Surry (Units 1 and 2), Salem (Units 1 and 2), Hope Creek, and Peach Bottom (Units 2 and 3) nuclear generating stations, the NRC has determined the probability-weighted consequences of severe accidents are SMALL (10 CFR 51, Appendix B, Table B-1). Finally, review of the North Anna Power Station Unit 3 environmental impact statement (NUREG-1917) shows that risks for the other proposed unit within the geographic area of interest are also well below current-generation reactors and meet the NRC's safety goals. On this basis, the review team concludes that the cumulative risks of severe accidents at any location within 50 mi of the Thiokol alternative site from the operation of a nuclear unit at the Thiokol site or from other nuclear plants listed are expected to be SMALL.

~~9.3.7~~9.3.6 Comparison of the Impacts of the Proposed Action and Alternative Sites

This section summarizes the NRC staff's impact characterizations for cumulative impacts related to locating one new U.S. EPR nuclear unit at the proposed site and each alternative site. The three Maryland sites selected for detailed review as part of the alternative sites environmental analysis included the Bainbridge site in Cecil County, the Eastalco site in Frederick County, and the Former Thiokol Site in St. Mary's County. Comparisons are made

between the proposed site and alternatives to determine if one of the alternative sites is environmentally preferable to the proposed site.

The need to compare the proposed site with alternative sites arises from the requirement in Section 102(2)(c)(iii), 42 USC 4332 of the National Environmental Policy Act of 1969 (NEPA) that environmental impact statements include an analysis of alternatives to the proposed action. The ~~U.S. Nuclear Regulatory Commission (~~NRC~~)~~ criteria to be employed in assessing whether a proposed site is to be rejected in favor of an alternative site is based on whether the alternative site is "obviously superior" or "environmentally preferable" to the site proposed by the applicant (Public Service Co. of New Hampshire 1977). An alternative site is "obviously superior" to the proposed site if it is "clearly and substantially" superior to the proposed site (Rochester Gas & Electric Corp. 1978). The standard of obviously superior "...is designed to guarantee that a proposed site will not be rejected in favor of an alternate unless, on the basis of appropriate study, the Commission can be confident that such action is called for" (New England Coalition on Nuclear Pollution 1978~~). "~~).

Field Code Changed

The "obviously superior" test is appropriate for two reasons. First, the analysis performed by the review team in evaluating alternative sites is necessarily imprecise. Key factors considered in the alternative site analysis, such as population distribution and density, hydrology, air quality, aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics, are difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site must have a wide range of uncertainty. Second, the applicant's proposed site has been analyzed in detail, with the expectation that most adverse environmental impacts associated with the site have been identified. The alternative sites have not undergone a comparable level of detailed study. For these reasons, a proposed site may not be rejected in favor of an alternative site when the alternative site is marginally better than the proposed site, but only when it is obviously superior (Rochester Gas & Electric Corp. 1978). NEPA does not require that a nuclear plant be constructed on the single best site for environmental purposes. Rather, "...all that NEPA requires is that alternative sites be considered and that the effects on the environment of building the plant at the alternative sites be carefully studied and factored into the ultimate decision" (New England Coalition on Nuclear Pollution 1978~~). "~~).

The NRC staff's review of alternative sites consists of a two-part sequential test (NRC 2000a). The first part of the test determines whether any of the alternative sites are environmentally ~~preferred sites are among the candidate sites.~~preferable to the applicant's proposed site. The staff considers whether the applicant has (1) reasonably identified candidate sites, (2) evaluated the likely environmental impacts of construction and operation at these sites, and (3) used a logical means of comparing sites that led to the applicant's selection of the proposed site. Based on NRC's own independent review, the staff then determines whether any of the alternative sites are environmentally preferable to the applicant's proposed site. If the staff determines that one or more alternative sites are environmentally preferable, then it would compare the estimated costs (i.e., environmental, economic, and time) of constructing the proposed plant at the proposed site and at the environmentally preferable site or sites (NRC

2000a). The second part of the test determines if an environmentally preferable alternative site is obviously superior to the proposed site. The staff must determine that (1) one or more important aspects, either singly or in combination, of an ~~acceptable and available~~environmentally preferable alternative site are obviously superior to the corresponding aspects of the applicant's proposed site~~,~~ and (2) the alternative site does not have offsetting deficiencies in other important areas. A staff conclusion that an alternative site is obviously superior to the applicant's proposed site would normally lead to a recommendation that the application for the license be denied.

Section 9.3.6.1 presents a summary of the information that is used to compare the sites. Sections 9.3.~~7~~6.1 and 9.3.~~7~~6.2, respectively, discuss the environmental impacts of proposed site in relation to the alternative sites as they relate to environmentally preferable and obviously superior evaluations. ~~Comparison with the no-action alternative is provided in Section 9.3.7.4.~~

~~9.3.7.1~~9.3.6.1 Comparison of Propose Site and Alternative Site Cumulative Impacts

The review team's characterizations of the cumulative environmental impacts of building and operating a new nuclear generating unit at the proposed site (impact levels from Chapter 7) and three alternatives sites (from Sections 9.3.~~4~~3 through 9.3.~~6~~5) are listed in Table 9-12~~Table 9-12Table 9-12~~.

Table 9~~The NRC staff reviewed UniStar's ER (Rev. 6, October 2009) and its supplemental Alternative Site Evaluation document (UniStar 2009 |Alternative Sites|). The NRC staff conducted site visits at the proposed Calvert Cliffs site and each of the alternative sites. The staff found that UniStar implemented a reasonable process to select alternative sites and used a logical press to compare the impacts at the proposed site to those at the alternative sites. The following section summarizes the staff's independent assessment of the proposed and alternative sites.~~

~~The NRC staff's characterization of the expected cumulative environmental impacts of building and operating a new unit at the Calvert Cliffs site and alternative sites are summarized by impact category level in Table 9-x. Full explanations for the particular characterizations are provided in Chapter 7 for the proposed site and in Sections 9.3.4, 9.3.5, and 9.3.6 for the alternative sites. In the following analysis, the staff characterized the likely impact category levels based on information provided under oath and affirmation by UniStar, technical documents, agency information, professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a COL is underway. These considerations and assumptions were similarly applied at each of the alternative sites to provide a common basis for comparison. The Calvert Cliffs site has received a Maryland Certificate of Public Convenience and Need (CPCN) from the Maryland Public Service Commission (MPSC 2009). The CPCN addresses many of the State permits requirements, and contains over a hundred licensing conditions to minimize environmental impacts (MPSC 2009).~~

~~Some environmental impacts considered are generic to all sites and, therefore, do not influence the comparison of impacts between the applicant's proposed site and the alternative sites. The generic environmental impacts common to all sites are nonradiological and radiological health impacts, environmental impacts from postulated accidents, and some aspects of ecology and socioeconomics. Review of these generic, non-site-specific issues can be found in Section 9.3.3.~~

~~The environmental impact areas listed in Table 9.x and have been evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – developed using the CEQ guidelines and set forth in the footnotes to Table B-1 of 10 CFR Part 52, Subpart A, Appendix B:~~

> ~~SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.~~
>
> ~~MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.~~
>
> ~~LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.~~

~~Summary of Cumulative Impacts~~

~~The staff's characterization of the environmental impacts of building and operating a new nuclear unit at the proposed site and the three alternatives sites are listed in in the context of cumulative impacts for each resource area.~~

~~**Table -**~~**12**. Comparison of Cumulative Impacts at the Proposed and Alternative Sites

Resource Category	Calvert Cliffs	Bainbridge	Eastalco	Former Thiokol
Land-Use				
The Site and Vicinity	SMALL	SMALL	SMALL	SMALL
Transmission Line Corridors	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water-Related				
Water Use	SMALL	SMALL	SMALL to MODERATE	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL
Ecology				
Terrestrial Ecosystems	~~SMALL TO~~ MODERATE	SMALL	SMALL	SMALL to MODERATE

Aquatic Ecosystems	SMALL TO MODERATE	SMALLMODERATE to LARGE	SMALL	SMALL to MODERATE to LARGE
Threatened and Endangered Species	SMALL to MODERATE	SMALL to LARGE	??	SMALL to MODERATE
Socioeconomic				
Physical Impacts	SMALL (except roads)	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL
Taxes and Economy	SMALL to MODERATE BENEFICIALLARGE Beneficial	SMALL to MODERATE BENEFICIALLARGE Beneficial	SMALL to MODERATE BENEFICIALBeneficial	SMALL to MODERATE BENEFICIALLARGE Beneficial
Housing and Transportation	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL TOto MODERATE
Public Services and Education	SMALL	SMALL	SMALL	SMALL
Aesthetics and Recreation	SMALL	SMALL? to MODERATE	?SMALL to MODERATE	SMALL to MODERATE
Environmental Justice	SMALL	SMALL	SMALL	SMALL

Table 9-12Table 9-12Table 9-12Table 9-9. (contd)

Resource Category	Calvert Cliffs	Bainbridge	Eastalco	Former Thiokol
Historic and Cultural Resources	MODERATE [to LARGE]	MODERATE to LARGE	MODERATE to LARGE	SMALL
Air Quality	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	[levels needed?]SMALL	SMALL	SMALL	SMALL
Design basis Accidents				
Severe Accidents				
Fuel Cycle Impacts				

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The NRC staff reviewed UniStar's ER (2009a) and its supplemental Alternative Site Evaluation document (UniStar 2009e). The NRC staff conducted site visits at the proposed Calvert Cliffs site and each of the alternative sites. The staff found that UniStar implemented a reasonable process to select alternative sites and used a logical process to compare the impacts at the proposed site to those at the alternative sites. The following discussion summarizes the staff's independent assessment of the proposed and alternative sites.

The NRC staff's characterization of the expected cumulative environmental impacts of building and operating a new unit at the Calvert Cliffs site and alternative sites are summarized by impact category level in Table 9-12~~Table 9-12Table 9-12~~~~In one issue, the Calvert Cliffs site is unique in that it contains potentially eligible historic and architectural resources that would be adversely affected by the site clearing activities for proposed Unit 3, requiring mitigation.~~

. Full explanations for the particular characterizations are provided in Chapter 7 for the proposed site and in Sections 9.3.3, 9.3.4, and 9.3.5 for the alternative sites. The staff's impact category levels are based on professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a COL is underway. These considerations and assumptions were similarly applied at each of the alternative sites to provide a common basis for comparison.

The environmental impact areas listed in Table 9.9 have been evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – as set forth in the footnotes to Table B-1 of 10 CFR Part 52, Subpart A, Appendix B:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The following section evaluates whether or not an alternative site is environmentally preferable to the proposed site.

~~9.3.7.2~~9.3.6.2 Environmentally Preferable Sites

None of the four sites appears to have any flaws that would prohibit building a nuclear power plant at that location. However, as shown in Table 9-12~~Table 9-12Table 9-12~~, there are some differences in the review team's impact characterizations among the sites. The cumulative impacts of building and operating ~~a~~ two new units at the proposed site and the alternative sites are generally SMALL for most impact categories. The categories for which the impact level at an alternative site ~~was~~would be the same as the proposed site would not cause the alternative site to be environmentally preferable to the proposed site. Therefore, these categories ~~for which the impacts are the same for proposed and alternative~~ sites are not discussed further in determining if an alternate site is environmentally preferable to the proposed site. The categories for which ~~there was~~an alternative site would have a ~~difference in~~higher or lower impact level ~~between~~than the proposed ~~and alternative sites~~site are discussed further to determine if an alternative site is environmentally preferable to the proposed site. The

Bainbridge site is characterized by the staff more favorably than the Calvert Cliffs site in Table 9-12~~Table 9-12Table 9-12~~ for the resource category terrestrial ecosystems. Conversely, the Calvert Cliffs site is characterized more favorably than the Bainbridge site in Table 9-12~~Table 9-12Table 9-12~~ for the following resource categories: land use aspects of transmission line corridors, aquatic ecosystems, aesthetics and recreation, and air quality. The potential for LARGE impacts to aquatic resources is the most significant differentiator among these categories. On balance, and based on the impact characterizations shown in Table 9-12~~Table 9-12Table 9-12~~, the NRC staff concludes that the Bainbridge site would not be environmentally preferable to the Calvert Cliffs site for a new nuclear generating unit.

The Eastalco site is characterized by the staff more favorably than the Calvert Cliffs site in Table 9-12~~Table 9-12Table 9-12~~ for the following resource categories: terrestrial ecosystems and aquatic ecosystems. Conversely, the Calvert Cliffs site is characterized more favorably than the Eastalco site in Table 9-12~~Table 9-12Table 9-12 As shown in Table 9-9, there are some differences in~~ for the resource categories: land use aspects of transmission line [and pipeline] corridors, taxes and economy, aesthetics, and air quality. These two sites rank closely, and it would be difficult through a comparison of impacts ~~among the sites~~in different resource categories to precisely state one is better than the other from an environmental perspective. In such a case, the proposed site prevails because the alternative is not clearly environmentally preferable.

The Former Thiokol site is characterized by the staff more favorably than the Calvert Cliffs site in Table 9-12~~Table 9-12Table 9-12~~ for the resource categories: terrestrial ecosystems and historic and cultural resources. Conversely, the Calvert Cliffs site is characterized more favorably than the Former Thiokol site in Table 9-12~~Table 9-12Table 9-12[in first paragraph discuss the differences between proposed and alternative site 1. Conclude with of why or why not alt is/is not environmentally preferable to the propose site}~~

~~[Discuss difference between proposed site and alternative site 2. Conclude with of why or why not alt is/is not environmentally preferable to the propose site]~~

~~[Discuss difference between proposed site and alternative site 3. Conclude with of why or why not alt is/is not environmentally preferable to the propose site]~~

for the following resource categories: land use aspects of transmission line corridors and aquatic ecosystems. Similar to the situation with the Eastalco site, the Former Thiokol site and the Calvert Cliffs site rank closely and it would be difficult through a comparison of impacts in different resource categories to precisely state that one is better than the other from an environmental perspective. In such a case, the proposed site prevails because the alternative is not clearly environmentally preferable.

Although there are differences and distinctions between the cumulative environmental impacts of building and operating a new nuclear generating unit at the Calvert Cliffs site and the alternative sites, the review team concludes that none of these differences is sufficient to determine that any of the alternative sites is environmentally preferable to the Calvert Cliffs site.

~~9.3.7.3~~9.3.6.3 Obviously Superior Sites

Because none of the alternative sites is environmentally preferable to the proposed site, none could be obviously superior and no additional evaluation is required.

~~9.3.7.4 Comparison with the No-Action Alternative~~

~~The no-action alternative refers to a scenario in which NRC denies the applicant's request for a COL or if the Corps denies the request for an Army permit.[make sure wording consistent; e.g., Corps no-action] If the application for the proposed COL or Corps permit for Unit 3 at Calvert Cliffs were denied, the impacts of construction and operation activities would not occur at the *Calvert Cliffs site*.~~

~~In the event that the NRC denies the COL application or the Corps denies the Army permit, the applicant could follow any of several paths to satisfy its electric power needs. The following paths could be pursued individually or in combination, and each would have associated environmental impacts.~~

- ~~Reapply with a revised application for the same proposed site.~~
- ~~Seek an Early Site Permit, a construction permit, or combined license for a new nuclear unit for a different location.~~
- ~~Purchase power from other electricity providers.~~
- ~~Establish conservation and demand-side management programs.~~
- ~~Construct new generation facilities other than nuclear at the currently proposed site.~~
- ~~Construct new generation facilities at other locations.~~
- ~~Delay retirement of existing generating facilities.~~
- ~~Reactivate previously retired generating facilities.~~

~~Each of the options listed above has its own set of impacts. Some of the options could have environmental impacts that are more adverse than those associated with construction and operation of new generation facilities at the Calvert Cliffs site. Unless the option involves nuclear facilities, the NRC would have no role selection of the option or evaluating the environmental impacts of the option.~~

9.4 System Design Alternatives

The ~~staff~~review team considered a variety of heat dissipation systems and circulating water systems alternatives~~. While~~ for the proposed Unit 3. Although other heat dissipation systems and water systems exist, by far the largest and the most likely to dominate the environmental consequences of operation is the normal heat sink cooling system. Other water systems, such as service water and ultimate heat sink cooling systems, are much smaller than the normal heat sink cooling system. However, because the structures to support safety-related functions, such as the ultimate heat sink, must be hardened to ensure ~~their ability to operate through~~safe operation during design~~-~~basis events, the ~~staff~~review team considers the intakes of both the normal and ultimate heat sinks independently. In this evaluation, the ~~staff~~review team only consider~~s~~ed alternative heat dissipation ~~and water treatment systems~~ for the normal heat sink cooling system~~. Because~~ , because it is the ~~water supply for normal~~dominant heat ~~sink and service water is often distinct,~~dissipation system. The review team considered the ~~staff considered~~possibility of separate water ~~supply alternatives~~supplies for ~~both~~ the normal heat sink and the service water. The proposed system is a mechanical draft cooling tower with plume abatement as discussed in Section 9.4.1.4.

9.4.1 Heat Dissipation Systems

About two-thirds of the heat from a commercial nuclear reactor is rejected as heat to the environment. The remaining one-third of the reactor's generated heat is converted into electricity. Normal heat sink cooling systems transfer this reject heat load into the atmosphere and/or nearby water bodies, primarily as latent heat exchange (evaporating water) or sensible heat exchange (warmer air or water). Different heat dissipation systems rely on different exchange processes. The following sections describe alternative heat dissipation systems considered by the ~~staff~~review team for proposed Unit~~s~~ 3.

9.4.1.1 Once-Through Cooling

Once-through cooling systems withdraw water from the source water body and return the same volume of water to the receiving water body at an elevated temperature. Typically the source water body and the receiving water body are the same body and the intake and discharge structures are separated to limit recirculation. While there is no consumptive use of water in a once-through heat dissipation system, the elevated temperature of the receiving water body ~~will~~would result in some induced evaporative loss that decreases the net water supply. The large intake and discharge flows associated with once-through cooling systems require large intake and discharge structures ~~and~~, result in higher levels of impingement and entrainment, and may result in hydrological alterations in the source/receiving water bodies. Based on ~~recent~~ rulemaking by EPA regarding Section 316(b) of the Clean Water Act, the ~~staff~~review team has

determined that once-through cooling systems for new nuclear reactors are unlikely to be permitted in the future, except in rare situations.

The existing CCNPP Units 1 and 2 use once-through cooling with an onshore intake structure and an offshore discharge structure. Separate intake and discharge structures would be required for proposed Unit 3, since the capacity of the existing intake system is inadequate to meet the combined needs of Units 1, 2, and ~~2 and Unit~~ 3. Either onshore or offshore intake and discharge structures are possible. In the ER (UniStar 200~~8~~9a), the applicant stated once-through cooling design was not considered feasible due to the cost that would be required to construct the intakes and discharges and ~~to~~ make them compliant with Clean Water Act Section 316(b) rules. The ~~staff~~review team determined that once-through cooling would not be environmentally preferable based on the environmental sensitivity of the Chesapeake estuary and the magnitude of the ~~construction of~~activities in building such large intake structures and operational impacts of such large flows.

~~9.4.1.2 Helper Tower Cooling~~

~~In order to reduce the temperature of water discharged through a once-through cooling system, a helper cooling tower can be added to cool the discharge water before it is finally discharged to the receiving water body. A helper tower can be used continuously or only be used under conditions when there is a concern with high temperatures in the receiving water body. If the helper tower is a wet cooling tower, it will increase the consumptive loss of water due to the evaporation from the cooling tower. The impingement losses are the same as for a wet cooling design, whereas the entrainment losses may increase when the helper cooling tower is operating.~~

~~Due to the dramatically smaller blowdown discharge flow rates, the thermal plume in the Chesapeake Bay of the proposed alternative would be considerably smaller than for a once-through system with or without helper towers. Therefore, as with the finding above for once-through cooling systems, the staff determined that once-through cooling systems with helper towers are not the environmentally preferable to the proposed cooling system design.~~

~~9.4.1.3~~9.4.1.2 Wet Mechanical Draft Cooling Towers Without Plume Abatement

A wet mechanical draft cooling tower transfers heat to the environment via evaporation and conduction. These towers can be relatively low profile compared to their natural draft counterparts~~,~~ and rely on large fans to force air through walls of falling water. Drift abatement features limit the amount of water suspended as droplets in the air to later come down to the ground outside the tower. Wet mechanical draft towers often generate visible plumes when the moisture in the cooling tower exhaust air cools and the moisture condenses. The proposed heat dissipation system uses plume abatement features to reduce aesthetic issues associated with the plume. The ~~staff~~review team determined that the advantage of the mitigation of the

visible plume aesthetic issue offsets the increased cost and land use with the preferred alternative. Therefore, the review team determined that a wet mechanical draft cooling tower without plume abatement would not be environmentally preferable to the proposed cooling system design.

~~9.4.1.4~~9.4.1.3 Mechanical Draft ~~W~~with Plume Abatement

~~Adding additional heat to a saturated cooling tower exhaust, without adding additional water, will result in subsaturated water vapor. A subsaturated water vapor reduces the potential for a visible plume. By combining wet and dry cooling features in a single cooling tower design the visual plume can be mitigated. In addition, such designs result in less consumptive water use. The staff concludes that the applicant's selection of a mechanical draft tower with plume abatement is the preferred alternative for the proposed Unit 3 is reasonable because the water supply from the Chesapeake Bay is virtually unlimited and plume formation would be minimal, providing the region a pristine visual horizon.~~

A mechanical draft plume abatement tower is the proposed heat dissipation system for Unit 3 and is discussed in Chapter 3 of this EIS.

~~9.4.1.5~~9.4.1.4 Combination Wet-Dry Mechanical Draft Cooling

A combination mechanical draft wet/dry cooling tower system uses both wet and dry cooling cells to limit consumption of cooling water~~, often with the added benefit of reducing plume visibility.~~. Water used to cool the turbine generators generally passes first through the dry portion of the cooling tower, where heat is removed by drawing air at ambient temperature over tubes through which the water is moving. Cooling water leaving the dry portion of the tower then passes through the wet tower where the water is sprayed into a moving air stream, and additional heat is removed through evaporation and sensible heat transfer. When ambient air temperatures are low, the dry portion of these cooling towers may be ~~sufficiently to meet cooling needs.~~sufficient to meet cooling needs. When ambient temperatures are high, the dry portion of these cooling towers would only be able to satisfy a small portion of the cooling need. The use of the dry portion of the system would result in a loss in generating efficiency that would translate into increased fuel cycle impacts. ~~Although a~~A combination mechanical draft wet/dry cooling tower system could reduce water-related impacts. However, as discussed in Chapter 5, the ~~staff~~review team determined that the impacts associated with aquatic ecology, water use, and water quality for the ~~construction and~~ operation of the proposed cooling system were SMALL. Therefore, any reduction in water use would not result in a lower impact level determination. The ~~staff~~review team concluded ~~that~~, given the ~~virtually limitless supply provided by the Chesapeake Bay~~increased fuel cycle impacts, a combination ~~of a~~ wet/dry mechanical draft cooling tower system would not be an environmentally preferable alternative for ~~the Calvert site~~Unit 3.

~~9.4.1.6~~9.4.1.5 Natural Draft Cooling Towers

Natural draft cooling towers, ~~[~~which use about the same amount of water as the proposed design~~,]~~, induce airflow up through large (500 ft tall and 400 ft in diameter) towers by cascading hot water downward in the lower portion of the cooling tower. As heat transfers from the water to the air in the tower, the air becomes more buoyant and moves upward. This buoyant movement induces more air to enter the tower through its open base. The size of the cooling towers results ~~both~~ in a large visual ~~and land-use footprint.~~impact on the viewshed. The ~~staff~~review team determined that th~~e~~is aesthetic issue ~~of such a large structure~~ makes ~~it~~the natural draft cooling tower alternative not environmentally preferable to the proposed design for a site such as Calvert Cliffs ~~with a pristine horizon~~.

~~9.4.1.7~~9.4.1.6 Dry Cooling Towers

Dry cooling towers would eliminate all water-related impacts from the cooling system operation. No makeup water would be needed, and no blowdown water would be generated. However, dry cooling systems require much larger cooling systems, and result in ~~some~~both a loss in electrical generation efficiency ~~since~~(because the theoretical approach temperature is limited to the dry-bulb temperature and not the lower wet-bulb temperature~~,~~) and greater parasitic energy losses for the large array of fans involved. This loss in generation efficiency translates into increased fuel cycle impacts. ~~Since~~Because the impacts associated with aquatic ecology, water use, and water quality for the ~~construction and operation of the~~ proposed cooling system have been determined to be SMALL in Chapters 4 and 5, respectively, the ~~staff~~review team determined that, although dry cooling eliminates water-related impacts, it is not environmentally preferred to the proposed alternative.

~~9.4.1.8~~9.4.1.7 Cooling Pond and Spray Ponds

Cooling pond cooling systems circulate water in man-made ponds. Heat transfer from the cooling pond surface to the atmosphere occurs primarily through evaporation, black-body radiation, and conduction. Cooling ponds generally result in less consumptive water use than a conventional wet mechanical or natural draft cooling tower. Spray ponds enhance evaporative cooling by spraying water into the air over the pond. ~~While~~Although spray ponds require substantiality less area than cooling ponds, both require a significant parcel of contiguous level property. Based on the relief of the proposed site, the ~~staff~~review team determined that neither cooling ponds nor spray ponds were feasible alternatives for the ~~CCNPP~~Calvert Cliffs site.

9.4.2 ~~Circulating Water~~Intake and Discharge Systems

The ~~staff~~review team evaluated alternatives related to the ~~proposed~~balance of the circulating water system; specifically the intakes and discharges for the normal heat sink cooling system~~,~~. The evaluation was based on the proposed heat dissipation system water requirements. The

capacity requirements of the intake and discharge system are defined by the proposed heat dissipation system. For proposed Unit 3, the proposed heat dissipation system is a closed-cycle mechanical draft cooling tower with plume abatement. The ~~staff~~review team also considered alternatives for the water supply sources for both the normal heat sink cooling system and the service water systems in Section 9.4.7.

9.4.2.1 Intake Alternatives

~~Intakes~~Alternative intakes can be constructed either along the shoreline or offshore. With either shoreline or offshore intakes, the structures containing the pumps and screens would not be offshore due to the difficulty of maintaining them offshore. For the U.S. EPR design, two independent intake systems are required to meet the water supply needs of normal operation and safety-related functions, respectively. ~~The high maintenance requirements of an offshore intake for the safety-related intake would be difficult to fulfill for an offshore site.~~ Using a common forebay near the shoreline ~~embayment~~ for ~~both~~ the applicant's proposed intake design~~s~~, consolidates the impacts to one area and ~~eliminates the need to dredge out into~~ limits dredging to a small part of the Chesapeake Bay to install ~~one or more~~ the intake pipelines. Therefore, the ~~staff~~review team determined that there were no alternative intake designs that were environmentally preferable to proposed intake design.

9.4.2.2 Discharge Alternatives

Discharges for the normal or ultimate heat sink cooling system can be constructed either along the shoreline or offshore. Shoreline discharges release water into the shallow tidal zone with more limited mixing than ~~would~~ an offshore discharge. These shallow tidal areas can be important habitat and due to the limited mixing, a shoreline discharge can influence the temperature and chemistry for a relatively large amount of this habitat. Therefore, the ~~staff~~review team determined ~~that~~ there were no alternative intake designs that were environmentally preferable to proposed offshore discharge design.

9.4.3 Water Supplies

The ~~staff~~review team considered alterative sources for both normal heat sink cooling water and service water.

Water Reuse

Sources of water for reuse can either come from the plant itself or from other local water users. Sanitary ~~waste water~~wastewater treatment plants are the most ubiquitous source of water for reuse. Agricultural processing, industrial processing, and oilfield production can also provide significant supplies of water for reuse. Additional treatment (e.g., tertiary treatment, chlorination) may be required to provide water of appropriate quality for the specific plant need.

Sources of water for reuse ~~at~~near the Calvert Cliffs site are limited, and~~ given~~, obtaining water from larger, more distant metropolitan areas would require installing considerable lengths of pipeline. Given the virtually unlimited water supply from the Chesapeake Bay, the ~~staff~~review team determined that water reuse was not an environmentally preferable alternative to the applicant's proposed water supply~~.~~ for Unit 3..

Groundwater

Either freshwater, brackish, or hypersaline aquifers can provide water supplies for various water uses. ~~Ranney~~Radial collector wells slowly draw surface water through sediments and, thereby, filter out some sediment that might have required some treatment~~, if~~ had the water~~ had~~ been directly withdrawn from the surface water body. In general, groundwater withdrawals eliminate most direct operational impacts to aquatic ecosystems (e.g., entrainment and impingement) associated with water withdrawal and eliminate some of the construction impacts (e.g., dredging). The ~~staff~~review team determined that ~~Ranney~~radial collector wells, inducing flow through the sediments beneath the Chesapeake Bay into lateral subterranean pipes extending from the shoreline out beneath the Chesapeake Bay, would require multiple large structures and pipelines near the shoreline. The space required for these structures would be greater that for the proposed system and would need to extend into the cliff area that is inhabited by the Federally listed Puritan tiger beetle (*Cicindela puritana*). The applicant did not consider such an alternative water source, but the ~~staff~~review team independently determined that, even if such a system were feasible, a ~~Ranney~~radial collector well design, although effectively eliminating impingement and entrainment, is not environmentally preferable to the proposed direct withdrawal of Chesapeake Bay water ~~, although effectively eliminating impingement and entrainment,~~ due to the requirement for multiple shoreline structures. The applicant proposes to not use groundwater for operation and ~~will~~would install a desalination system to provide freshwater for the needs of both the existing and proposed facilities. This ~~will~~would eliminate the existing demands for freshwater to the regional aquifer that has experienced considerable increase in local demand and, therefore, is environmentally preferable to any alternative that would rely on local freshwater aquifers.

~~***Surface water***~~

~~Surface water supplies at the Calvert Cliffs site are either brackish (Chesapeake Bay) or fresh (streams). The freshwater streams are too small to reliably meet the water demands for the proposed facility. The Chesapeake Bay provides a virtually unlimited supply of water and is, therefore, the preferred alternative supply of water.~~

9.4.4 Water Treatment

Both inflow and effluent water may require treatment to ~~ensure that~~confirm they meet plant water needs and effluent water standards. The applicant proposes to add chemicals to plant

water to meet appropriate water quality process needs. The effluent water chemistry is regulated by EPA through the NPDES permitting process. The largest chemical inputs are required to maintain the appropriate chemistry in the cooling towers to preclude biofouling. Mechanical treatment is generally not a viable option in cooling tower designs. Other alternatives to preclude biofouling, such as UV treatment, are feasible, but ~~likely~~ would not ~~entirely~~ eliminate the need for some chemical treatment. Chemical treatment is a reliable and well-established engineering practice that has been shown to provide minimal impacts in a variety of settings. The ~~staff~~review team identified no environmentally preferable alternative to the applicant's proposed chemical water treatment. The effluents from cooling tower blowdown are specifically regulated in 40 CFR 423 by the EPA to protect the environment.

9.4.5 Summary of System Design Alternatives

The ~~staff~~review team considered a variety of heat dissipation systems, ~~circulating water~~ intake and discharge systems, water source, and water treatment alternatives. As previously discussed ~~above~~, the ~~staff~~review team identified no environmentally preferable alternative to the applicant's proposed design.

~~9.5 Corps Alternatives Evaluation~~

~~[Per Kathy's email of 5/7/09 12:58 pm related to alternatives, not necessarily onsite.] The Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material ("Guidelines"), stipulate that no discharge of dredged or fill material into a waters of the U.S. (including jurisdictional wetlands) shall be permitted if there is a practicable alternative which would have less adverse impact on the aquatic environment, so long as the alternative does not have other significant adverse environmental consequences. Even if an applicant's preferred alternative is determined to be the Least Environmentally Damaging Practicable Alternative (LEDPA), the Corps must still determine whether the LEDPA is in the public interest. The Corps Public Interest Review (PIR), described at 33 CFR 320.4, directs the Corps to consider a number of factors in a balancing process. A permit will be not be issued for an alternative that is not the LEDPA, nor will a permit be issued for an activity that is determined to be contrary to the public interest. In considering both the LEDPA and the PIR the Corps must consider compliance with other applicable substantive laws such as the ESA [Endangered Species Act] and the NHPA [National Historic Preservation Act] as well as consult with other Federal Agencies. The Corps also must follow procedural laws such as NEPA, and other applicable laws described in 33 CFR 320.3.~~

~~Section 230.10(a) of the Guidelines requires that "*no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.*" Section 230.10(a)(2) of the Guidelines~~

~~states that "*an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant which could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered".* Thus, this analysis is necessary to determine which alternative is the LEDPA that meets the project purpose and need.~~

~~Where the activity associated with a discharge is proposed for a special aquatic site (as defined in 40 CFR Part 230, Subpart E), and does not require access or proximity to or siting within these types of areas to fulfill its basic project purpose (i.e., the project is not "water dependent"), practicable alternatives that avoid special aquatic sites are presumed to be available, unless clearly demonstrated otherwise (40 CFR 230.10(a)(3)).~~

~~9.5.1 Onsite Alternatives~~

~~[Per earlier email from Kathy] As part of its permit evaluation process, the Corps reviewed UniStar's application for proposed Unit 3 and alternatives for onsite siting to minimize wetlands and shoreline effects. Under Section 404 of the Clean Water Act, the Corps can only permit the least environmentally damaging practicable alternative (LEDPA).~~

~~The Corps requested that UniStar provide a detailed analysis of the steps taken to minimize onsite impacts including project alternatives (Corps October 28, 2009). In response to the Corps' request, UniStar's described the basis for the selection of location for the proposed site as follows (UniStar 2008e—and others? The first sentence and some of the other wording and table numbers are the same. I emailed Kathy asking for the source that includes this specific information and she wasn't certain either.):~~

> ~~The placement of CCNPP Unit 3 was designed to minimize environmental impacts, while maintaining the integrity of the existing CCNPP campus. Due to the magnitude/size of contiguous area required for the project, complete avoidance of some impacts to wetlands and cultural resources was not feasible. The site layout study evaluated four configurations. Criteria and considerations to evaluate layout locations included environmental, land use and zoning, construction considerations, construction facilities, switchyard/transmission lines; security; permanent facility considerations, and impact to existing facilities or structures. The northern layout option would make better use of industrial land, but due to the distance from the barge facility, primary laydown, long heavy haul road route, crossing under transmission lines and that this location would have more wetland impacts than the proposed location, this location was not chosen. The southern location is located within the area zoned Rural/Resource Preservation and would require an exemption from the County Zoning Ordinance or the land must be rezoned. However, the southern location would be more advantageous for construction~~

activities due to the location of the existing barge facility, heavy haul road, batch plant, laydown and parking facilities. The southern location segregates the construction activities from the operating units; would not disrupt the current traffic flow; and maintains the security access facilities. The southern location does not allow for a single site protected area that is connected with the existing Units 1 and 2. The applicant recommended southern location with a closed circulating water system based on locating the entire power block and cooling tower arrangement outside the 1000-foot wide Critical Area, with the assumption that approvals could be obtained to allow water-critical structures/pipelines within the Critical Area.

Table -. Wetland and Stream Impact Areas of Onsite Alternatives

Alternative	Approximate Wetland Impact	Approximate Stream Impact
Option A Northern	29.27 ac	9753 linear ft
Option B Northern	29.27 ac	9753 linear ft
Option C Northern	29.67 ac	11,474 linear ft
Permit Application Southern	11.7 ac	8350 linear ft

According to the applicant's delineation, the Calvert Cliffs campus has approximately 133 acres of wetlands and 94,200 linear feet of streams.

The project will implement Best Management Practices and Best Available Technologies to ensure environmental compliance with applicable Federal, State and local requirements to minimize turbidity during dredging and pile-driving activities. Cultural resource impacts were identified and a Memorandum of Agreement will be signed to ensure necessary protections are in place.

This draft EIS provides the environmental information and analyses upon which the LEDPA judgment is based. However, the LEDPA evaluation can not be completed by the Corps until it receives public feedback in the form of public comments on the draft EIS. The Corps will address whether the LEDPA criterion is met in the final EIS.

9.5.2 UniStar's Alternative Sites

[yet to be written by the Corps? – perhaps write from UniStar's analysis to Corps for LEDPA determination?]

9.69.5 References

[Highlighting left in for benefit of reference editor]

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