From: "Routh, Stephen" <sdrouth@bechtel.com>
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Date: Fri, Mar 10, 2006 12:43 AM
Subject: North Anna Early Site Permit Application

Nitin Patel -

On behalf of Joe Hegner and Tony Banks of Dominion, attached please find copies of Dominion's planned presentations for today's meeting.

Steve Routh

Bechtel-Frederick

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North Anna ESP Application

Meeting With NRC Staff
March 10, 2006

Agenda

- Objective
- Description of Cooling System
- Detailed Discussion of Staff RAIs
- Identification of Open Actions

Overview

- How did we get here?
- Cooling System Design
- Water Saving Features
- Model Comparisons

Dominion

Stakeholder Issues with Once-Through Cooling

- Water Temperatures
  - Residents concerned with increase in WHTF temperature
  - Potential impact on striped bass
- Water Consumption
  - Lake level below 248 ft MSL
  - Reduced outflow from dam

Dominion

What is needed?

- Reduce thermal impact to the WHTF and Reservoir
- Reduce water consumption
- Problem: Methods for reducing temperature involve evaporating water for heat removal.

Dominion

What is needed?

- Solution: Incorporate water conservation into closed cycle cooling system.
  - Removes thermal impact to WHTF / Reservoir
  - Portion of dry cooling to reduce evaporation
  - Water-saving wet towers
  - Lower condenser flow increases dry tower efficiency.

Dominion

Cooling Water System Design

- Substantially addresses concerns expressed by agencies and the public
  - Unit 3 will use a closed cycle cooling system.
  - No additional cooling water flow to WHTF and no additional thermal impact to Lake Anna.
  - Water consumption for Unit 3 substantially reduced.
  - Significant reduction in Unit 3 impingement and entrainment.

Dominion

Cooling Water System Design

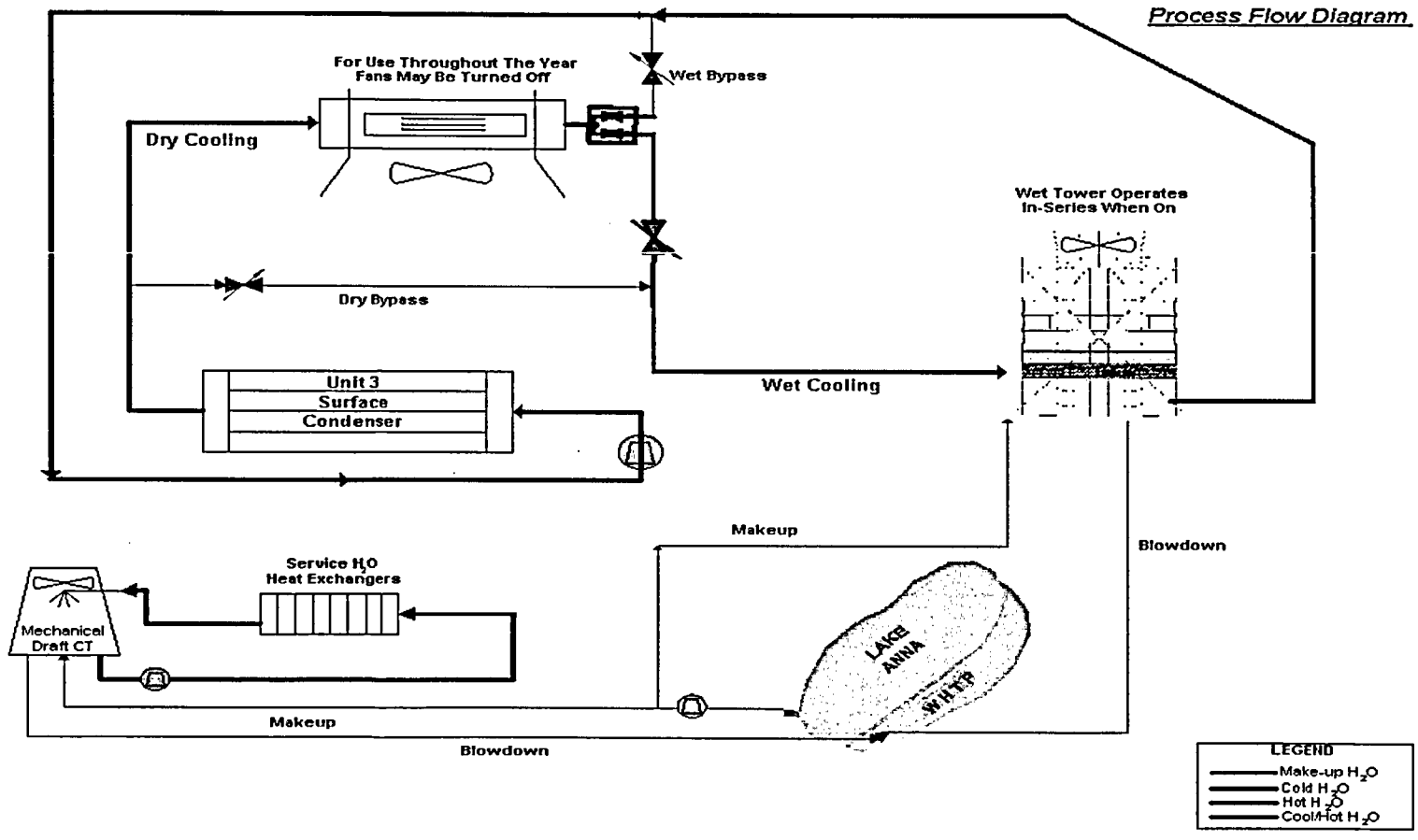
- Closed Cycle cooling system design
  - Unit 3 condenser water cooled initially in Dry Towers
    (forced air = no water loss).
  - Water then passed through Wet Towers
    (water spray = some evaporation with condensation return).

- Two operating modes
  - Energy Conservation (EC) – Dry cooling will be reduced with reliance on wet towers for heat removal.
  - Maximum Water Conservation (MWC) – 1/3 heat removal by Dry, 2/3 heat removal by Wet.

Dominion

Flow Path & Cycles

NORTH ANNA EARLY SITE PERMIT - HEAT SINK EVALUATION CLOSED LOOP SYSTEM DRY/WET (IN-SERIES) SYSTEM



Cooling Water System Design

- Operating Assumptions for Analysis
  - When Lake level is at or above 250 ft. MSL, the EC mode will be used.
  - If Lake level is below 250 ft. MSL and if the level is not restored within 7 days, the MWC mode will be used.

Dominion

Cooling Water System Design

- Design Criteria/Assumptions
  - Heat Duty: 2900 MWth (1E10 Btu/hr)
  - One-Third Dry Cooling Capacity / 100% Wet Cooling Capacity
  - Circulating Water Flowrate = 670,000 gpm
  - Return Temperature = 100 °F
  - Service Water evaporation is included in water budget analysis.

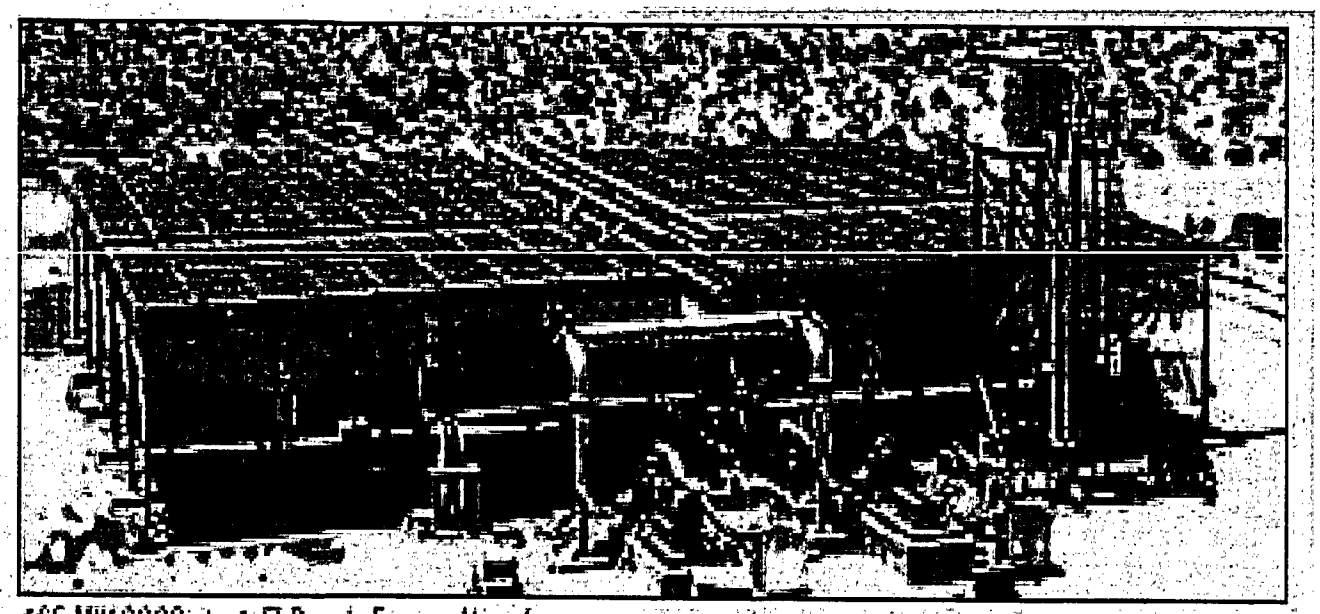
Dominion

Cooling Water System Design

- Wet Towers
  - 52 cells – 66 ft X 66 ft
  - Tower height of approximately 80 feet, maximizes land use
  - Will consider taller towers, height will be included in the PPE
- Dry Towers
  - 100 cells – 42 ft X 44 ft
  - Tower height bounded by wet towers

Dominion

Dry Cooling Towers

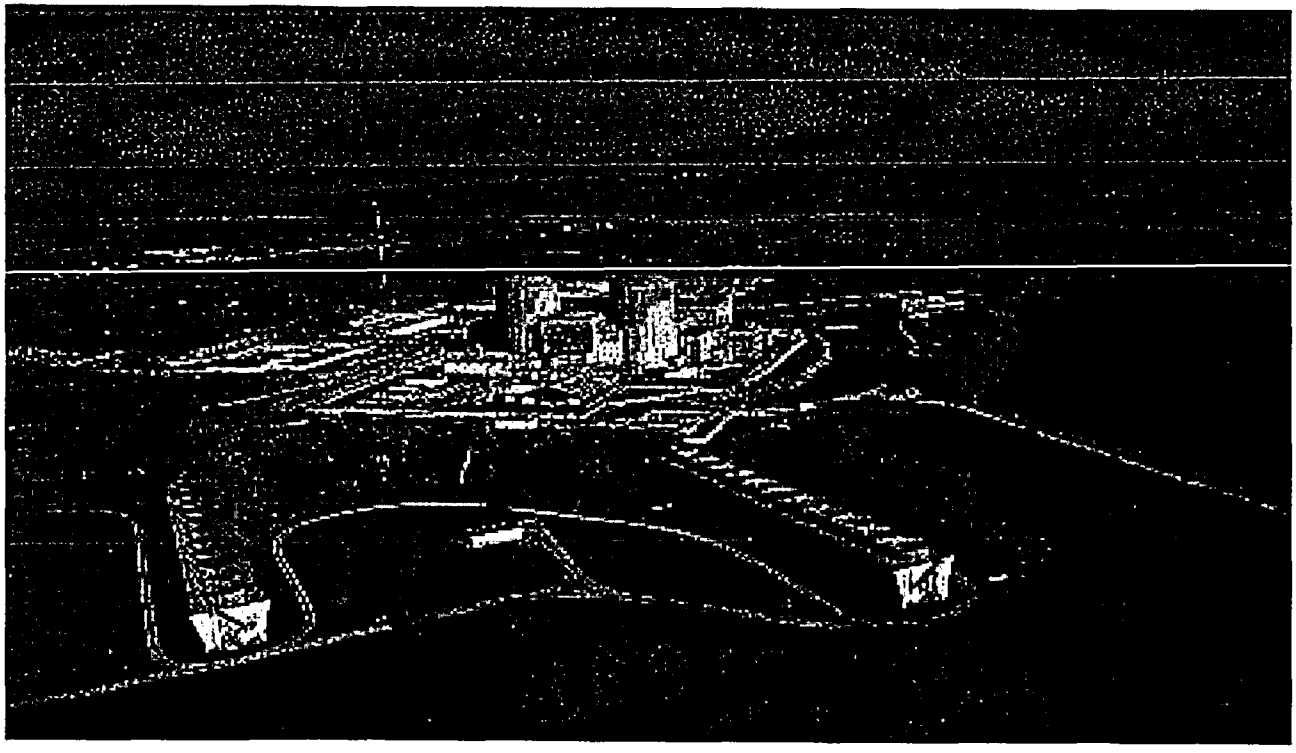


465 MW CCGP plant, El Dorado Energy, Nevada

SPX Cooling Technologies

Dominion

Wet Cooling Towers



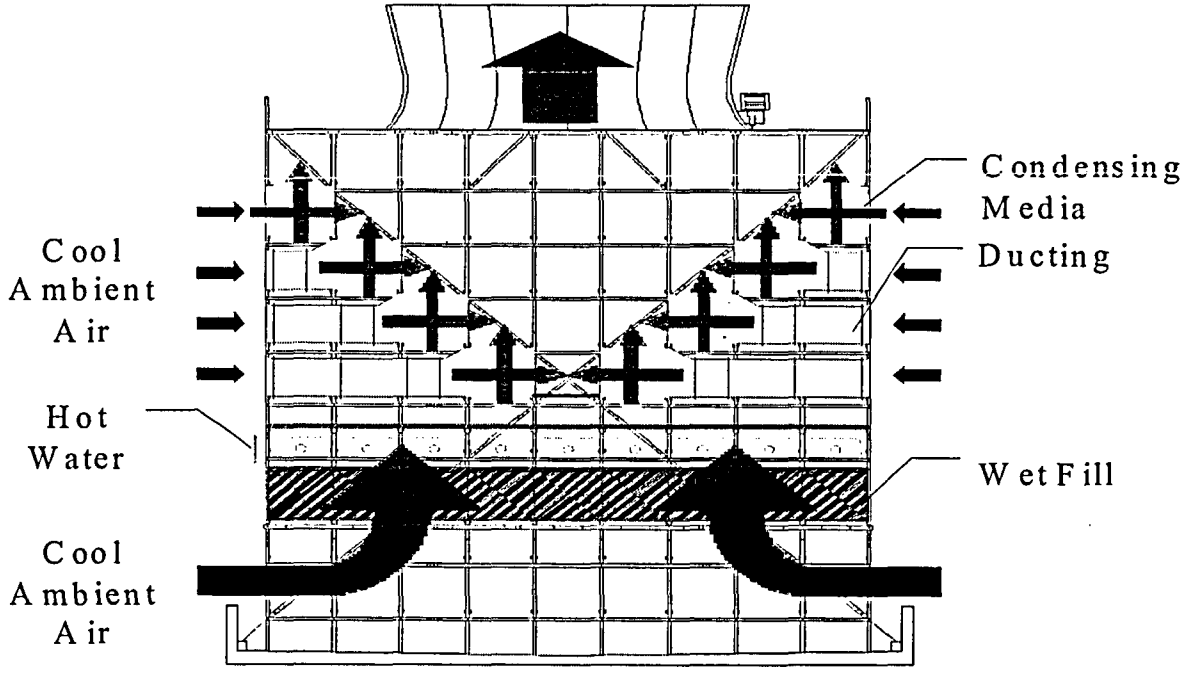
Prairie Island Nuclear Power Plant

Dominion

Wet Cooling Towers

Marley Cooling Technologies

Figure 1. Air to Air Cooling Tower



Dominion

Cooling Model Comparisons

- % Time Water Level is Below 248 ft, msl
  - Existing Open Cycle Once-Through 5.2
  - Proposed Open Cycle Once Through (ESP Rev. 5) 11.6
  - Closed Wet Towers Only* 11.2
  - Closed Cycle Wet/Dry (EC & MWC) 7.3
  - Closed Cycle Wet/Dry (MWC Only) 7.1

- Lowest Lake Level During 2002 Drought (change), ft
  - Existing Open Cycle Once-Through 245.1 (0)
  - Proposed Open Cycle Once Through (ESP Rev. 5) 242.6 (2.5)
  - Closed Wet Towers Only* 242.6 (2.5)
  - Closed Cycle Wet/Dry (EC & MWC) 244.2 (0.9)
  - Closed Cycle Wet/Dry (MWC Only) 244.2 (0.9)

*unverified

Dominion

Cooling Model Comparisons

Based on Historical Ambient Conditions…

- Average Water Consumption, cfs (approx. gpm)
  - Proposed Open Cycle Once Through (ESP Rev. 5) — 28 (12,600)
  - Closed Wet Towers Only* — 26.4 (11,850)
  - Closed Cycle Wet/Dry (EC & MWC) — 18.5 (8,300)
  - Closed Cycle Wet/Dry (MWC Only) — 7.1 (3,200)

Assumes 96% capacity factor.

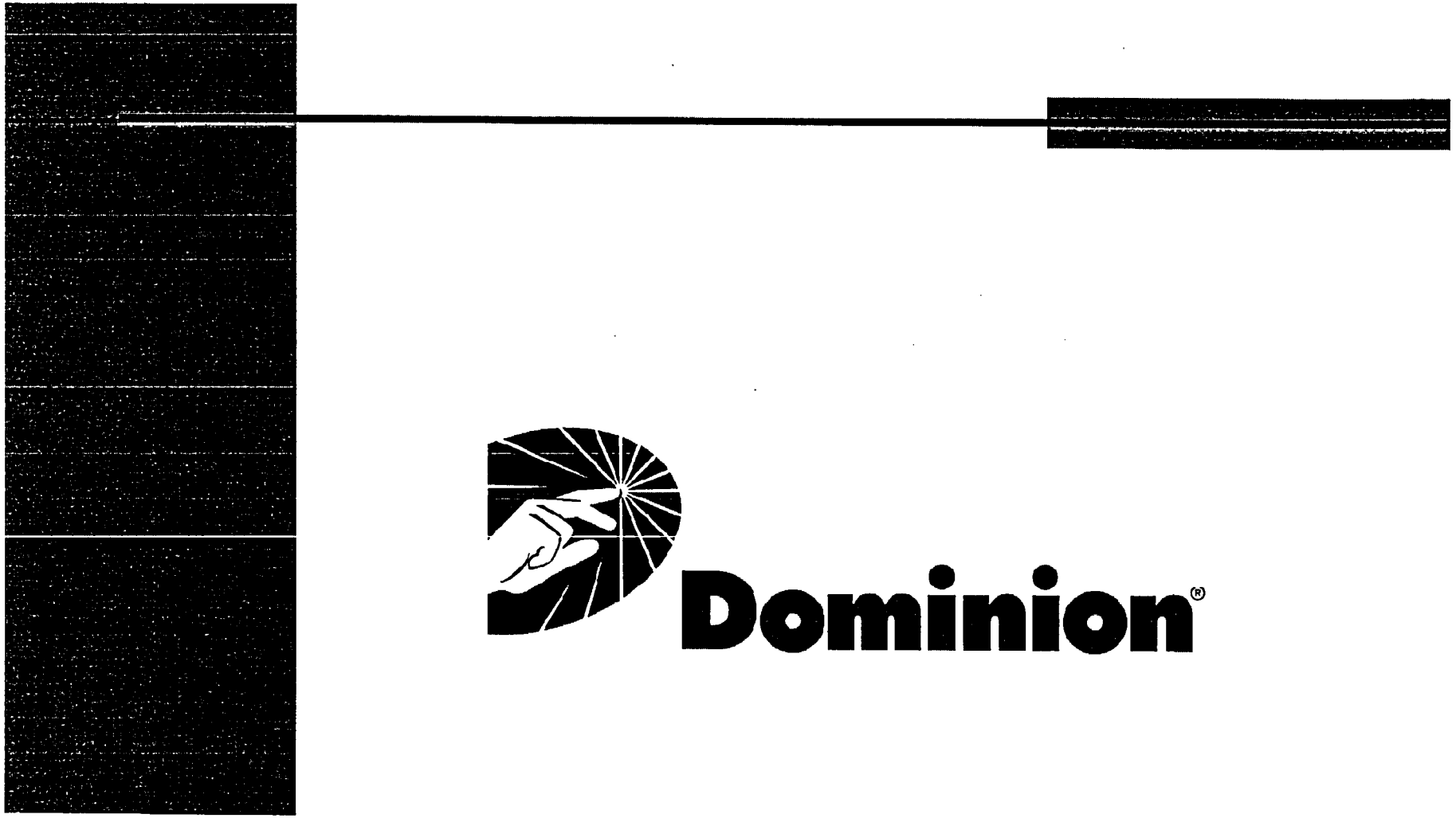
*unverified

Dominion

Summary

- Closed Cooling Design addresses stakeholder issues.
- Wet and Dry Cooling Tower System removes thermal impact from the lake and provides for significant water savings.

Dominion



1. Drift (NRC 3/2/06 Letter)

a. ER Table 3.1-9 — Include a plant parameter envelope (PPE) value related to cooling tower drift for the Unit 3 wet cooling tower.

- A drift rate, based on a percent of cooling water flow, will be added to ER Table 3.1-9 based on vendor data.

b. ER Table 3.3-1 — Include drift estimates for the cooling towers.

- ER Table 3.3-1 is the Water Use table.
- A drift estimate will be added to this table, based on the value described in Item a, above.

c. ER Sections 3.4.1.1, 3.6.1 — Drift needs to be discussed in these sections.

- For ER Section 3.4.1.1, the discussion will be revised to state that makeup water of "X" gpm is estimated to be required to compensate for "A" gpm of evaporation, "B" gpm of blowdown, and "C" gpm of drift loss.
- ER Section 3.6.1 discusses plant liquid effluents. The section already indicates that discharges would occur due to the cooling tower treatment. This should be adequate treatment for the cooling tower. The drift loss is not in the same category as liquid effluent.

d. ER Section 5.1.1 — Drift should be included in the bullet list.

- ER Section 5.1.1 is for Environmental Impacts of Station Operation – Land Use Impacts – The Site and Vicinity.
- Drift will be added to the list and a new section (ER Section 5.1.1.4) will be added to provide a reference to ER Section 5.3.3.2.1 for drift, fogging, icing, salt deposition, visible plumes.

e. ER Section 5.3.3.2.1 — Provide an evaluation of cooling tower drift and visible plumes.

- ER Section 5.3.3.2.1 will be revised to describe the drift, visible plume, fogging, icing, and salt deposition evaluations.
- Visible plume is also addressed in RAIs #5, 7c1, and 7c2.

2. ***Noise (NRC 3/2/06 Letter)***

ER Section 5.8.1.2

This section concluded that the noise associated with the new cooling design would not cause adverse offsite impacts and that a noise study would be described in a future COL application. Make reasonable assumptions about the design and analyze the environmental impact, if the final design of the cooling system and the associated noise level is not known at ESP stage.

a. ***ER Section 3.1.5 states that operation of the cooling fans would produce noise below 60–65 dbA at the exclusion area boundary (EAB). Table 3.1-9 lists this noise level for the Unit 4 dry towers, but does not provide values for the Unit 3 or the Ultimate Heat Sink (UHS) towers. If all of the towers are running (Unit 3 dry and wet, Unit 4 dry, and the UHS towers), would the total noise level still be below 65 dbA at the EAB?***

- Yes, the noise level would be below 65 dbA.
- A description of the analysis will be provided in ER Section 5.8.1.2.
- ER Table 3.1-9 will be revised to include noise levels for the Unit 3 towers.

b. ***Provide the calculations and assumptions used to estimate noise levels at the EAB and the closest residence. Include initial sound levels (background and cooling towers), the number of sources, distances, and attenuation factors considered in reaching a conclusion but not included in the calculations.***

- See RAI #2a.
- A description of the analysis including the items requested in the RAI will be provided in ER Section 5.8.1.2.
- The analysis will include Unit 3 (both modes of cooling tower operation) and Unit 4
- The analysis will include no attenuation except due to distance, no background noise, and no other sources. This is appropriate because of the towers proximity to the EAB.

3. ER Section 3.4.1.1 (NRC 3/2/06 Letter)

Explain the statement: "The wet towers would incorporate water savings features to reduce evaporative water losses." Describe the associated design features and how they affect the amount of water used by the cooling towers.

- Typical water saving features can include variable speed fans, dry cooling section, etc.
- The above sentence in ER Section 3.4.1.1 will be revised to read as follows:

  "The wet towers would incorporate water savings features (e.g., variable speed fans, dry cooling section) to reduce evaporative water losses."

4. Terrestrial Ecosystems (NRC 3/2/06 Letter)

ER Section 2.4.1.8, Wetlands

Are there any areas identified as Army Corp of Engineers (ACE) as jurisdictional wetlands under the Clean Water Act? If so, what protection or mitigation measures have been proposed or agreed to?

- Wetlands delineation for the potentially affected areas was obtained by Dominion last year.
- This information was presented to ACE, and additional information was requested.
- Dominion is currently in the progress of finalizing the survey information requested, expecting to present this to ACE by the end of April and request ACE confirmation.
- Following that, mitigation measures will be addressed as necessary.

5. ***Aesthetic (NRC 3/2/06 Letter)***

ER Section 5.8.1.5

Provide an evaluation of the aesthetic impacts of the moisture plumes from the cooling towers. Estimate by season (summer, fall, winter, spring) the approximate percentage of the time that the plume would be visible above the containment building and would extend more than 0.5 miles. Provide this information for two cases: 1) with the wet cooling towers operating 100% of the time in energy conservation (EC) mode and 2) with the wet cooling towers operating 100% of the time in maximum water conservation (MWC) mode.

- A SACTI analysis will be performed for the two modes of cooling tower operation and described in ER Section 5.3.3.2.1. A reference to that analysis will be included in ER Section 5.8.1.5.
- The SACTI computer program is typically used for this type of an analysis. SACTI provides visible plume information only an annual average basis (whereas fogging, icing, salt deposition are reported on a seasonal basis).
- See also RAIs #1e, 7c(1), 7c(2), ER Section 5.3.3.2.1.

6. Human Health (NRC 3/2/06 Letter)

ER Section 5.3.4.1

Recent correspondence with Virginia Department of Health (VDH, September 2005) addressed the health risks associated with exposure to Naegleria fowleri. Dominion stated in its supplement that it is working with State agencies to communicate the information related to risk that was provided in the VDH correspondence to residents around the waste heat treatment facility (WHTF).

a. Provide the details of the plan for communication regarding the risk from thermophilic organisms to the residents around the WHTF.

- With the changed cooling system, Unit 3 does not contribute to the risk of exposure to thermophilic organisms.
- Dominion, in concert with VDEQ and VDH, has prepared a notification for WHTF residents to communicate information related to existing risks.
- Dominion will coordinate with VDEQ to release the notification this spring; a copy will be provided to the NRC.

b. Provide an evaluation of the thermophilic micro-organisms in the basins below the wet cooling towers.

- The makeup water to the towers would be treated with a biocide (such as chlorine).
- With this treatment, there would be no growth of thermophilic organisms in cooling towers.
- This information will be described in ER Section 5.3.4.1.

c. In view of the fact that the WHTF, although regulated as a private pond with a point of compliance at Dike 3, is also used for water-based recreation (especially swimming), specifically include an analysis of any health impacts of swimming in the WHTF. Include in your analysis the impacts related to the cooling water blowdown from the wet cooling towers that will be regulated as an internal source in accordance with 40 CFR 423.10.

- With the changed cooling system, Unit 3 does not contribute to the risk of exposure to thermophilic organisms.
- Health risks to swimming in the WHTF were discussed in VDH's September 2005 letter to VDEQ. The VDH letter will be added as a reference to ER Section 5.3.4.1.
- Cooling Tower Blowdown
  - Risk information on recreational exposures to many metals and S/VOCs in the cooling tower blow down is available.
  - A screening-level human health risk assessment will be performed based on concentrations of blowdown chemicals at the end-of-pipe discharge and in the WHTF lagoons.
  - The concentrations will be compared to EPA and Virginia Ambient Water Quality Criteria. If the concentrations of the blowdown constituents are below the water quality criteria, the analysis is complete because the concentrations are below levels that

could cause impacts. If not, a human health risk assessment will be performed on the constituents of concern.
- ER Section 5.2.2.5 will be revised to include this information.
- See also RAI #10d

7. Meteorology (NRC 3/2/06 Letter)

a. SSAR Section 2.3.2 and ER Section 2.7.4.1

Describe how potential increases in atmospheric moisture resulting from the operation of a wet cooling tower for proposed Unit 3 would impact onsite humidity data and provide a quantitative analysis for the potential for increased fog formation.

- Site humidity data at 10m is available.
- The site humidity data (dry bulb temperature, wet bulb temperature) correlates well with Richmond NWS data. The basis for the correlation will be provided in response to this RAI.
- The Richmond data will be used for the evaluation. Richmond is a first-order NWS.
- SSAR Section 2.3.2.2 and ER Section 2.7.4.1 will be revised to describe to report the relative humidity and wet bulb ternperatures.
- SSAR Section 2.3.2.3 will be revised to describe the impact (see RAI 7b, below)

b. SSAR Section 2.3.2.3

Describe how potential increases in atmospheric temperature and moisture resulting from the operation of a closed-cycle dry and wet cooling tower system for proposed Unit 3 would impact plant design and operation.

- A qualitative evaluation of the impacts of potential increases in atmospheric temperature and moisture from the proposed Unit 3 cooling towers on design and operation will be added to SSAR Section 2.3.2.3.

c. ER Section 5.3.3.1

(1) What is the basis for the statement that "Salt deposition rates would be below the threshold value of 1 kg/ha/month beyond the site boundary at ground levels"?

- A description of the SACTI analysis will be included in ER Section 5.3.3.2.1.
- See also RAIs #1e, 5.

(2) The supplement states: "In a COL application, when a specific reactor design is selected, a more detailed evaluation would be made of the fogging and salt deposition, and specific design consideration would be given to mitigate the effects of these phenomena or to eliminate them from occurring." Provide the detailed evaluation of fogging and salt deposition, including any assumptions necessary to perform the analysis, so that the staff can reach its conclusion on the impacts of fogging and salt deposition. Include a discussion of mitigation if necessary.

- A description of the SACTI analysis will be included in ER Section 5.3.3.2.1.
- Because the fogging and salt deposition analysis will be included in the ESP Application, the above sentence will be deleted.
- See also RAIs #1e, 5.

(3) What are the "industry standard techniques for limiting fogging?"

(4) What is a "reasonable level" for fogging?

- This sentence will be deleted.
- A conservative SACTI analysis will be performed of expected fogging conditions and described in EER Section 5.3.3.2.1.

d. ER Section 5.3.3.2.1

The first sentence Section 5.3.3.2.1 states: "As concluded in Section 5.3.3.1, steam fog formation, drift and steam-fog-induced icing conditions resulting from operation of the WHTF are very localized and infrequent at the NAPS site." Provide the justification for the above statement.

- This statement is based on observed conditions for the existing units.
- Because cooling towers will be used, Unit 3 would not contribute to these effects.

8. Land Use (NRC 3/2/06 Letter)

a. SSAR Section 2.3.2.4 and ER Section 2.7.4.1.7

A sentence in the last paragraph of SSAR Section 2.3.2.4 and ER Section 2.7.4.1.7 states: "No large-scale cut and fill activities would be needed to accommodate the new units since a large portion of the area to be developed is already relatively level." Given the additional land area that the wet and dry towers for Unit 3 will use in comparison to a once through cooling system, confirm or revise the above statement.

b. ER Section 4.1

Given the change in cooling system for Unit 3, is the total land area to be used shown in Section 4.1.1.4 and Table 4.1-2 of the ESP environmental report still the same? Will the overall footprint of the cooling towers, including areas that will be cleared to support construction and laydown areas, etc., fit within the 55 acres previously identified as the cooling tower area. If not then, provide updated land use figures.

- The ESP Application identifies an area for the power block and an area for cooling towers.
- No changes to the power block or cooling tower areas are proposed.
- The wording in SSAR Section 2.3.2.4 and ER Section 2.7.4.1.7 will be clarified to describe that the planned power block area is relatively level and that undulating surfaces in the area of the planned cooling towers would be leveled to accommodate the towers.

c. ER Section 5.3.3.2.2

What is the expected atmospheric temperature rise at the vegetation level at the NAPS site boundary?

- Based on engineering judgment, we expect the temperature rise to be minimal.
- Cooling tower vendors have stated that they have not observed significant temperature increases at ground level.
- We have not been able to identify any technical publications addressing this.
- Not aware of NRC regulatory criteria.

9. Construction (NRC 3/2/06 Letter)

ER Table 3.1-1 and Table 3.1-9

Confirm that the number of construction personnel (combined maximum of 5000 for two units) is the same as originally stated, the number of operating personnel is still 720 for the two new units, and that the number of additional outage personnel is still 700-1000. If these numbers have changed, provide the new values, and make adjustments to the corresponding values in all of the sections of the ER that depend on these values.

- The original estimates were based on a sufficiently conservative set of assumptions for construction and operation of new units (e.g., simultaneous construction activity on Units 3 and 4, no credit for offsite modular construction).
- The incremental change in the size and complexity of the plant (now with cooling towers versus once-through cooling) will not cause a change in the estimates.

10. Hydrology/Water Use and Quality (NRC 3/2/06 Letter)

*a. **PPE Table 3.1-1 includes cooling water temperature rise. Explain why this value is relevant as a PPE value for a cooling tower design.***

- This parameter is not relevant to cooling tower design; it is only relevant to once through cooling.

*b. **In Site Characteristics and Design Parameters Table 3.1-9, a 96 percent plant capacity factor was used to define the average evaporation rate. Explain how the average was estimated. What would be the average at 100% load factor? Justify why a load factor of 96% (and 93% for existing units) would be appropriate during critical periods (e.g. dry summers, droughts).***

- The 8303 gpm value is based on long term average water consumption for the described operating plan and a 96% capacity factor.
- The average at a 100% load factor is 8650 gpm.
- Long term averages have been used to evaluate impacts.

*c. **Provide a copy of Dominion's response to the questions regarding water use and quality and aquatic impacts in the Commonwealth of Virginia's January 31, 2006, letter.***

- A response to the state will be submitted by March 31, 2006.
- A copy of the information submitted to VDEQ will be provided to the NRC.

*d. **Provide a water quality analysis in sufficient detail for the staff to establish the magnitude of potential water quality impacts and weigh the environmental effects of degradation, if any, in water quality as a result of the new cooling systems.***

- ER Section 2.2.3 will be revised to provide a water quality analysis to determine compliance with Virginia water quality standards and human health impacts.
- This analysis will incorporate requirements consistent with federal and state regulations.
- See also RAI #6c.

*e. **Dominion established 250 mean sea level (MSL) as the lake level setpoint for shifting between energy conservation and water conservation modes. Provide documentation of the basis for selecting this setpoint and the 7 day lag before the shift in modes is implemented. If any studies were conducted to assess the impact of increasing or decreasing this setpoint, provide a description of the studies.***

- The 250 ft MSL setpoint is the existing normal lake level.
- The ability to maintain 250 ft MSL while meeting required discharge requirements indicates an adequate water supply to support Energy Conservation (EC) mode evaporation rates. Inability to maintain 250 ft MSL indicates the need for water conservation and operating the towers in MWC mode.

- The basis for the 7 day lag is to provide a reasonable time period to allow for actions to be taken to restore level
  - Allows for short-term level variations
  - Intervening event (rainfall) would alleviate low water situation
  - Minimizes changes in equipment alignments
  - Provides planning/communication time for transmission entity
- Dominion has informed VDEQ of the operating strategy during informational meetings. Copies of final documentation will be provided to the NRC.

f. The volume of water in Lake Anna could be reduced due to evaporation from Unit 3's wet tower. This reduction in lake volume could result in less water volume in the lake to disperse the heat from Units 1 and 2 and therefore some increase in lake temperature. This indirect increase in lake temperature would cause some increased evaporation from the lake. Provide documentation demonstrating that this indirect increase in lake temperature and evaporation is insignificant or quantify the increase in temperature and evaporation.

- ER Section 5.2.2.1 will be revised to describe that the indirect increase in lake temperature and evaporation is insignificant.

g. Provide an electronic copy of the analysis spreadsheet used to estimate the lake level and downstream flow impacts.

- A copy of the analysis spreadsheet will be provided to the NRC.

h. Quantitatively define the relationship between meteorological conditions and the percent of heat load being dissipated via dry towers in the water conservation mode.

- ER Section 3.4.1.1 will be revised to define the design point: i.e., the dry tower will have the capacity to remove 33% of the design condenser heat duty at a design dry bulb temperature of 95F.
- A qualitative discussion on the dry tower's capacity to remove a greater heat duty as dry bulb temperatures decrease will be provided in ER Section 3.4.1.1.

i. SSAR Section 2.4.11.3 discusses consumption of additional water and outflow from the dam. Provide an analysis of the number of additional days of reduced downstream flow that might result from operation of Unit 3.

- The percent of time is provided in ER Table 5.2-3 of the ESP Supplement. This will not be converted to days.

j. Define when the cooling system would be placed into the MWC mode (an example of the time period, "e.g., 7 days," is not sufficient).

- See RAI #10e for the basis for the 7-day period.

k. ***Provide the maximum amount of water Unit 3 would consume when operating at the following lake levels: above 250 MSL, between 248 and 250 MSL, and below 248 MSL. Based on the above water use, evaluate the impact on lake level and downstream users.***

- ER Section 5.2.2 will be revised to identify the maximum water consumption for operation above and below 250 ft MSL for the EC and MWC operating modes. There is no change below 248 ft MSL.
- It is inappropriate to use instantaneous maximum values to predict long term changes in lake levels and downstream flows.

l. ***Provide further analysis on Unit 3 alternative 6 (dry cooling) in light of the proposed wet and dry hybrid cooling system. Include in your analysis the environmental impacts of the efficiency penalty of dry cooling (increased fuel consumption) versus the base case of combination wet and dry cooling towers.***

- The alternative analysis in ER Section 9.4.1 will be supplemented to address the items identified in the RAI.

m. ***With respect to SSAR Section 2.4, the ESP application supplement changed the normal plant cooling system for proposed Unit 3 from a once-through system to a wet and dry hybrid cooling tower system.***

(1) ***Provide a conceptual description of the hybrid cooling tower system, its interaction with safety-related components, and an assessment of the reliability of this system.***

- No interaction of the hybrid cooling system with any safety related systems.
- No system interconnections.
- Separation distance to the nearest safety-related component/structure is sufficient to preclude any physical interaction from a postulated collapse of a cooling tower structure.
- The cooling tower system is typical for steam power plants and will be designed for reliability consistent with the requirements of power generation.
- The hybrid cooling tower system does not rely on the emergency cooling system.

(2) ***Describe how the hybrid cooling towers function for the normal cooling system (NCS) for the plant, and whether or not the NCS draws water from the ultimate heat sink (UHS) underground reservoir. If so, show how the remaining volume of water in the UHS reservoir will be adequate for a 30 day cooling water supply for safety system cooling.***

- There is no reliance of the normal cooling system on the UHS.

(3) In order to show that there is no abrupt or frequent reliance on the UHS, provide an estimate of the frequency of reliance on the UHS due to various failure modes of the hybrid NCS.

- Typical failure modes affect incremental capacity of the normal cooling system and include such events as fan failures and tube leaks.
- The final system design will incorporate sufficient margin to ensure reliable production of power.

(4) Any increase of the required lake water surface elevation above 250 ft MSL would necessitate staff re-evaluation of the probable maximum flood elevation at the proposed ESP site. If the lake water surface elevation is increased above 250 ft MSL, identify the increase and provide an analysis of the probable maximum flood (PMF) for the new and increased lake level.

- No change in operating lake level above 250 ft MSL is being proposed.
- Increasing the lake level is not a reasonable alternative.
- VDEQ has requested additional analyses to assess a scenario that postulates raising the normal lake level and lowering the Contingency Plan level. The results of this evaluation do not indicate that changes to either of these values or the conceptual operating strategy are necessary. Copies of the VDEQ information will be provided to the NRC.

11. ER-Aquatic Impacts (NRC 3/2/06 Letter)

a. Section 5.2.2.2 states that the frequency of reduced flow from the dam would increase. Provide an analysis of the impact on fish and other aquatic communities in the North Anna River downstream of the dam. Specifically, address how the reduced water flow rates would affect environmental conditions at known striped bass spawning habitat areas during the striped bass spawning season.

- The impact on striped bass spawning due to the reduced dam release flow will be evaluated using results from the water budget model and historical stream flow data from gauging stations in the downstream river reach to Pamunkey River.
- ER Section 5.2.2.2 will be revised to include the impact on striped bass spawning for the closed-cycle combination wet dry cooling tower system.

b. Dominion's RAI response dated April 12, 2005, stated that Dominion planned to provide assistance to aid the Virginia Department of Game and Inland Fisheries (VDGIF) in development and stocking of a more thermally tolerate species, such as a sterile white bass/striped bass hybrid. Given the change to the cooling system, does Dominion still plan to provide this assistance?

- Dominion remains committed to work with the state to maintain a viable and healthy habitat.
- The elimination of any thermal impact eliminates the need to develop and stock a more thermally tolerant species.

12. ER-State Permits (NRC 3/2/06 Letter)

a. Please confirm that the concerns raised by State agencies have been resolved and that permits for consumptive water use can be obtained.

- Copies of Dominion's responses to Virginia agency concerns will be provided to the NRC.
- In a February 2006 conference call, VDEQ confirmed to the NRC that Dominion's cooling water approach addresses their concerns.
- Dominion believes that the state's concurrence with the CZMA consistency certification would provide assurance that consumptive water use permits can be obtained.

b. What is your schedule for obtaining the Coastal Zone Management Act consistency certification?

- In communications with VDEQ, Dominion has been told that a CZMA concurrence review would be scheduled for spring-to-summer 2006.
- A NOAA "stay of review" is expected to be removed by March 31, 2006, with Dominion's submittal of additional analyses to VDEQ.
- See also RAI #10c.

c. The Virginia Pollution Discharge Elimination System (VPDES) permits for the existing Units 1 and 2 are undergoing renewal. Because the operating limits in these permits factor into the analysis for proposed Unit 3, as necessary, update the analysis to account for any changes in the permit. Provide within 30 days of issuance of the renewed VPDES permits the updated analysis to the NRC or a justification for why the analysis is not affected.

- Based on a review of the draft VPDES renewed permit for existing Units 1 & 2, Dominion does not anticipate any change in the analysis for new Unit 3.
- A copy of the final permit will be provided to the NRC when it is issued.

d. Provide Clean Water Act (CWA) Section 401 certification or documentation from the Commonwealth of Virginia that Section 401 certification is not needed because Dominion will request a permit condition that will prohibit any activities that could result in discharges to navigable waters until a Section 401 certification is obtained or waived by the Commonwealth of Virginia.

- Dominion believes that with the proposed ESP permit condition additional documentation from the state is not needed.

13. SSAR and ER Section 7.1 (NRC 3/2/06 Letter)

Address the following source term related issues for the ESBWR design demonstrating the reactor accident source term PPE values specified in SSAR are still appropriate and that the radiological consequence doses at the proposed ESP site would meet the requirements of 10 CFR 50.34:

a. Provide ESBWR source terms for a power level at 4590 MWt (102% of requested power level to account for uncertainty). The source terms are expressed as the timing and release rate of fission products to the environment from the proposed ESP site.

- ESBWR source terms at 4590 MWt will be added for all accidents having radiological consequences, except LOCA, from Revision 1 of the ESBWR DCD.
- For the LOCA analysis, GE will be providing source terms that will be included in the ESP Application and a future revision of the ESBWR DCD.

b. Describe your analysis of selected design basis accidents based on the proposed version of the ESBWR design to demonstrate compliance of the proposed ESP site with the dose consequence evaluation factors specified in 10 CFR 50.34(a)(1).

- All DBAs shown as having radiological consequences in the ESBWR DCD will be added to the ESP Application, with doses adjusted to reflect site-specific atmospheric dispersion.

c. Provide ESBWR design-specific χ/Q values used in the ESBWR design and compare them with the site-specific χ/Q values at the proposed ESP site.

- The ESP Application will show the ESBWR DCD and site-specific χ/Q values, as well as the ratio of the two.

14. ER Section 7.2 Severe Accidents (NRC 3/2/06 Letter)

a. Include the results of a site-specific assessment of the consequences of severe accidents for air and surface water pathways based on the results of the MACCS2 computer code.

- GE is providing accident source term release fractions and their corresponding frequencies for the ESBWR.
- The site-specific assessment of the consequences will be calculated using the MACCS2 computer code.
- The population dose and economic cost out to a 50 mile radius from the site will be reported for all severe accident categories.
- This information will be included in ER Section 7.2.

b. Provide electronic copies of input and output files for the MACCS2 code for an ESBWR at 4500 MWt.

- The site specific MACCS2 input and output files using the source term inventory for a ESBWR design thermal power level of 4500 MWt will be provided separately.

c. For an ESBWR, provide and justify the accident release categories and the core damage frequency for each release category.

- ER Section 7.2 will be revised to include a description of the ESBWR accident release categories and their corresponding release frequencies as provided to Dominion by GE.
- Agreement on severe accident release categories and their justification will be documented in the ESBWR DCD.

15. ER-Fuel Transportation (NRC 3/2/06 Letter)

Provide an assessment of the impacts of the revised power levels on the numbers of shipments of unirradiated fuel, spent fuel, and radioactive waste and the radionuclide inventories of spent fuel assemblies.

- The impacts of the revised power level have been assessed and there is no increase in the number of shipments.
- ER Section 3.8.1 will be revised to describe this assessment.

16. (NRC 3/2/06 Letter)

Provide justification for the sections identified as unaffected by the change to the cooling system and the increase in power level. For example, why is ER Section 7.2, Severe Accidents, not affected by the increase in power from 4300 - 4500 MWt? Examples of the sections that appear to be affected, (which are not exhaustive) are given below.

a. ER Section 1.2

ER Section 1.2 and the associated table state that a Coastal Zone Management Act (CZMA) consistency determination is not applicable. Given that Dominion has submitted its project to the Commonwealth of Virginia for a consistency determination, justify or revise the first sentence of the first paragraph, the next to last sentence of the third paragraph, and the entry in Table 1.2-1 which lists the CZMA as N/A.

- ER Section 1.2 will be revised as requested.

b. ER Sections 2.7.4.1.4 and 2.7.4.1.6

Provide a detail discussion of onsite humidity data as a baseline input for evaluating fogging and increased humidity due to the addition of a wet cooling tower.

- Similar to RAI #7a.
- Site humidity data at 10m is available.
- The site humidity data (dry bulb temperature, wet bulb temperature) correlates well with Richmond NWS data. The basis for the correlation will be provided in response to this RAI.
- The Richmond data will be used for the evaluation. Richmond is a first-order NWS.
- This information will be included in ER Section 2.7.4.1.4.

c. ER Section 3.6.3.3

Include a discussion of any scale or other waste from the wet cooling tower and potential wastes from cleaning the dry towers.

- Using lake water quality data (ER Table 2.3-13), the circulating water quality will be projected considering the proposed cycles of concentration operation to determine the scaling potential of the wet tower and tube internals of the dry tower
- Chemical treatment would be used to prevent scaling as required
- Periodic cleaning of the dry cooling tower heat exchangers would be performed to remove any solids entrained in the air flow that are trapped as it passes through the radiator panels and the minor debris which would fall to the ground
  - The area under the dry tower would be designed to limit runoff to storm drains
  - A low volume, high velocity pump would be used to reduce runoff
- ER Section 3.6.3.3 will be revised to include this information

- ER Section 5.5.1.1 will be revised to address discharge constituents in the waste stream

d. ER Section 5.3.3.1

Because of the addition of a wet cooling tower, include a discussion of humidity on site at the level of the cooling tower exit.

- ER Section 5.3.3.1 will be revised to include a discussion of humidity onsite at the level of the cooling tower exit

e. ER Section 5.8.1.2

Provide an estimate of the maximum height of trees on the site that may help block the view of new facilities from offsite locations. The location of the cooling towers needs to be clearly identified in Figure 5.8-1.

- A qualitative description of the tree barrier around the ESP site will be provided in ER Section 5.8.1.5 (see ER Section 2.4.1 for discussion of tree varieties)
- As defined in ER Table 10.1-1, a 50-100 ft band of trees will be maintained along southern edge of the construction zone
- Further, the band of coniferous trees on the northern shore of the reservoir finger directly north of the defined construction area would be maintained
- The cooling towers would be located within the defined cooling tower area (ER Figure 5.8-1). Specific locations are not available.

f. ER Section 5.8.2.3

Discuss the potential impacts of operating Lake Anna above the 250 MSL level.

- See RAI #10m(4).

g. ***ER Section 6.4.1 and SSAR Section 2.3.3***

Section 6.4 of the Environmental Standard Review Plan (NUREG-1555) states that in order to provide an adequate meteorological database for evaluating the effects of plant operation, basic onsite meteorological instrumentation should include atmospheric moisture measurements at a height(s) representative of water-vapor release at sites at which large quantities of water vapor are emitted during plant operation. Likewise, SSAR Section 1.8.2 states that the SSAR conforms to Proposed Revision 1 to Regulatory Guide (RG) 1.23, "Onsite Meteorological Programs." Section C.2 of Proposed Revision 1 to RG 1.23 states "ambient moisture should be monitored at approximately 10 meters and also at a height where the measurements will represent the resultant atmospheric moisture content if cooling towers are to be used for heat dissipation." Provide the additional onsite humidity meteorological information at a height where the measurements will represent the resultant atmospheric moisture content if wet cooling towers are to be used for heat dissipation for Unit 3.

- Specific relative humidity data at the proposed level of the cooling tower exit is not available.
- Humidity measurement at the height of cooling tower exits is not typically performed.
- The conformance statement to RG 1.23 in SSAR Section 1.8.2 will be revised to identify an exception for humidity measurement.

h. ***ER Sections 7.1.1 and 7.2***

Revise these sections of the ER to make them consistent with responses to the questions 13 and 14 of this letter.

- ER Section 7.1.1 will be revised to include all ESBWR accidents which have radiological consequences.
- ER Section 7.2 will be revised to present the ESBWR severe accident information.

i. ***ER Section 7.1.2***

The increase in power level for the ESBWR should result in a revision to the calculated DBA doses. The time-dependent ratios of the LPZ site-to-design certification (site/DC) X/Q values presented in ER Table 7.1-1 are based on (1) four DC 50% X/Q values that are a function of time and (2) one site 50% X/Q value that is time-independent. The ER DBA LPZ dose calculations should be based on 50% LPZ X/Q values that vary throughout the course of each design basis accident in accordance with NRC guidance (e.g., Environmental Standard Review Plan 7.1 and Regulatory Guide 1.145) and the approach used in the SSAR Chapter 15 accident analyses. Therefore, (1) provide 50% LPZ X/Q values that vary as a function of time for AP1000, ABWR and ESBWR, (2) replace the LPZ site/DC X/Q ratios presented in Table 7.1-1 by LPZ site/DC X/Q ratios where both the DC and site LPZ X/Q values are a function of time, and (3) revise Table 7.1-2 accordingly.

- Changing the power level to 4500 MWt does not affect the methodology for calculating X/Q.
- Since accident X/Q values decrease with time, it is conservative to use the highest X/Q for the duration of each accident. The 0 – 2 hour 50% X/Q in the ER is already a small fraction of the conservative value used in the SSAR analysis.
- The use of the single value over the duration of the accident, while it is conservative, is not excessively conservative.
- Note that RG 1.145, Section C, states:

  "Selection of conservative, less detailed site parameters for the evaluation may be sufficient to establish compliance with regulatory guidelines."

j. ***ER Section 9.3***

Justify not reevaluating the North Anna site versus the alternative sites in the light of the changes to the cooling system. Discuss the differences that the cooling system change would have on the North Anna site rating.

- The rating of the site (compared to other alternative sites) will be re-evaluated.