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August 28, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
DOMINION NUCLEAR NORTH ANNA, LLC)	Docket No. 52-008-ESP
)	
(Early Site Permit for North Anna ESP Site))	

NRC STAFF ANSWER SUPPORTING DOMINION'S SECOND MOTION
FOR SUMMARY DISPOSITION OF CONTENTION EC 3.3.2

INTRODUCTION

Pursuant to 10 C.F.R. § 2.1205(b), the staff of the Nuclear Regulatory Commission ("Staff") hereby responds to "Dominion's Second Motion for Summary Disposition [of] Contention EC 3.3.2 - Impacts on Striped Bass in Lake Anna," ("Motion") filed by Dominion Nuclear North Anna, LLC ("Dominion" or "Applicant") on August 7, 2006. For the reasons set forth below and in the Joint Affidavit of Jeffrey A. Ward and Lance Vail, the Staff submits that there does not exist a genuine dispute of material fact concerning Contention EC 3.3.2 and that, based on these facts, the Applicant is entitled to a decision in its favor as a matter of law. Accordingly, the Applicant's Motion should be granted.

BACKGROUND

On September 25, 2003, Dominion filed an application pursuant to 10 C.F.R. Part 52 in which it requested an early site permit ("ESP") for the North Anna ESP site in Louisa County, Virginia. On May 3, 2006, a joint petition for leave to intervene was filed by the Blue Ridge Environmental Defense League ("BREDL"), the Nuclear Information and Resource Service ("NIRS") and Public Citizen (collectively, "Intervenors"), and several contentions were filed, including seven contentions concerning the Environmental Report ("ER") filed as part of the Application.

On August 6, 2004, the Atomic Safety and Licensing Board ("Licensing Board") ruled upon the admissibility of the Intervenor's proffered contentions. *Dominion Nuclear North Anna, LLC* (Early Site Permit for North Anna ESP Site), LBP-04-18, 60 NRC 253 (2004). The Licensing Board admitted two contentions, EC 3.3.2 and EC 3.3.4.¹ Contention EC 3.3.2, as admitted, was restated by the Board as follows:

The ER does not adequately address the adverse impact of operating one or two additional reactors on the striped bass in Lake Anna and the North Anna River. In particular, the ER does not adequately consider the impacts of the proposed reactors on the striped bass at Lake Anna and downstream arising from increased water temperature.

LBP-04-18, Appendix A, 60 NRC at 276.²

In November 2004, the Staff published the "Draft Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna Site," NUREG-1811 ("DEIS").³ In July 2006, in light of the Applicant's revised proposal to use a closed-cycle cooling system employing a combination wet and dry cooling system, the Staff published a supplement to the DEIS, updating its environmental analysis. See NUREG-1811, Supplement 1 ("SDEIS"). In the SDEIS, the Staff addressed the thermal impacts of one or two additional units on striped bass

¹ The Licensing Board dismissed Contention EC 3.3.4 following the Applicant's and Intervenor's "Joint Motion for Approval of Settlement and Dismissal of Contention EC 3.3.4," dated December 29, 2004. See *Dominion Nuclear North Anna, LLC* (Early Site Permit for North Anna ESP Site), Order (Approving Settlement and Dismissal of Contention EC 3.3.4), slip op. (Jan. 6, 2005).

² On June 16, 2005, the Board granted the Applicant summary disposition on EC 3.3.2 with respect to the impacts from the proposed fourth unit at the North Anna ESP site. See *Dominion Nuclear North Anna, LLC* (Early Site Permit for North Anna ESP Site), Order (Granting in Part and Denying in Part Summary Disposition on Contention EC 3.3.2 - Impacts on Striped Bass in Lake Anna), slip op. (June 16, 2005).

³ The DEIS was transmitted to the administrative judges and the parties to this proceeding on December 9, 2004. See Letter from R.M. Weisman, NRC Staff Counsel, to Administrative Judges, dated December 9, 2004. The SDEIS was transmitted to the administrative judges and the parties to this proceeding on July 14, 2006. See Letter from R.M. Weisman, NRC Staff Counsel, to Administrative Judges, dated July 14, 2006.

populations in Lake Anna, on other striped bass populations in the ESP site vicinity, and on the Lake Anna striped bass recreational fishery. See SDEIS Section 5.4.2.5.

On August 7, 2006, Dominion filed the instant Motion seeking summary disposition of Intervenor's Contention EC 3.3.2.

DISCUSSION

A. Legal Standards

A moving party is entitled to summary disposition of a contention as a matter of law if the filings in the proceeding, together with the statements of the parties and the affidavits, demonstrate that there is no genuine issue as to any material fact. See 10 C.F.R. §§ 2.1205 and 2.710(d)(2); see also *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 384 (2001); *Advanced Medical Systems, Inc.* (One Factory Row, Geneva, Ohio), CLI-93-22, 38 NRC 98, 102-03 (1993).

The Commission's summary disposition procedures have been analogized to Rule 56 of the Federal Rules of Civil Procedure.⁴ See *Advanced Medical Systems*, CLI-93-22, 38 NRC at 102; *Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-05-04, 61 NRC 71, 79 (2005). As such, the party seeking summary disposition bears the burden of demonstrating the lack of a genuine issue of material fact and the evidence submitted must be construed in favor of the non-moving party. See *Sequoyah Fuels Corp. & General Atomics Corp.* (Gore, Oklahoma Site Decontamination and Decommissioning Funding), LBP-94-17, 39 NRC 359, 361, *aff'd*, CLI-94-11, 40 NRC 55 (1994).

For a finding that there is a genuine issue of material fact, "the factual record, considered in its entirety, must be enough in doubt so that there is a reason to hold a hearing to

⁴ In pertinent part, this rule states, "The judgment sought shall be rendered forthwith if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." FED. R. CIV. P. 56(c).

resolve the issue.” *Cleveland Elec. Illuminating Co.* (Perry Nuclear Power Plant, Units 1 & 2), LBP-83-46, 18 NRC 218, 223 (1983). As such, to avoid summary disposition of Contention EC 3.3.2, any affidavit filed by the Intervenors in opposition to the Dominion Motion must establish that a genuine issue of material fact remains in dispute regarding Contention EC 3.3.2. *See Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 & 4), ALAB-950, 33 NRC 492, 496-99 (1991) (affirming licensing board’s grant of motion for summary disposition despite difference of opinion between intervenor’s expert supporting motion and the licensee).⁵ In this vein, it should be noted that, in discussing changes made in 1989 to the contention requirements of 10 C.F.R. § 2.714 (now § 2.309) and the summary disposition criteria of 10 C.F.R. § 2.749 (now § 2.710),⁶ the Commission described as follows the higher level of evidentiary support needed to withstand summary disposition motions, compared to the standard for admitting contentions:

The Commission expects that at the contention filing stage the factual support necessary to show that a genuine dispute exists need not be in affidavit or formal evidentiary form and need not be of the quality necessary to withstand a summary disposition motion. At the summary disposition stage the parties will likely have completed discovery and essentially will have developed the evidentiary support for their positions on a contention. Accordingly, there is much less likelihood that substantial new information will be developed by the parties before the hearing. Therefore, the quality of the evidentiary support provided in

⁵ *See also Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-03-21, 58 NRC 338, 342-43 (2003), quoting *Perry*, LBP-83-46, 18 NRC at 223 (“It is not enough that the nonmoving party merely allege an ‘issue of fact’; rather, the issue of fact must be ‘genuine.’ In order to be ‘genuine’, the factual record, in its entirety, must ‘be enough in doubt so that there is reason to hold a hearing to resolve the issue.’”)

⁶ Although the Commission recently revised its Rules of Practice in 10 C.F.R. Part 2, the standards for judging motions for summary disposition were not substantively changed. *See* Final Rule, Changes to Adjudicatory Process, 69 Fed. Reg. 2182, 2218, Table 1, “Cross-References Between New Subparts C and G and Old Provisions of Subpart G” (Jan. 14, 2004) (noting that the modifications to “old” Section 2.749 consist of “new requirements on timing of summary disposition motions, responses, and presiding officer consideration of the motions.” *See also* 69 Fed. Reg. at 2227 col. 1 (“Section 2.710 generally retains the former provisions of Section 2.749 regarding summary disposition.”))

affidavits at the summary disposition stage is expected to be of a higher level than at the contention filing stage.⁷

Moreover, the Commission has stated that bare assertions or general denials are not sufficient to bar summary disposition. *See Advanced Medical Systems*, CLI-93-22, 38 NRC at 102. *See also Houston Lighting & Power Co.* (Allens Creek Nuclear Generating Station, Unit 1), ALAB-629, 13 NRC 75, 78 (1981); *Virginia Elec. Power Co.* (North Anna Power Station, Units 1 & 2), ALAB-584, 11 NRC 451, 455 (1980).

Finally, where there is disagreement among competing experts over material facts, it is not appropriate in ruling on a summary disposition motion to "untangle the expert affidavits and decide which experts are more correct."⁸ The trier of fact should be left to weigh competing expert opinions at hearing, so long as such opinions are shown to be relevant to material facts.⁹ However, conflicting expert testimony will not necessarily preclude summary disposition. The trier of fact must focus on whether opinions supporting or opposing summary disposition are sufficiently grounded in a factual basis.¹⁰ Thus, a party cannot avoid summary disposition simply by presenting the unsupported opinion of an expert.¹¹ Expert opinion may defeat summary disposition only if it appears that the affiant is competent to give an expert opinion and

⁷ Final Rule, Rules of Practice for Domestic Licensing Proceedings - Procedural Changes in the Hearing Process, 54 Fed. Reg. 33,168, 33,171 col. 3 (August 11, 1989), *aff'd sub nom. Union of Concerned Scientists v. NRC*, 920 F.2d 50 (D.C. Cir. 1990).

⁸ *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-01-39, 54 NRC 497, 510 (2001), *citing Norfolk Southern Corp. v. Oberly*, 632 F. Supp. 1225, 1243 (D.Del. 1986), *aff'd on other grounds*, 822 F.2d 388 (3d Cir. 1987).

⁹ *PFS*, LBP-01-39, 54 NRC at 510, *citing Kannankeril v. Terminix Int'l*, 128 F.3d 802, 807 (3d Cir. 1997).

¹⁰ *Kannankeril*, 128 F.3d at 807.

¹¹ *Rohrbough v. Wyeth Laboratories, Inc.*, 719 F. Supp. 470 (N.D. W.Va. 1989), *aff'd on other grounds*, 916 F.2d 970 (4th Cir. 1990); *State Farm Fire & Cas. Co. v. Miles*, 730 F. Supp. 1462 (S.D. Ind. 1990), *aff'd*, 930 F.2d 25 (7th Cir. 1991).

the factual basis for the opinion is adequately stated in the affidavit. *See Garside v. Osco Drug, Inc.*, 895 F.2d 46, 50 (1st Cir. 1990).

As more fully set forth below, the Staff submits that summary disposition of Contention EC 3.3.2 is appropriate in accordance with these standards.

B. Applicant's Motion for Summary Disposition of Contention EC 3.3.2

1. Staff Analysis of the Basis for the Contention

On April 13, 2006, Dominion provided Revision 6 to its ER, which proposed to 1) change the cooling system for Unit 3 from a once-through system to a closed-cycle wet and dry system, and 2) increase the maximum power output per unit from 4300 to 4500 megawatts-thermal. This proposal formed the basis for the SDEIS, which was issued for public comment by the NRC in July 2006. 71 Fed. Reg. 39372 (July 12, 2006). The cooling system and maximum power output described in Revision 6 remain the same in Revision 8, and Revision 8 will be cited hereinafter.

The Staff has determined that potential thermal impacts to the striped bass population in Lake Anna and in the North Anna River downstream of the North Anna Dam could occur under two hypothetical, bounding scenarios, namely: 1) if the discharge of heated blowdown water from the Unit 3 wet and dry cooling system results in elevated water temperatures in the WHTF, Lake Anna, and in the North Anna River downstream of the Dam and 2) if the evaporative loss of water from the Unit 3 wet and dry cooling system results in a lower lake level and a subsequent increase in overall lake temperature. Joint Affidavit of Jeffrey A. Ward and Lance W. Vail ("Ward/Vail Aff."), ¶ 16 (attached as Staff Exhibit 1). The latter scenario assumes that if the volume of Lake Anna decreases due to the operation of Unit 3, there is less water available to dissipate the heat rejected from Units 1, 2, and 3, and this would result in an overall increase in lake temperature, especially during the summer months. *Id.*

With respect to the first scenario, based on the current operational design described in Revision 8 and the plant parameter envelope ("PPE") described therein, the Staff concluded that the release of blowdown water from Unit 3 would not result in a measurable increase in lake temperature beyond the increase currently occurring due to the operation of Units 1 and 2. Ward/Vail Aff., ¶ 17. The closed-cycle wet and dry system proposed for Unit 3 would release a maximum of 12.4 cfs to the WHTF at a temperature not to exceed 100°F. *Id.*; SDEIS at 5-28. This flow represents only a 0.3 percent increase to the overall flow into the WHTF already occurring from the operation of Units 1 and 2, and the proposed discharge temperature is within the range currently observed in the discharge canal in July and August of 98.6°F to 102.4°F (37 - 39.1°C) due to the operation of Units 1 and 2. Ward/Vail Aff., ¶ 17; SDEIS at 5-29. During some times of the year, blowdown water temperature from Unit 3 could exceed existing discharge temperatures from Units 1 and 2; at other times of the year, the blowdown water temperature could be lower than existing discharge temperatures. Ward/Vail Aff., ¶ 17. However, because the expected maximum flow of blowdown water from Unit 3 represents only a 0.3 percent increase above that observed for Units 1 and 2, and Unit 3 would be a minor contributor to the overall flow. *Id.* In any event, Unit 3 blowdown flow would be small compared to the volume of water in the WHTF. *Id.* Therefore, proposed Unit 3 would have an insignificant effect on the water temperature within the WHTF, Lake Anna, and the North Anna River. *Id.*

With respect to the second scenario discussed above, in Revision 8, Dominion evaluated the potential increases in lake temperature due to the loss of lake water associated with the operation of the wet and dry cooling system proposed for Unit 3. Ward/Vail Aff., ¶ 18. Under the assumption that the heat rejection rate for Units 1 and 2 would remain constant, Dominion concluded that the reduction in the Lake Anna water level caused by operation of Unit 3 would result in an average increase in Lake Anna water temperature of 0.1°F. *Id.* The

Staff's independent analysis concluded that this assessment was reasonable, and that it represented an insignificant increase in lake temperature. *Id.*; see SDEIS at 5-11 to 5-12. This assessment was also corroborated in the affidavit of Patrick Ryan, who concluded that the increase in the temperature of Lake Anna would be "on the order of 0.3°F or less, for about 3 weeks out of 24 years during periods of prolonged drought." Affidavit of Dr. Patrick J. Ryan, attached to the Applicant's Motion ("Ryan Aff.") ¶ 13. All three analyses concluded that the increase in water temperature resulting from the operation of proposed Unit 3, even during periods of prolonged drought, would not be significant. Ward/Vail Aff., ¶ 18. The Staff, therefore, concluded that the thermal impacts to striped bass from operating the proposed Unit 3 at the North Anna ESP site would be small. *Id.* ¶ 19; see SDEIS at 5-29 to 5-30.

2. Staff Analysis of Dominion's Statement of Material Facts

In its Motion, Dominion has appended a "Statement of Material Facts On Which No Genuine Dispute Exists" ("Fact Statement"), in which Dominion identifies eight material facts it claims are not in dispute. Dominion concludes that, based on these facts, there is no genuine factual dispute remaining that would preclude summary disposition of Contention EC 3.3.2. For the reasons described above, the Staff generally agrees with the material facts identified by Dominion, and the Staff agrees with Dominion's conclusions that thermal impacts to striped bass from the operation of a possible Unit 3 at the North Anna ESP site would be small. The Staff provides its assessment of the specific Material Facts submitted by Dominion as follows:

Material Fact 1: "Dominion proposes to use a closed cycle cooling system for Unit 3, employing a combination of dry and wet cooling towers. Environmental Report (Rev. 8, July 2006) ("ER") at 3-3-57 and Figure 3-4.11; Ryan Aff. at 6." Fact Statement at 1.

The Staff agrees with Dominion's statement of Material Fact 1. Ward/Vail Aff., ¶ 5.

Material Fact 2: The maximum blowdown from the cooling towers would be no greater than 12.4 cubic feet per second (cfs), which would mix in the discharge canal with 4246 cfs of circulating water from Units 1 and 2. ER at 3-3-64; Ryan Aff. at 7." Fact Statement at 1.

The Staff generally agrees with Dominion's statement of Material Fact 2.

Ward/Vail Aff., ¶ 8. However, the Staff also notes that, during times of Units 1 and 2 outage, the net discharge in the canal would be greatly reduced. *Id.*

Material Fact 3: "The blowdown would cause a water temperature increase at the end of the discharge canal of less than a tenth of a degree F in the cooler months. ER at 3-5-59; Ryan Aff. At 9. In the warmer months, the blowdown would cause a temperature increase of less than a hundredth of a degree F at the end of the discharge canal. ER at 3-5-58; Ryan Aff. at 8." Fact Statement at 1.

The Staff agrees with Dominion's statement of Material Fact 3 with respect to times when Units 1 and 2 are operating. Ward/Vail Aff., ¶ 17. The staff also notes that even during periods when Units 1 and 2 are not operating, the blowdown flow from proposed Unit 3 would still have an insignificant effect on water temperature in the WHTF, Lake Anna, and the North Anna River. *Id.*

Material Fact 4: "The small temperature increase in the discharge canal would dissipate to an undetectable level within a short distance of travel in the Waste Heat Treatment Facility ("WHTF"). ER at 3-5-59. Therefore, blowdown from Unit 3 would have no effect on temperature in Lake Anna. ER at 3-5-63; Ryan Aff. at 10." Fact Statement at 1-2.

The Staff agrees with the conclusion presented in Dominion's Material Fact 4, although the Staff notes that Units 1 and 2 may not be operating at all times that Unit 3 is operating. Ward/Vail Aff., ¶¶ 8, 17-18. Nevertheless, considering the relatively large volume of the WHTF compared to the small blowdown discharge of Unit 3, the Staff agrees that impacts of Unit 3 operation on Lake Anna are expected to be insignificant. *Id.* ¶¶ 17-18.

Material Fact 5: "For this reason, the blowdown from Unit 3 would have no thermal impact on aquatic communities, including striped bass, in Lake Anna. ER at 3-5-63." Fact Statement at 2.

The Staff agrees with Dominion's statement of Material Fact 5. Ward/Vail Aff., ¶ 19.

Material Fact 6: "For purposes of determining whether reduction in Lake level would have any impact on evaporative loss, Dominion also calculated whether any decrease in Lake level, and therefore surface area, resulting from Unit 3

water consumption would increase Lake temperature. On average, the temperature increase attributable to the decrease in Lake level due to the addition of Unit 3 would be less than 0.1°F. ER at 3-5-15; Ryan Aff. at 13. The NRC has determined that this temperature effect is insignificant. Supplement 1 of its Draft Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site, NUREG-1811, Supp. 1 (July 2006) ("SDEIS") at 5-12." Fact Statement at 2.

The Staff agrees with Dominion's statement of Material Fact 6. Ward/Vail Aff., ¶¶ 17-18.

Material Fact 7: "The increase in Lake temperature attributable to the maximum decrease in Lake level due to the addition of Unit 3 would be of the order of 0.3°F or less, with an occurrence of about 3 weeks out of 24 years during periods of prolonged drought. Ryan Aff. at 13." Fact Statement at 2.

The Staff agrees with Dominion's statement of Material Fact 7. Ward/Vail Aff., ¶¶ 17-18.

Material Fact 8: "The NRC has assessed the thermal impacts of Unit 3 in the SDEIS. Because Unit 3 would not significantly contribute to the current thermal impacts to Lake Anna, the NRC Staff concludes that the thermal impacts to striped bass in the Lake and North Anna/Pamunkey Rivers from the operation of the Unit 3 closed-cycle, combination wet and dry cooling system and the Unit 4 dry cooling system would be small. SDEIS at 5-29 and 5-30." Fact Statement at 2.

The Staff agrees with Dominion's statement of Material Fact 8. Ward/Vail Aff., ¶¶ 17-19; SDEIS at 5-28 to 5-32.

3. Staff Conclusion as to Summary Disposition of Contention EC 3.3.2

Based on its independent analyses, the Staff has determined that the wet and dry cooling system for Unit 3, as described in Revision 8, would not result in additional thermal impacts to striped bass in Lake Anna, or to adult or juvenile striped bass in the North Anna River below the North Anna Dam. Ward/Vail Aff., ¶ 19. The original contention was based on a once-through cooling system for Unit 3 that is no longer being considered, and, as discussed in the SDEIS, the expected thermal impacts to Lake Anna and the North Anna River from the operation of the Unit 3 wet and dry cooling system would be insignificant. *Id.* Consequently, with respect to the basis for contention EC 3.3.2, Staff agrees with the Applicant's conclusion that the thermal impacts to striped bass from operating the proposed Unit 3 at the North Anna

ESP site would be small. *Id.* Therefore, there remains no genuine issue of material fact, and the NRC Staff has adequately addressed the impacts of proposed Unit 3 on striped bass in Lake Anna and the North Anna River downstream of the North Anna Dam. Accordingly, the Board should grant the Applicant summary disposition with respect to EC 3.3.2.

CONCLUSION

For the reasons set forth above, the Staff submits that the Applicant's motion for summary disposition of Contention EC 3.3.2 should be granted as a matter of law.

Respectfully submitted, . . .

Robert M. Weisman

Robert M. Weisman
Patrick A. Moulding
Counsel for the NRC Staff

Dated at Rockville, Maryland
this 28th day of August, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
DOMINION NUCLEAR NORTH ANNA, LLC)	Docket No. 52-008-ESP
)	
(Early Site Permit for North Anna ESP Site))	ASLBP No. 04-822-02-ESP

JOINT AFFIDAVIT OF JEFFREY A. WARD AND LANCE W. VAIL

Jeffrey A. Ward (JAW) and Lance W. Vail (LWV) do hereby state as follows:¹

1a. (JAW) I am employed as a senior research scientist with the Ecotoxicology and Biotechnology Technical Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this Affidavit under a technical assistance contract with the staff of the U.S. Nuclear Regulatory Commission ("NRC"). I am the lead technical reviewer on the aquatic biology issues associated with the application submitted on September 25, 2003, by Dominion Nuclear North Anna, LLC ("Dominion" or "Applicant") for an early site permit ("ESP") for a site within the existing boundaries of the North Anna Power Station ("NAPS") in Louisa County, Virginia. A statement of my professional qualifications is attached.

1b. (LWV) I am employed as a senior research engineer with the Hydrology Group at the Battelle Pacific Northwest Division, Pacific Northwest National Laboratory. I am providing this Affidavit under a technical assistance contract with the NRC Staff ("Staff"). I am the lead technical reviewer on the hydrology issues associated with the application submitted by Dominion for an ESP for a site within the existing boundaries of the NAPS in Louisa County, Virginia. A statement of my professional qualifications is attached.

¹ In this Affidavit, the sponsor of each numbered paragraph is identified by his initials; no such designation is provided for paragraphs that are sponsored by both Affiants.

2. This Affidavit is in response to "Dominion's Second Motion for Summary Disposition [of] Contention EC 3.3.2—Impacts on Striped Bass in Lake Anna" dated August 7, 2006 ("Dominion 2006 Motion"), and the "Statement of Material Facts on Which No Genuine Dispute Exists" attached thereto.

3a. (JAW) As part of my official responsibilities as the lead technical reviewer on the aquatic biology issues associated with the application, I evaluated impingement, entrainment, and the physical, chemical, and thermal effects on aquatic biota associated with the operation of Units 3 and 4 as described in Revision 8 to the Application ("Revision 8"), submitted to NRC on July 31, 2006. My assessment of the impacts to aquatic biology expected to result from the operation of NAPS Units 3 and 4 is presented in NUREG-1811, "Draft Environmental Impact Statement [(DEIS)] for an Early Site Permit (ESP) at the North Anna ESP Site," Supplement 1, July 2006 (SDEIS).

3b. (LWV) As part of my official responsibilities as the lead technical reviewer on the hydrology issues associated with the application, I evaluated physical and thermal effects on the Lake Anna reservoir and the North Anna River below the North Anna Dam associated with the operation of NAPS Units 3 and 4 as described in Revision 8, submitted to NRC on July 31, 2006. My assessment of the impacts to hydrology expected to result from the operation of NAPS Units 3 and 4 is presented in the SDEIS.

4. Contention EC 3.3.2, submitted in this proceeding by the Blue Ridge Environmental Defense League ("BREDL"), Nuclear Information and Resource Service ("NIRS"), and Public Citizen (collectively, "Intervenors"), as clarified and restated by the Atomic Safety and Licensing Board in its Memorandum and Order of August 6, 2004,² alleges that:

² *Dominion Nuclear North Anna, LLC* (Early Site Permit for North Anna ESP Site), 60 NRC 253 (2004).

The [Environmental Report (ER)] does not adequately address the adverse impact of operating one or two additional reactors on the striped bass in Lake Anna and the North Anna River. In particular, the ER does not adequately consider the impacts of the proposed reactors on the striped bass at Lake Anna and downstream arising from increased water temperature.³

We are familiar with the contention and the bases submitted in its support presented in the Intervenor's filing dated May 3, 2004, and as discussed in the Board's unpublished "Memorandum and Order (Granting in Part and Denying in Part Summary Disposition on Contention EC 3.3.2 – Impacts on Striped Bass in Lake Anna)" dated June 16, 2005.⁴ It is our understanding that the basis for the contention concerns potential thermal impacts to striped bass (*Morone saxatilis*) in Lake Anna and in locations downstream of the North Anna Dam in the North Anna River resulting from the operation of the proposed Unit 3 using a once-through cooling system.

5. On April 13, 2006, Dominion provided Revision 6 to its application (including its ER), which proposed changing the cooling system for Unit 3 from a once-through system to a combination wet and dry system. Dominion provided subsequent revisions (7 and 8) to the NRC after publication of NUREG-1811 that incorporated the analysis from earlier revisions (including Revision 6) but did not provide additional information on cooling system impacts or any change in proposed power levels of Units 3 and 4. Based on the information provided in Revision 8 and on our independent analysis, we have concluded that the operation of the combination wet and dry cooling system for Unit 3 would eliminate the thermal impacts to striped bass in Lake Anna and downstream of the North Anna Dam. SDEIS at 5-29, 5-30.

³ North Anna, 60 NRC at 276.

⁴ Since the Board's June 16, 2005 Memorandum and Order granted summary disposition on Contention EC 3.3.2 with respect to Unit 4, we do not discuss impacts of Unit 4 further in this Affidavit. See Memorandum and Order at 10-11.

Thus, we concur with conclusions provided in the Dominion 2006 Motion and the affidavit of Dr. Patrick J. Ryan dated July 28, 2006.

6. This Affidavit reflects our previous familiarity or recent review of the following documents:

- (a) "Dominion Nuclear North Anna, LLC North Anna Early Site Permit Application Response to NRC Questions and Revision 8 to the North Anna ESP Application," dated July 31, 2006 ("Revision 8").
- (b) "Draft Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site," Draft Report for Comment. NUREG-1811, Supplement 1, July 2006 ("SDEIS").
- (c) "Dominion's Motion for Summary Disposition Contention EC 3.3.2 - Impacts on Striped Bass in Lake Anna," dated April 22, 2005 ("Dominion 2005 Motion").
- (d) "Patrick J. Ryan Affidavit in Support of Dominion's Motion for Summary Disposition of Contention EC 3.3.2," dated March 21, 2005 ("Ryan 2005 Affidavit").
- (e) "Affidavit of John William Bolin, III in Support of Dominion's Motion for Summary Disposition of Contention EC 3.3.2," dated April 21, 2005 ("Bolin 2005 Affidavit").
- (f) "NRC Staff Answer Supporting Dominion's Motion for Summary Disposition of Contention EC 3.3.2," dated May 11, 2005 ("NRC 2005 Answer").
- (g) "Affidavit of Duane A. Neitzel (NRC Staff Exhibit 1)," dated May 2, 2005. ("Neitzel 2005 Affidavit").
- (h) "Exhibits to the Affidavit of Duane A. Neitzel" attached to the NRC 2005 Answer ("Neitzel 2005 Exhibits").
- (i) "Dominion's Second Motion for Summary Disposition Contention EC 3.3.2 - Impacts on Striped Bass in Lake Anna," dated August 7, 2006 ("Dominion 2006 Motion").
- (j) "Patrick J. Ryan Affidavit in Support of Dominion's Second Motion for Summary Disposition of Contention EC 3.3.2," dated July 28, 2006 ("Ryan 2006 Affidavit").
- (k) . NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 7 Regarding North Anna Power Station, Units 1 and 2," Final Report, November 2002 ("GEIS Supplement 7").

Description of Previous and Currently Proposed Cooling Systems for Units 3 and 4

7. On April 13, 2006, Dominion submitted ER Revision 6 to the NRC. In ER Revision 6, Dominion proposed to 1) change the cooling system for Unit 3 from a once-through system to a closed-cycle wet and dry system, and 2) increase the maximum power output per unit from 4300 to 4500 megawatts-thermal. This proposal formed the basis for the SDEIS, which was issued for public comment by the NRC in July 2006. 71 Fed. Reg. 39372 (July 12, 2006). The cooling system and maximum power output described in Revision 6 remain the same in Revision 8, and Revision 8 will be cited hereinafter.

8. (LWV) The wet and dry cooling system proposed for Unit 3 would discharge blowdown water into the waste heat treatment facility (WHTF) at a maximum discharge rate of 12.4 cubic feet per second (cfs) and a maximum temperature of 100°F. SDEIS at I-5. This Unit 3 blowdown water would mix with a maximum flow of 4246 cfs of circulating water discharged from Units 1 and 2. SDEIS at I-12. During Unit 1 and 2 outages, the net discharge to the canal would be greatly reduced.

Description of Lake Anna, the North Anna River, and Downstream Locations

9. (LWV) The Lake Anna reservoir was created by damming the main stem of the North Anna River. SDEIS at 2-4. The reservoir consists of two distinct water bodies: the WHTF and Lake Anna. SDEIS at 2-4. At the normal pool elevation of 250 ft (76.2 m) above mean sea level (MSL), the total area of the WHTF is 3400 ac (1400 ha); Lake Anna occupies approximately 9600 ac (3900 ha). SDEIS at 2-4. The WHTF is composed of three lagoons interconnected by channels and is designed to dissipate the heat resulting from the operation of the once-through cooling systems associated with Units 1 and 2. SDEIS at 2-8 through 2-10. During the operation of these units, heated water flows via the discharge canal into the WHTF, where cooling occurs. SDEIS at 2-10. Water then enters Lake Anna via Dike 3, which is

located approximately 0.5 mi (0.8 km) west of the North Anna Dam. SDEIS at 2-9, Figure 2-4. Water passes over or through the dam into the North Anna River, which joins the South Anna River to form the Pamunkey River about 27 mi (43 km) southeast of the NAPS site. SDEIS at 2-4. The Pamunkey River flows in a southeasterly direction to West Point, Virginia, where it joins the Mattaponi River to form the York River, which flows into Chesapeake Bay approximately 15 mi (24.1 km) north of Hampton, Virginia. SDEIS at 2-4.

Description of the Striped Bass Fishery in Lake Anna and Downstream Locations

10. (JAW) Because the Lake Anna Reservoir was created by the impoundment of the North Anna River, only a few species inhabiting the river were expected to remain in the lake after impoundment, including pumpkinseed (*Lepomis gibbosus*), spotted bass (*Micropterus punctulatus*), gizzard shad (*Dorosoma cepedianum*), and several species of catfish (*Ictalurus* spp.). The striped bass (*Morone saxatilis*) was not present in the river prior to impoundment. Neitzel 2005 Affidavit ¶ 11. After the impoundment was completed, a variety of species were introduced into the newly formed lake, including largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear (*Lepomis microlophus*), sunfish (*Enneacanthus* spp.), and channel catfish (*I. punctatus*). Other species introduced into the lake include striped bass and walleye (*Stizostedion vitreum*) to improve and diversify the recreational fisheries. In the 1980s, blueback herring (*Alosa aestivalis*) and threadfin shad (*D. petenense*) were successfully introduced to provide adequate forage food for pelagic predators. Neitzel 2005 Affidavit ¶ 11. As a result of annual stocking and introduction of prey species, the striped bass fishery in Lake Anna is stable, and has resulted in Lake Anna being one of the premier recreational fishing lakes in the Commonwealth of Virginia. Neitzel 2005 Affidavit ¶ 12. Striped bass are known to spawn in the York and Pamunkey Rivers, but indigenous populations of striped bass have not

been observed above the Fall Line in the North Anna River.⁵ SDEIS at 5-29, *citing* Jenkins, R.E. and N.M. Burkhead, American Fisheries Society, Bethesda, Maryland, *Freshwater Fishes of Virginia* at 684 (1984) ("Jenkins and Burkhead").

11. (JAW) Because striped bass have not been observed to naturally reproduce in the North Anna Reservoir, the Virginia Department of Game and Inland Fisheries (VDGIF) continues to stock this species annually, manages the stocking of prey species, and specifies catch limits to maintain the population. Neitzel 2005 Affidavit ¶ 13.

12. (JAW) The North Anna River in the vicinity of the North Anna reservoir did not support a striped bass population prior to impoundment, and any striped bass found in the North Anna River immediately below the dam are assumed to have entered from the lake.

Thermal Tolerance of Striped Bass

13. (JAW) Because striped bass are physiologically capable of living exclusively in fresh water, they are frequently stocked in lakes and reservoirs in the southeast [United States]. Although stocking is generally conducted as a "put-and-take" fishery, self-sustaining populations have been observed in the Kerr Reservoir in Virginia and North Carolina, and the Santee-Cooper River in South Carolina. Jenkins and Burkhead at 683. Subadult striped bass generally prefer water temperatures of 68 to 75.2°F (20-24°C), are generally not found in temperatures ranging from 77 - 80.6°F (25-27°C), and have exhibited an avoidance response in the laboratory at a temperature of 80°F (26.7°C). Coutant, C.C., and D.S. Carrol, *Transactions*

⁵ The Fall Line is the geologic boundary between the Coastal and Piedmont Physiographic Provinces in Virginia. The harder metamorphic rocks of the Piedmont Physiographic Province transition to the softer Coastal Plain Physiographic Province sediments at the Fall Line. This transition zone, when traversed by Atlantic coastal rivers, is characterized by an increase in stream gradient, rapids, pools, islands, and occasional waterfalls. These features can be, and are often barriers to fish migration. Great Falls on the Potomac River near Washington, D.C., is the result of an Atlantic river crossing the Fall Line. The Fall Line on the North Anna River is approximately 21 river miles (34 river kilometers) below the North Anna Dam. *See also* Ryan 2005 Affidavit ¶ 13.

of the American Fisheries Society 109:195-202, "Temperature Occupied by Ten Ultrasonic-Tagged Striped Bass in Freshwater Lakes" (1980). Coutant reports that striped bass exhibit stress when dissolved oxygen levels decrease to approximately 3 milligrams per liter (mg/L), and considers levels of 2 mg/L or less to be uninhabitable. Coutant, C.C., Transactions of the American Fisheries Society 114: 31-61, "Striped Bass, Temperature, and Dissolved Oxygen: A Speculative Hypothesis for Environmental Risk" (1985). When the surface waters of lakes and reservoirs exceed preferred temperatures, bass seek refuge in cooler, deeper locations, and often occupy a zone between the warm upper water layer and the oxygen-deficit deeper layer. Jenkins and Burkhead at 683. When water temperatures decrease in the fall and winter months, striped bass habitat increases, and striped bass no longer need habitat refugia.

Current Thermal Impacts to Striped Bass from Units 1 and 2

14. (JAW) In Lake Anna, VDGIF stocks between 100,000 and 200,000 striped bass fry and fingerlings annually to sustain the population. Young bass grow rapidly and reach a harvestable size of 20 in. (50.8 cm.) in about 30 months. Revision 8 at 3-2-77. As part of the striped bass fishery management, VDGIF has evaluated striped bass habitat quality during the late summer since the early 1990s. Based on the results of temperature and oxygen profiles created by the agency, portions of Lake Anna do not provide acceptable habitat for striped bass during the summer due to high temperature (> 78.8°F or 26°C) and low dissolved oxygen (<2 mg/L). Revision 8 at 3-2-77. These conditions are exacerbated during abnormally warm years or during extended drought conditions. When these conditions occur, it is believed that striped bass move uplake to cooler, more oxygenated water. Revision 8 at 3-2-77.

15. (JAW) During the development of the NAPS relicensing supplemental environmental impact statement in 2002, thermal impacts associated with the operation of Units 1 and 2 were evaluated by the NRC staff and its consultants. Virginia Electric and Power

Company's (VEPCo) demonstration of compliance with § 316(a) of the Clean Water Act for the existing NAPS units indicated that Lake Anna contained a highly abundant and diverse fish population that was similar to other southeastern reservoirs when that study was completed in the 1980's. SDEIS at 2-22. The fish community has remained "relatively stable since 1975, with some year-to-year variation in species composition" despite the fact that habitat for some species is reduced during the warmer summer months. GEIS Supplement 7 at 4-17. The NRC ultimately concluded that the potential for heat shock impacts to the aquatic environment in the vicinity of the plant resulting from the operation of Units 1 and 2 was small, and no additional mitigation was warranted. GEIS Supplement 7 at 4-17.

Expected Thermal Impacts Associated with the Operation of the Unit 3 Wet and Dry Cooling System

16. (LWV) Potential thermal impacts to the striped bass population in Lake Anna and in the North Anna River downstream of the North Anna Dam could occur under two hypothetical, bounding scenarios, namely: 1) if the discharge of heated blowdown water from the Unit 3 wet and dry cooling system results in elevated water temperatures in the WHTF, Lake Anna, and the North Anna River downstream of the dam, and 2) if the evaporative loss of water from the Unit 3 wet and dry cooling system results in a lower lake level and a subsequent increase in overall lake temperature. The latter scenario assumes that if the volume of the lake decreases due to the operation of Unit 3, less water is available to dissipate the heat rejected from Units 1 and 2 and proposed Unit 3, and this would result in an overall increase in lake temperature, especially during the summer months.

17. (LWV) The NRC staff evaluated the first scenario identified in ¶ 16 as follows: Based on the current operational design and the plant parameter envelope (PPE) described in Revision 8, the release of blowdown water from Unit 3 would not result in a measurable increase in lake temperature beyond the increase currently occurring due to the operation of

Units 1 and 2. The closed-cycle wet and dry system proposed for Unit 3 would release a maximum of 12.4 cfs to the WHTF at a temperature not to exceed 100°F. This flow would represent only a 0.3 percent increase to the overall flow into the WHTF already occurring from the operation of Units 1 and 2, and the proposed discharge temperature is within the 98.6°F to 102.4°F (37 - 39.1°C) range currently observed in the discharge canal in July and August due to the operation of Units 1 and 2. SDEIS at 5-29. During some times of the year, the temperature of blowdown water from Unit 3 could exceed existing discharge temperatures from Units 1 and 2; at other times of the year, the blowdown water temperature could be lower than existing discharge temperatures. However, the expected maximum flow of blowdown water from Unit 3 would represent only a 0.3 percent increase above that observed for Units 1 and 2, and proposed Unit 3 would be a minor contributor to the overall flow. In any event, Unit 3 blowdown flow would be small compared to the volume of water in the WHTF. Therefore, proposed Unit 3 would have an insignificant effect on the water temperature within the WHTF, Lake Anna, and the North Anna River.

18. (LWV) The NRC staff evaluated the second scenario identified in ¶ 16 as follows: Assuming the heat rejection rate for Units 1 and 2 remains constant, the discharge of water from the lake would decrease due to the evaporative water loss from the wet portion of the proposed wet and dry cooling system. Additionally, the water surface elevation of the lake would decrease during times of relative drought due to operation of the wet and dry cooling system proposed for Unit 3. Since the discharge of waste heat downstream would be reduced and the volume of water in the lake would be less, the average temperature in the lake would increase. In Revision 8, Dominion calculated the resulting average increase in Lake Anna water temperature to be approximately 0.1°F. This assessment was corroborated in the

affidavit provided by Patrick Ryan, who agreed that lake temperature would increase by about 0.1°F under this scenario and added that for periods of prolonged drought (approximately 3 weeks out of 24 years), the increase in water temperature would be 0.3°F or less. Ryan 2006 Affidavit at ¶ 13. The NRC staff reviewed these values, found them to be reasonable, and determined that this increase in water temperature would be insignificant. SDEIS at 5-12. Because the WHTF volume is much greater than proposed Unit 3 blowdown flow, this is true even when Units 1 and 2 are not operating. Therefore, the Applicant, the affidavit submitted by Patrick Ryan, and the NRC Staff are in agreement that the increase in water temperature resulting from operation of Unit 3, even during periods of prolonged drought, would not be significant.


Conclusions

19. Based on the above analyses, we conclude that the wet and dry cooling system for Unit 3, as described in Revision 8, would not result in additional thermal impacts to striped bass in Lake Anna, or to adult or juvenile striped bass in the North Anna River below the North Anna Dam. Without additional thermal impacts to striped bass in Lake Anna or downstream in the North Anna River, no changes are expected as a result of the proposed NAPS Units 3 related to striped bass regarding their life history, reproductive strategy, or habitat utilization. The original contention was based on a once-through cooling system for Unit 3 that is no longer being considered, and, as discussed in the SDEIS, the expected thermal impacts to Lake Anna and the North Anna River from the operation of the Unit 3 wet and dry cooling system would be insignificant. Therefore, with respect to the basis for contention EC 3.3.2, we agree with the Applicant's conclusion that the thermal impacts to striped bass from operating proposed Unit 3 at the North Anna ESP site would be small.

Jeffrey A. Ward
Lance W. Vail

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20. (JAW) I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief.

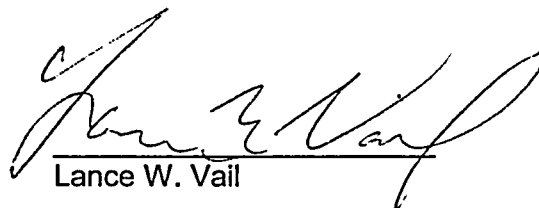


Jeffrey A. Ward

Jeffrey A. Ward
Lance W. Vail

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21. (LWV) I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief.



Lance W. Vail

STATEMENT OF PROFESSIONAL QUALIFICATIONS OF JEFFREY A. WARD

CURRENT POSITION

Senior Research Scientist
Pacific Northwest National Laboratory, Battelle Marine Sciences Laboratory

EDUCATION

M.S. Environmental Engineering, Kennedy Western University, Thousand Oaks, CA, 2000
B.A. Zoology, University of Washington, Seattle, WA, 1980

QUALIFICATIONS

Mr. Jeff Ward joined Battelle in 1986 and has over 20 years experience in environmental baseline studies, ecological risk assessments, benthic community structure and function, and the management of contaminated sediment in urban waterways. Mr. Ward's current activities involve serving as a senior technical advisor to research on endocrine disruptor compounds; serving as manager of the PEMEX program, a large-scale environmental baseline study to better understand the effects of oil platforms and related activities in the Gulf of Mexico; and providing continued support for the US Navy environmental programs for bases located in California. Mr. Ward is involved in several innovative programs involving evaluation of contaminants and assessment of risk. Some of these include the evaluation and development of technologies to decontaminate sediment, beneficial-use options analysis, the use of a weight-of-evidence approach to the evaluation of contaminants, development of the "toxic unit" approach to assessing complex mixtures in stormwater, development of sensor systems to assess the aquatic surface microlayer (top 50 microns), and the evaluation of pathways for evaluating contaminant transport and potential exposure in determining risk.

- **Assessment of Aquatic Impacts Associated with Nuclear Power Plants Equipped with Once-through Cooling Systems: Supplemental Environmental Impact Statements for Plant Relicensing.** The Calvert Cliffs Nuclear Power Plant in Solomons, Maryland, was the first facility in the United States to request an extension to its operating license. In support of this request, Mr. Ward participated in a multidisciplinary team of scientists, engineers, environmental planners, sociologists, and economists working with the US Nuclear Regulatory Commission (NRC) to develop the draft and final supplementary environmental impact statement (SEIS) to extend the plant's operation on the shores of Chesapeake Bay. Mr. Ward was responsible for addressing all potential effects of the plant on the marine communities in Chesapeake Bay near the plant, including the impacts associated with once-through cooling water discharge, and assisting with the development of the SEIS, participation at public meetings, and the formal response to questions associated with the study. The final SEIS was submitted to the EPA by NRC in early 1999. Mr. Ward was also a key member of a multidisciplinary team evaluating the environmental impacts of relicensing the Millstone Power Station Units 2 and 3, operated by Dominion Nuclear Connecticut, and is currently working with the NRC on a similar project in New Jersey. All of these projects require critical review of complex environmental monitoring data, environmental assessment models, and other technical documentation to determine whether the available information is adequate to support a determination of impact at local and regional scales.

- **PEMEX Marine Program (Phase I & II) (1996 - present). Phase II Program Manager.** The goal of this study is to understand the impacts of PEMEX activities (oil platform operations, transshipment, waste disposal) on the marine environment and nearshore areas in the southern Gulf of Mexico. Mr. Ward is coordinating all toxicity testing and research associated with determining marine effects associated with benthic community impacts, impacts to fisheries, and evaluations of environmental risk associated with all aspects of the PEMEX operation. This study includes an assessment of impacts to air, receiving water, sediment, and biota in the study area. Mr. Ward was also responsible for multiple tasks during Phase I of this project, including the development of a screening database of worldwide regulations and standards, technical evaluation of United States and Mexico monitoring data, participation in meeting with colleagues in Mexico City and Geneva, Switzerland, and coordination and integration of data and results into a geographical information system platform.

- **Evaluation of Stormwater Effects on Nearshore Communities to Support Restoration Efforts:** Mr. Ward developed a "toxic-unit" approach to characterizing complex mixtures typical of stormwater, which can then be simulated and tested as a dilution series in the laboratory to develop dose-response relationships. Testing is designed to determine the concentrations at which adverse effects are likely to be observed in the environment. The approach will provide restoration ecologists with a useful tool for assessing the potential impacts of stormwater on candidate restoration sites, and for determining appropriate source-control measures.

- **Weight-of-Evidence Approach to Evaluating Regulatory Programs for Contaminated Sediment Management:** Mr. Ward applied a weight-of-evidence evaluative model, typically used in risk assessment and sediment evaluation studies, to national and regional regulatory guidance manuals to determine whether species selection and test recommendations are applicable and appropriate to safeguard environmental quality. National guidance documents reviewed included EPA/USACE publications associated with dredged material testing in marine, estuarine, and freshwater environments; regional practices included current guidance in New York/New Jersey and Puget Sound, Washington. The approach to assessing current environmental testing guidelines may serve as a basis for potential changes in legislation relative to the assessment of dredged material.

- **Behavior-Based Exposure Framework:** Mr. Ward developed a semi-quantitative behavior-based exposure framework for selecting species that are the best indicators of potential ecological damage resulting from exposure to xenobiotic or natural contaminants. The approach provides sufficient discriminatory power to observe differences among species relative to their potential for exposure. The framework can be adapted to a variety of ecosystems throughout the world, and can enhance environmental assessments by providing a consistent, documented approach to selection of ecologically relevant species.

- **US EPA Centredale Manor Environmental Risk Assessment Program.** Mr. Ward served as Program Manager for the Centredale Manor fish early-life-stage (ELS) toxicity testing study designed to help EPA develop protective sediment cleanup levels relative to dioxin and PCB contamination at this listed Superfund site. Toxicity testing focused on innovative methods for assessing chronic sediment toxicity using catfish fry. Preliminary data suggested the ELS experiment was successful in developing a dose-response relationship between sediment contaminants and maternal uptake, and may lead to new ways to assess environmental contamination and develop meaningful cleanup criteria.

- **Post-Remedial Biomonitoring of Pesticides at the EPA United Heckathorn Superfund Site, Richmond, California:** Mr. Ward was responsible for the oversight of operations for EPA during cleanup of this superfund site. Mr. Ward dealt with important safety and hazard issues and addressed issues of turbidity, sediment core sampling, and water quality. In addition, he presented to Waste Management innovative ideas of various means of dewatering hazardous sediment and time- and cost-saving measures to meet important deadlines. The Post-Remedial Biomonitoring program is a continuation of the original remedial investigation and feasibility study, which included determination of the areal and vertical extent of contamination and volume of sediment requiring remediation, characterization of biological effects of sediment and the quality of effluent derived from dewatered sediment, and development and evaluation of alternatives for removing, containing, and/or treating contaminated sediment.

SELECTED PUBLICATIONS AND PRESENTATIONS

Peer-Reviewed Journals

Ward, JA, HL Diefenderfer, AD Skillman, and SL Blanton. 2002. "The Use and Utility of Early Life-stage Toxicity Tests in Characterizing Contaminated Sediment." PNWD-SA-5599. Invited presentation at the Association for Environmental Health and Sciences, Twelfth Annual West Coast Conference on Contaminated Soils, Sediments, and Water, March 18, 2002, San Diego, California. Published in *Soil and Sediment Contamination: An International Journal*, Vol. 11(3), May 2002.

Presentations / Proceedings

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Thom RM, AB Borde, NR Evans, CW May, GE Johnson, and JA Ward. 2004. "A Conceptual Model for the Lower Columbia River Estuary." PNNL-SA-43245. Presented by Ronald M. Thom at the 2004 Annual Review of the Anadromous Fish Evaluation Program (AFEP), Portland, OR on November 18, 2004.

Ward, JA, CW May, and RM Thom. 2004. "Evaluation of Stormwater Effects on Nearshore Communities to Support Environmental Restorations." PNWD-SA-6525. Presented by Jeff Ward at the Society of Environmental Toxicology and Chemistry: Fourth SETAC World Congress, Portland, Oregon, on November 17, 2004.

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STATEMENT OF PROFESSIONAL QUALIFICATIONS OF LANCE W. VAIL

CURRENT POSITION

Senior Research Engineer II
Environmental Technology Division
Battelle, Pacific Northwest Division
Pacific Northwest National Laboratory

Since joining Battelle in 1981, Mr. Vail has been involved in projects covering a diverse set of water related issues. His professional experience includes basic and applied research, and regulatory compliance assessments. His areas of expertise cover a broad spectrum of areas related to water resources.

RESEARCH INTERESTS

Water resource management
Multiple objective tradeoff analysis in water resources
Uncertainty analysis in water resources
Advanced hydrologic process modeling
Impacts of climate on water resources
Neural networks, fuzzy logic, and genetic algorithms applied to water resource issues
Linking simulation models with optimization methods to water resource problems
Linkage of physical and biological models in fisheries management

EDUCATION

B.S.	Humboldt State University, environmental resources engineering	1979
M.S.	Montana State University, civil engineering	1982

PROFESSIONAL AFFILIATIONS

American Geophysical Union
American Society of Civil Engineers
American Water Resources Association

CURRENT PROJECTS

Hydrologic Site Safety Reviews for Early Site Permits. Principal Investigator and Project Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This project provides an independent assessment of hydrologic suitability of the proposed sites. Assessments include a broad range of considerations such as flooding, low water conditions, ice impacts, seiches, storm surge, and tsunamis.

Water-related Environmental Reviews for Early Site Permits. Task Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This task provides an independent assessment of the proposed sites' environmental suitability. Assessments include a broad range of considerations such as water-use conflicts and changes in water quality.

Snohomish Basin Characterization. Technical Lead. Advanced distributed watershed models were applied to provide the Tulalip Tribes of Western Washington state a thorough understanding of the impacts of logging, development, and climate on the Snohomish River Basin.

Acid Rain TMDL. Principal Investigator and Technical Project Manager. The objective of this work assignment for Region II of the U.S. Environmental Protection Agency is to develop a preliminary assessment approach for TMDLs for pH impaired waters listed on the New York State Section 303(d) list. The intent is to enhance and further develop TMDL program capabilities by providing expertise in both acid deposition and TMDL development. The development of such an assessment approach requires that available models and data resources be reviewed. Systems engineering methods will be used in developing a conceptual model to ensure the relationships between models and data are fully understood. The assessment approach will be tested on one or more representative watersheds to be determined in close coordination with EPA, NYSDEC and Battelle. <http://acidraintmdl.pnl.gov>

PAST PROJECTS

- **Environmental Impact of License Renewal of Commercial Nuclear Power Plants.** Contributor. Mr. Vail assesses the water use, water quality, and hydrologic impacts of license renewal for the Nuclear Regulatory Commission's NEPA process. He has performed this function for the following commercial nuclear plants: Calvert Cliffs, Oconee, Arkansas Nuclear One, Hatch, McGuire, Catawba, North Anna, Robinson, Ginna, and St. Lucie.
- **Chehalis Basin Characterization.** Principal Investigator and Project Manager. Advanced numerical modeling and GIS methods were applied to assist the Corps of Engineers in characterizing the Chehalis Basin in Western Washington State. The Chehalis Basin is subject to frequent flooding. The native populations of anadromous fish have been stressed to adverse changes in habitat resulting from development and logging.
- **Generic Environmental Impact Statement (GEIS) for Decommissioning Commercial Nuclear Power Plants.** Contributor. Mr. Vail is providing expertise in the development of a GEIS for decommissioning of nuclear plants. He provides expertise on water use, water quality, and hydrologic impacts for the Nuclear Regulatory Commission.
- **Impact of Climate on the Lower Yakima Basin.** Principal Investigator and Project Manager. The objective of this three-year EPA STAR Grant Project was to develop and demonstrate an integrated assessment of the impact of climate variability and climate change on a diverse set of interests in the Lower Yakima Valley in Central Washington State. Interests considered include: surface and groundwater supply, surface and groundwater quality, air quality, public health, farm and regional economics, and fisheries. The project considered the effectiveness of changes in land management (crop selection) and water management (reservoir operation) in adapting to an uncertain future climate. A diverse set of models was linked with an optimization procedure to ensure that the tradeoffs between various resource management objectives are clearly articulated. <http://projects.battelle.org/yakima/>
- **Use of NOAA's Seasonal Climate Forecast for Water Resource Management.** Task Manager of Reservoir Optimization Task. The objective of this NOAA funded project was to show the potential value of improved climate forecasts in managing surface water reservoirs for multiple objectives. Using a pareto genetic algorithm, the reservoir operating rules were optimized to define the tradeoff curves for hydropower, flood control, and instream flow requirements in the Tennessee River basin. Changes in forecast reliability result in changes to these tradeoffs and thereby express the value of such improved forecasts.
- **Accelerated Climate Prediction Initiative.** Task Manager of Water Resources and Habitat Task. This project will provided a limited, systematic assessment of the potential effects of anthropogenic climate change over the next half-century on water resources in the western United States. This objective was accomplished by "downscaling" the results of the global-scale simulations described above to the spatial and temporal resolution needed to drive impact assessment models. Downscaling is particularly important for the West, where topography is a dominant climate driver. An important aspect of the hydrology of

almost all western rivers is water management. Other than a few headwater streams, the hydrology of most rivers in the west is strongly affected by water use and artificial storage. Water management models were used to study the effect of reservoir operations and understand the implications of climate variability and change on the water resources of the west. <http://acpiwater.pnl.gov>

- ***Linking Physical and Biological Models.*** Principal Investigator and Project Manager. The objective of this three-year Laboratory Directed Research and Development project is to develop and demonstrate an integrated natural resource analysis framework. This framework: dramatically improves the ability to integrate physical and biological models, thereby encouraging the utilization of advanced process models; allows utilization of large, sparse, and distributed data sets (including model output); communicates high-level tradeoffs and their respective uncertainties; and assesses, communicates, and minimizes scales issues. During the first year, the fundamental structural differences between such models was identified as a significant obstacle to successful linking of physical and biological models. The pervasive vagueness of rules and the multivaluedness associated with temporal/spatial upscaling suggested an approach using "fuzzy methods". The second year of this project utilized a variety of fuzzy methods including: fuzzy arithmetic, fuzzy logic, fuzzy clustering, and adaptive neural fuzzy inference systems (ANFIS). A series of rules and a database from the Multispecies Framework Process were employed to test the various fuzzy methods. These rules and data are used to define aquatic habitat diversity in the Pacific Northwest. A tool called FuzzyHab was developed to estimate habitat diversity from a set of categorical statements about the environment. Each of these categorical statements is vaguely defined. Estimates for each categorical statement are derived from physical process models.
- ***Integrated Natural Resource Data System.*** Contributor. This project is to demonstrate INRDS. INRDS is an advanced, web-based environmental information system that will promote public understanding of natural resource management issues and assist planners and decision makers in accessing the most relevant information and analytical tools and evaluating the tradeoffs of alternate actions. <http://inrds.pnl.gov>
- ***Early Warning of El Niño Southern Oscillation (ENSO) Events for Regional Agriculture.*** Task Manager of Reservoir Optimization Task. This project is investigating the current predictability of interannual variability in climate conditions in the Pacific Northwest to determine whether and how early warning and seasonal climate forecasts by the Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration (NOAA) forecasts can be used to reduce the vulnerability of irrigated agriculture to low water-availability conditions. The study is funded by a grant from the economics and Human Dimensions Program of the NOAA Office of Global Programs. The Economics and Human Dimensions program aims to improve our understanding of how social and economic systems are currently influenced by fluctuations in short-term climate (seasons to years), and how human behavior can be (or why it may not be) affected based on information about variability in the climate system. <http://elrino-northwest.labworks.org>
- ***Impact of Reservoir Operating Strategies on Resident Fish*** - Mr. Vail has employed several models to assess the impact on resident fish species of a variety of reservoir operating strategies. This study was undertaken as part of the Columbia Basin System Operation Review process. Mr. Vail helped define the values and value measures of the Resident Fish Work Group.
- ***Multiobjective Optimization*** - Mr. Vail is the project manager of an effort to assess the multiobjective optimization needs of Bonneville Power Administration. Objectives include: hydropower, resident fish, anadromous fish, irrigation, flood control, wildlife, and navigation. Mr. Vail is developing definitions of the canonical mathematical form of each of these objectives. The resulting multiobjective statement will be used to define the required optimization tools.
- ***Integrated Environmental Monitoring Initiative*** - Mr. Vail is a co-principal investigator for the Integrated Environmental Monitoring Initiative. The objective of this initiative is to develop and demonstrate a

comprehensive interdisciplinary methodology targeted to improve the effectiveness of environmental monitoring and restoration activities. This objective required comprehensive integration of monitoring regimes, analytical practices, design methodologies, and compliance needs.

- ***Coupled Simulation/Optimization of Ground Water Remediation*** - Mr. Vail developed a computer code that coupled a ground water flow model with an optimization procedure. The code was able to provide estimates of the pumping/injection rates that would mitigate or remove a plume at minimal cost.
- ***Simulation of Watershed Hydrologic Responses to Alternative Climates*** - Mr. Vail is the principal investigator of a project studying the impacts of global climate change on the hydrologic response of a watershed. The results of hydrologic simulations using distributed snowmelt and soil moisture accounting algorithms were graphically compared via video displays of daily simulated snow water equivalent, soil moisture, and runoff for the American River, Washington, which drains 204 square kilometers of the east slopes of the Cascade Mountains, Washington. Snow water equivalents and snowmelt were simulated using a simplified distributed temperature-index model augmented with seasonally estimated net solar radiation. A classification scheme was used to partition the empirical cumulative probability distributions of precipitation (rain plus melt) and a topographic index over the basin into groups of near-equal membership. Topographically-based soil moisture capacities were assumed for each class and were estimated via automated calibration methods using historical data. The simulated soil moisture and snow water accumulations for each class were geographically mapped for visualization. Test of the effect of alternative, warmer climates on snow accumulation, the seasonal distribution of soil moisture, and runoff were conducted by adjusting historical (daily) temperature and precipitation and repeating the analysis.
- ***Pacific Northwest Climate Change Case Study - Water Resource Impacts*** - Mr. Vail is investigating the effects of global climate change on water resources of the Pacific Northwest. Spatially distributed snowmelt, soil moisture, and runoff models have been combined with a graphics visualization package to understand the changes in snowpack, soil moisture, and evapotranspiration over time. A weather classification scheme has been developed which estimates point precipitation as a function of large-scale atmospheric variables. This allows the synthesis of point precipitation given large-scale meteorological information as might be produced by GCM simulations. Orographic effects also have a significant role in defining climate at the watershed scale. Efforts are under way to develop a scientific basis to extend the sparse meteorological measurements basis to extend the sparse meteorological measurements available for any watershed to estimate the spatial distribution of precipitation, temperature, and wind speed within the watershed. A reservoir network model for the Columbia River Basin has been aggregated to fourteen nodes. This network model of the Columbia River Basin has been aggregated to fourteen nodes. This network model will be driven by a collection of index watersheds. A daily hydroclimatological data set has been developed to aid in the selection of index watersheds.
- ***Acid Rain Watershed Modeling Project*** - Mr. Vail directed the hydrologic part of a study to evaluate and apply several coupled hydrology/geochemical codes that were developed to model the impact of acid rain on surface water chemistry. The project involved extensive behavior and sensitivity analyses of three coupled geochemical/hydrological simulation codes.
- ***Incineration at Sea*** - The objective of this project was to assess the impact of incinerating toxic waste at sea on the aquatic environment. Mr. Vail developed a model on an IBM-PC to estimate the concentration of contaminant in the ocean.
- ***Aquifer Thermal Energy Storage*** - The objective of this project was to develop and apply computer codes that would simulate the trade-offs between different management policies of an Aquifer Thermal Energy Storage system. Mr. Vail independently developed, validated, and applied several computer codes for this purpose.

- ***Flow and Fractured Media*** - The objective of this study is to develop a state-of-the-art predictive capability for flow and transport in saturated fractured media. Mr. Vail was responsible for implementing, modifying, and testing a computer code that models steady flow in permeable media with discrete fractures. Mr. Vail has also developed a computer code that models steady flow through fractures in an impermeable rock mass. The fractures can either be specified or generated via Monte Carlo Methods. This code was applied in an investigation of the potential impact of a nuclear meltdown on groundwater.
- ***Modeling Flow With Certainty in Hydraulic Parameters*** - The objective of this study is to develop a methodology to analyze the uncertainty in predicting piezometric surfaces caused by uncertainty in groundwater flow parameters. Mr. Vail developed a computer code that couples perturbation and finite-element techniques to estimate the mean and variance of the piezometric surface.
- ***Stripa Mine Hydrogeologic Characterization*** - The objective of this study was to perform three-dimensional simulations with the CFEST code for ground water flow at the Stripa Mine in Sweden. Mr. Vail was the Battelle project manager of this effort.

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August 28, 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

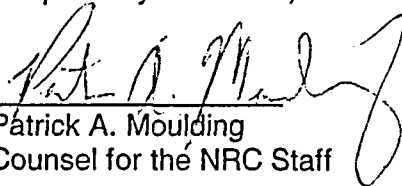
In the Matter of)	
)	
DOMINION NUCLEAR NORTH ANNA, LLC)	Docket No. 52-008-ESP
)	
(Early Site Permit for North Anna ESP Site))	

NOTICE OF APPEARANCE

Notice is hereby given that the undersigned attorney enters an appearance in the above-captioned matter. In accordance with 10 C.F.R. § 2.314(b), the following information is provided:

Name:	Patrick A. Moulding
Address:	U.S. Nuclear Regulatory Commission Office of the General Counsel Washington, D.C. 20555
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Admissions:	State of Maryland
Name of Party:	NRC Staff

Respectfully submitted,


Patrick A. Moulding
Counsel for the NRC Staff

Dated at Rockville, Maryland
this 28th day of August 2006

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
DOMINION NUCLEAR NORTH ANNA, LLC)	Docket No. 52-008-ESP
)	
(Early Site Permit for North Anna ESP Site))	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF ANSWER SUPPORTING DOMINION'S SECOND MOTION FOR SUMMARY DISPOSITION OF CONTENTION EC 3.3.2", "JOINT AFFIDAVIT OF JEFFREY A. WARD AND LANCE W. VAIL", with attachments, and "NOTICE OF APPEARANCE" of Patrick A. Moulding in the above-captioned proceeding, have been served on the following through deposit in the NRC's internal mail system, with copies by electronic mail, as indicated by an asterisk, or by deposit in the U.S. Postal Service, as indicated by double asterisk, with copies by electronic mail this 28th day of August, 2006:

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Administrative Judge
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