RAS 9899

April 22, 2005

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
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DOMINION'S MOTION FOR SUMMARY DISPOSITION
CONTENTION EC 3.3.2 – IMPACTS ON STRIPED BASS IN LAKE ANNA

I. INTRODUCTION

Dominion Nuclear North Anna, LLC ("Applicant" or "Dominion") hereby moves for summary disposition of Contention EC 3.3.2 – Impacts on Striped Bass in Lake Anna, ("EC 3.3.2") pursuant to 10 C.F.R. § 2.1205. Summary disposition should be granted because there exists no genuine issue as to any material fact relevant to the contention; therefore, under the applicable Commission regulations, Dominion is entitled to a decision as a matter of law. This motion is supported by a Statement of Material Facts as to which Dominion asserts that there is no genuine dispute; affidavits from John William Bolin, III, Manager, Environmental Biology for Dominion Resources Services, Inc. ("Bolin Aff.") and Dr. Patrick J. Ryan, Manager, Geotechnical and Hydraulic Engineering Services Group of Bechtel Corporation, the engineering consultant to Dominion ("Ryan Aff."); and correspondence with the Commonwealth of Virginia, Department of Game and Inland Fisheries ("VDGIF"), attached as exhibits to Mr. Bolin's affidavit.

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II. STATEMENT OF THE ISSUE

On May 3, 2004, the Blue Ridge Environmental Defense League, Nuclear Information and Resource Service, and Public Citizen (collectively, the "Intervenors") submitted contentions in this proceeding, including Contention EC 3.3.2.[1] On August 6, 2004, the Atomic Safety and Licensing Board ("ASLB" or "Board") admitted Contention EC 3.3.2. Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna Site), LBP-04-18, 60 NRC 253 (2004). The contention as admitted asserts that:

> 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.

Id. at 276.

The admitted contention can be subdivided into three issues: (1) thermal impacts on striped bass in the North Anna River; (2) thermal impacts from a fourth unit; and (3) impacts arising from the effect of increased temperature due to operation of a third unit on the striped bass fishery in Lake Anna. With respect to the first issue, however, it should be noted that in admitting the contention, the Licensing Board ruled

> Admitted . . . as it concerns the adverse thermal impacts on the striped bass population in Lake Anna. Inadmissible, as to the other generalized portions of the contention. . . .

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[1] Contentions of Blue Ridge Environmental Defense League, Nuclear Information and Resource Service, and Public Citizen Regarding Early Site Permit Application for Site of North Anna Nuclear Power Plant (May 3, 2004) ("Intervenors' Contentions").

Id. at 271. Therefore, the thermal impact on striped bass in the North Anna River downstream of the Lake Anna Dam appears beyond the intended scope of the admitted contention. Nevertheless, this summary disposition motion addresses this first issue out of an abundance of caution.

Because thirty years of monitoring indicates that there is no striped bass population in the North Anna River below the North Anna Dam (the "Dam") that could be impacted by thermal discharges from additional units, and because Dominion's application specifies dry cooling for the fourth unit (i.e., there would be no thermal discharge to Lake Anna from the fourth unit), no genuine disputes exist for the first two issues. With regard to the third issue, Dominion has committed to support the development and stocking in Lake Anna of an alternate fish (e.g., Palmetto bass, a hybrid between striped bass and white bass) that is more thermally tolerant and of equivalent value for recreational fishing. Therefore, the issue of whether striped bass would persist after a third unit starts operations is now moot. No contested material issues remain. Accordingly, the Applicant is entitled to a decision as a matter of law.

III. LEGAL BASIS FOR SUMMARY DISPOSITION

The admission of a contention for adjudication in a licensing proceeding under the standards set forth in 10 C.F.R. § 2.309 does not constitute an evaluation of the merits of that contention. Instead, such a ruling reflects merely the determination that the contention is well pled. The admission of a contention also does not dictate that a hearing be held on the issues raised. Sections 2.710 and 2.1205 of the NRC's rules of practice authorize a licensing board to grant summary disposition.

In ruling on motions for summary disposition in an informal (Subpart L) hearing,[2] the a licensing board applies the same standards that apply for summary disposition in a formal (Subpart G) hearing. 10 C.F.R. § 2.1205(c). In general, the same standards apply to motions for summary disposition as apply to motions for summary judgment under Rule 56 of the Federal Rules of Civil Procedure.[3] A party is entitled to summary disposition "as to all or any part of the matters involved in the proceeding," 10 C.F.R. § 2.710(a),[4] "if the filings in the proceeding ... and admissions on file, together with the statements of the parties and 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 decision as a matter of law." 10 C.F.R. § 2.710(d)(2).

The party moving summary judgment bears the initial burden of showing the absence of a genuine issue as to any material fact.[5] "Only disputes over facts that might affect the outcome of the suit under the governing law will properly preclude the entry of summary judgment. Factual disputes that are irrelevant or unnecessary will not be counted."[6] A licensing board will ultimately determine which facts are material on the basis of the parties' submissions and the record.[7]

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[2] This proceeding is conducted in accordance with Subpart L. North Anna ESP, LBP-04-18, 60 NRC at 272.

[3] Advanced Medical Systems, Inc. (One Factory Row, Geneva, Ohio 44041) CLI-93-22, 38 NRC 98, 102 (1993). 10 C.F.R. § 2.749 is now 10 C.F.R. § 2.710. 69 Fed. Reg. 2,182, 2,218 (2004).

[4] In any proceeding involving a construction permit for a production or utilization facility, summary disposition applies only to specific subordinate issues and not to the ultimate issue as to whether the permit shall be issued. 10 C.F.R. § 2.710(d)(2).

[5] Advanced Medical Systems, CLI-93-22, 38 NRC at 102.

[6] Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 248 (1986) (citations omitted).

[7] Advanced Medical Systems, CLI-93-22, 38 NRC at 115 & n.65.

A motion for summary disposition must include a statement of material facts as to which the moving party contends that there is no genuine issue to be heard. 10 C.F.R. § 2.710(a). All material facts in this statement will be considered to be admitted unless controverted by the opposing party. Id.

A motion for summary disposition may be supported by affidavits. Id. When a motion for summary disposition is supported by affidavits, a party opposing the motion may not rely on mere allegations or denials. 10 C.F.R. § 2.710(b). Compare Fed. R. Civ. P. 56(c). A party cannot avoid summary disposition on the basis of guesses or suspicions, or on the hope that at the hearing the applicant's evidence may be discredited or that "something may turn up."[8]

Instead, to defeat a properly supported motion for summary disposition, the opposition must contain "contrary evidence that is so significantly probative that it creates a material factual issue."[9] Although the opposing party does not have to show that it would prevail on the issues, it must at least demonstrate that there is a genuine factual issue to be tried.[10] Merely a "metaphysical doubt" concerning the material facts is insufficient.[11] Therefore, for example, where expert opinions submitted by opposing parties differ, a board may weigh the support for the opinions

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[8] Gulf States Utilities Co. (River Bend Station, Units 1 & 2), LBP-75-10, 1 NRC 246, 248 (1975) (citation omitted).

[9] Advanced Medical Systems, CLI-93-22, 38 NRC at 102 & n.13 (citing Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), CLI-92-8, 35 NRC 145, 154 (1992); see Daubert v. Merrell Dow Pharms., 509 U.S. 579, 596 (1993) (if "the scintilla of evidence presented supporting a position is insufficient to allow a reasonable juror to conclude that the position more likely than not is true, the court remains free to . . . grant summary judgment"); Gulf States Utilities Co. (River Bend Station, Unit 1), LBP-95-10, 41 NRC 460, 469-73 (1995) (weighing sufficiency of expert opinions).

[10] Advanced Medical Systems, CLI-93-22, 38 NRC at 102.

[11] Id. n.13 (citing Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 586-87 (1986)).

and the relative qualifications and experiences of the experts in determining the existence of a genuine issue.[12]

To determine whether an opponent's expert opinion raises a genuine issue regarding a material fact, a board or court "must 'look behind [the expert's] ultimate conclusion ... and analyze the adequacy of its foundation.'"[13] Affidavits from experts must set forth specific facts rather than mere conclusions. Duplantis v. Shell Offshore, 948 F.2d 187, 191-92 (5th Cir. 1991); see 10 C.F.R. § 2.710(b).[14] Thus, if an expert affidavit does not contain the facts and reasons supporting the expert's opinion, it will be excluded outright as not useful. Fed. R. Evid. 702.[15] Hence, expert affidavits that are merely unsupported conclusions will be rejected out of hand.[16]

"Affidavits must set forth the facts as would be admissible in evidence and must demonstrate affirmatively that the affiant is competent to testify to the matters stated in the affidavit." 10 C.F.R. § 2.710(b). Thus, an affidavit must ordinarily be made on the basis of the personal

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[12] See Carolina Power & Light Co. (Shearon Harris Nuclear Plant, Units 1 and 2), LBP-84-7, 19 NRC 432, 453-54 (1984).

[13] Mid-State Fertilizer Co. v. Exchange Nat'l Bank of Chicago, 877 F.2d 1333, 1339 (7th Cir. 1989) (citation omitted).

[14] The provision of Federal Rule of Evidence 705 that allows an expert to testify to conclusions at trial does not allow conclusory affidavits at summary judgment. M&M Medical Supplies & Serv. v. Pleasant Valley Hosp., 981 F.2d 160, 165 (4th Cir. 1992), cert. denied, 508 U.S. 972 (1993). Expert opinion must also not be within the common knowledge of lay persons. E.g., Evans v. Mathis Funeral Home, Inc., 996 F.2d 266, 268 (11th Cir. 1993).

[15] Mid-State Fertilizer, 877 F.2d at 1339; Harris, supra note 12, LBP-84-7, 19 NRC at 447; see Richardson v. Richardson-Merell, Inc., 857 F.2d 823, 829 (D.C. Cir. 1988), cert. denied, 493 U.S. 882 (1989) (looking behind conclusions); 10 C.F.R. § 2.710(b) (affidavits "must set forth specific facts"). But see Kerr-McGee Chemical Corp. (West Chicago Rare Earths Facility), ALAB-944, 33 NRC 81, 146 n.308 (1991) (expert affidavit requires factual basis but not "underlying factual details and the reasoning upon which the opinion is based").

[16] Public Service Co. of New Hampshire, (Seabrook Station, Units 1 and 2), LBP-83-32A, 17 NRC 1170, 1177 (1983); Pa. Dental Ass'n v. Medical Serv. Ass'n., 745 F.2d 248, 261-62 (3d Cir. 1984), cert. denied, 471 U.S. 1016 (1985). If it is impossible for the court to evaluate the soundness of an opinion without supporting facts or reasoning, a court may subsequently require the expert to provide them. M&M Medical Supplies, 981 F.2d at 165. Failure to provide such information upon request is grounds for exclusion of the affidavit. Claar v. Burlington N. R.R., 29 F.3d 499, 502 (9th Cir. 1994).

knowledge of the affiant.[17] Hearsay is not admissible unless it falls under an exception to the hearsay rule.[18] Non-expert testimony, regarding "matters [outside the firsthand knowledge of the witness] which are beyond the realm of common experience and which require the special skill and knowledge of an expert" is simply inadmissible.[19]

Because the affiant of opinion testimony must be an expert,[20] such affidavits must demonstrate the qualifications of the affiant as an expert.[21] "It is the burden of the party offering the expert testimony to lay a foundation for its admission."[22] A board will determine the affiant's qualifications under Rule 702 of the Federal Rules of Evidence.[23] To qualify as an expert, an affiant must possess "knowledge, skill, experience, training, or education." Fed. R. Evid. 702. While either formal education or significant experience may suffice,[24] it must be shown that the

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[17] Commonwealth Edison Co. (Braidwood Nuclear Power Station, Units 1 and 2), LBP-86-12, 23 NRC 414, 418-19; Columbia Pictures Indus., Inc. v. Professional Real Estate Investors, Inc., 944 F.2d 1525, 1529 (9th Cir. 1991), aff'd on other grounds, 508 U.S. 49 (1993) (rejecting affidavit based on information and belief). Nevertheless, a Licensing Board, as an administrative board, may "dispense with the personal knowledge requirement with less constraints than a judicial court, to expedite and facilitate the adjudicatory process, but not to the exclusion of a fair opportunity for the opponent of the proffered evidence to rebut it." Braidwood, LBP-86-12, 23 NRC at 419. Moreover, personal knowledge may be inferred from the position of the affiant. E.g., Catawba Indian Tribe v. South Carolina, 978 F.2d 1334, 1342 (4th Cir. 1992) (family members knowledgeable of family affairs; corporate officers knowledgeable of corporation).

[18] Winskunas v. Birnbaum, 23 F.3d 1264, 1268 (7th Cir. 1994).

[19] Randolph v. Collectramatic, Inc., 590 F.2d 844, 846 (10th Cir. 1979) accord Doddy v. Oxy USA, Inc., 101 F.3d 448, 460 (5th Cir. 1996). See Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), ALAB-950, 33 NRC 492, 500-01 (1991); Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), LBP-88-31, 28 NRC 652, 663 (1988) (non-experts may not re-analyze technical material submitted by an opponent).

[20] Sullivan v. Rowan Cos., 952 F.2d 141, 144 & n.6 (5th Cir. 1992).

[21] See Duplantis, 948 F.2d at 191. See also, e.g., Houston Lighting and Power Company (Allens Creek Nuclear Generating Station, Unit 1), LBP-81-34, 14 NRC 637, 669 (1981).

[22] United States v. Williams, 95 F.3d 723, 729 (8th Cir. 1996), cert. denied, 519 U.S. 1082 (1996) (citation omitted).

[23] Turkey Point, ALAB-950, 33 NRC at 501 n.5.

[24] Sullivan, 952 F.2d at 144-45.

expertise possessed by an expert is significant.[25] Moreover, the expert's education or experience must pertain particularly to the matter to which he or she testifies.[26]

The Commission has encouraged Boards to use the summary deposition process where the proponent of a contention has failed to establish that a genuine issue exists, so that evidentiary hearing time is not unnecessarily devoted to such issues.[27] The summary dispositions procedures "provide in reality as well as in theory, an efficacious means of avoiding unnecessary and possibly time-consuming hearings on demonstrably insubstantial issues ...."[28]

IV. DOMINION IS ENTITLED TO SUMMARY DISPOSITION OF CONTENTION EC 3.3.2

Dominion is entitled to summary disposition of Contention EC 3.3.2 because there remains no genuine issue as to any material fact relevant to the contention, for the following reasons:

- There is no striped bass population in the North Anna River between the Lake Anna Dam and the Fall Line, 25 river miles downstream of the Dam; and any striped bass that might be present further downstream during spring spawning runs would not be affected because of the cool water temperatures during the spring. Bolin Aff. at ¶¶15-18.

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[25] United States v. An Article of Drug, 661 F.2d 742, 745 (9th Cir. 1981).

[26] E.g., Eagleston v. Guido, 41 F.3d 865, 874 (2d Cir. 1994), cert. denied, 516 U.S. 808 (1995) (must embrace "specific body of scientific or technical expertise pertinent" to the issue in question).

[27] Statement of Policy on Conduct of Licensing Proceedings, CLI-81-8, 13 NRC 452, 457 (1981).

[28] Allens Creek, ALAB-590, 11 NRC 542, 550 (1980).

- There would be no thermal discharges from a fourth unit using dry cooling towers. Ryan Aff. at ¶19.

- Dominion's characterization of the thermal impact on striped bass as moderate is reasonable because the only important attribute of striped bass in Lake Anna is their contribution to recreational fishing, and recreational fishing would not be destabilized. Bolin Aff. at ¶¶25-30.

- Dominion's commitment to support development and stocking of an alternative fish like the Palmetto bass in Lake Anna precludes any significant impact on recreational fishing, thereby rendering moot the issue about whether striped bass will persist after a third unit starts operating. Bolin Aff. at ¶¶31-37. Where a contention is rendered moot by events occurring after its admission, summary disposition is warranted.[29]

A. There Is No Striped Bass Population in the North Anna River Downstream of The Dam That Would Be Affected By The Thermal Discharges from Additional Units

There is no genuine dispute associated with striped bass downstream of the Dam. Based on the historical habitat of striped bass and extensive monitoring performed since the Dam was built, striped bass do not inhabit the 25-mile stretch of the North Anna River between the Dam and the Fall Line. Bolin Aff. at ¶15. There is a small, 2-mile stretch of the North Anna River below the Fall Line that striped bass could conceivably reach during their spring spawning runs, but

[29] See Seabrook, CLI-92-8, 35 NRC at 154; Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-945, 33 NRC 175, 177 (1991).

the water temperatures during the spring are relatively cool and would not affect these fish. Id. at ¶17.

The natural habitat for striped bass is the open ocean, associated open water estuaries, and the tidal rivers that flow into estuaries. Id. at ¶¶7, 9, and 28. Striped bass enter the tidal freshwater portions of rivers to spawn in the spring, and then move back into the estuaries and ocean. Id. at ¶9. Along the East Coast, striped bass typically do not come upstream of the Fall Line between the Coastal Plain and the Piedmont regions. Id. at ¶13.

On the North Anna River, the Fall Line is about 25 river-miles downstream of the Dam. Id. Further, on the North Anna River, there are rock impediments at the Fall Line that prevent striped bass from moving upstream past that point. Id. Monitoring in the North Anna River for 30 years found only one striped bass, which was most likely a "wash-over" from Lake Anna, showing no evidence of a striped bass population or viable striped bass fishery in the North Anna River between the Dam and the Fall Line. Id. at ¶15. Also, consistent with the in-river monitoring, a study monitoring the regular release points from the Dam showed no striped bass passing downstream through the Dam. Id. at ¶16. Based on historical habitat and consistent with the results of monitoring, there is no evidence of a population of striped bass in the North Anna River between the Dam and the Fall Line.

There is a small stretch of the North Anna River (about 2 river-miles in length) below the Fall Line, before it joins the South Anna River to form the Pamunkey River.[30] Id. at ¶17. It is

[30] The North Anna and South Anna join to form the Pamunkey River, approximately 27 miles below the Lake Anna Dam. The Pamunkey River flows on a generally southeasterly course for another 98.4 miles until it is joined by the Mattaponi River, at West Point, Virginia, to form the York River. The York River flows into the Chesapeake Bay, about 15 miles north of Hampton, Virginia.

possible that some striped bass might reach this small stretch of the North Anna river during their spring spawning runs. Id. The thermal discharge from additional units would not affect striped bass that might be found below the Fall Line in the spring, because the temperature of water released from Lake Anna in the spring is on the order of 65 °F (well within the thermal tolerance of the striped bass), river flow is at its maximum, and any striped bass in the river are far downstream. Id.

The Intervenors have never alleged that striped bass inhabit the North Anna River downstream of the Dam, and as previously discussed, the Board ruled that Intervenors raised a genuine issue only with regard to "the adverse thermal impacts on the striped bass population of Lake Anna." LBP-04-18, 60 NRC at 271. Further, when Intervenors proffered their contentions, they described the fishery in the North Anna River below the Dam as including primarily "largemouth bass, smallmouth bass, and redbreast sunfish," and made no mention of striped bass. Intervenors' Contentions at 33. For all these reasons, Intervenors have effectively admitted that there is no striped bass population in the North Anna River downstream of the Dam that would be affected by the thermal discharge from additional units.

In sum, there is no striped bass population or fishery downstream of the Dam that would be impacted by thermal discharges from additional units. The analysis in Dominion's ER is therefore adequate with regard to any thermal impacts on striped bass downstream of Lake Anna.

B. There Can Be No Thermal Impact from The Fourth Unit As Proposed Because Dry Cooling Towers Result in No Thermal Discharge to Lake Anna

There is no genuine dispute associated with the thermal impacts from the fourth unit, because Dominion has revised its proposal for the fourth unit to use dry cooling towers. ER at 3-3-

57. Dry cooling towers result in no increase in lake temperature because there is no thermal discharge to Lake Anna. Ryan Aff. at ¶7. Because there would be no potential for increased water temperature from the fourth unit as proposed, there can be no adverse impact from a fourth unit on striped bass. The analysis in the ER is therefore adequate with regard to impacts on striped bass in Lake Anna from operation of a fourth unit with dry cooling towers.

C. Dominion's ER Reasonably Described the Thermal Impact on Striped Bass in Lake Anna As Moderate, Because It Would Not Destabilize Recreational Fishing

Dominion's ER states that the impact on striped bass from increased thermal discharges from a third unit would be moderate and could warrant mitigation. Bolin Aff. at ¶25, citing the ER at 3-5-69. An impact is described as moderate if the environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource. Id., citing the ER at 3-7-32. Dominion's characterization of the thermal impact on striped bass is reasonable, because the only important attribute of striped bass in Lake Anna is the contribution to recreational fishing, and recreational fishing would not be destabilized.

Intervenors contend that, with additional units' thermal discharges to Lake Anna, the surface temperature of the reservoir would be above the preferred temperature range for striped bass more of the time causing the striped bass not to feed normally, perhaps jeopardizing the entire striped bass fishery. Intervenors' Contentions at 34-35. At the pre-hearing conference, counsel for Intervenors stated that the dispute is not about the facts of Dominion's application; "what our dispute centers on here is not so much the factual information that is presented about the impacts but Dominion's characterizations of those impacts." Pre-hearing Conference Transcript (June 22, 2004) at 242-243.

Considering that striped bass have survived in other Southeast reservoirs and have shown the ability to find cooler refuges and survive the stress arising from short-term temperature increases, it is reasonable to presume striped bass will persist. Bolin Aff. at ¶24. Surface temperatures in Lake Anna seasonally exceed the preferred temperature range for adult striped bass and these fish seek deeper, cooler water or cool tributaries in which to pass the summer. Id. It is reasonable that striped bass will continue to find cooler refuges even after Unit 3 commences operations. When the cool water becomes less available in late summer, research in southeastern reservoirs shows that the striped bass can tolerate higher temperatures for a month or more before die-offs begin to occur. Id. Nevertheless, the modeling performed by Dominion to estimate the projected conditions for Lake Anna does not preclude the possibility of habitat restrictions and die-offs. Ryan Aff. at ¶18; Bolin Aff. at ¶24.

In considering the significance of the impact on striped bass, it is necessary to determine what are the important attributes of that resource, and how those attributes will be affected. Striped bass exist in Lake Anna only because they are stocked by the VDGIF to support recreational fishing. Bolin Aff. at ¶11. Striped bass cannot reproduce in Lake Anna or its tributaries; therefore, their existence in Lake Anna depends entirely on the stocking for recreational fishing. Id. Striped bass are not a threatened, endangered, or otherwise protected species. In fact, they are quite common. Id. at ¶8. Survival of striped bass in Lake Anna is not important to protect or preserve this species. Id. Thus, the only important attribute of striped bass in Lake Anna is their contribution to the value of the recreational fishery. Id. at ¶26. In essence, the magnitude of the environmental impact resulting from the thermal effect on striped bass is determined by the magnitude of the effect on recreational fishing.

Lake Anna contains a number of fish that support recreational fishing. They include the largemouth bass, striped bass, and black crappie, and to a lesser extent, bluegill, white perch, channel catfish and walleye. Id. at ¶27. Largemouth bass is the most sought species, pursued by about 69% of the anglers. Id. at ¶29. Striped bass is sought by only about 15% of the anglers. Id. Black crappie is the fish most frequently caught. Id. Striped bass increase the recreational fishing value of Lake Anna because unlike largemouth bass that prefer sheltered shore areas, striped bass are an open water fish, and they are often trophy size. Id. at ¶28. They are therefore stocked to supplement the recreational fishing opportunities at Lake Anna.

In sum, striped bass is only one of a number of species that support recreational fishing, and is not the fish that is most sought after or most frequently caught. The species other than striped bass are warm water fish that would be little affected by the temperature increase. Id. at ¶30. As noted in the ER, other southern reservoirs with higher water temperatures than projected for Lake Anna with an additional unit support thriving fisheries of these species, and the Mount Storm reservoir in West Virginia includes a hybrid striped bass. Id. Therefore, while an impact on striped bass would noticeably affect the recreational fishery (if not mitigated), it certainly would not destabilize it. Id. Therefore, the characterization of the impact in Dominion's ER is reasonable.

D. Persistence of Striped Bass If A Third Unit Is Added Is No Longer A Material Issue Because Palmetto Bass Would Provide an Equivalent Recreational Fishery

While the ER's characterization of the impact on striped bass is reasonable for the reasons stated above, any issue concerning the persistence of the striped bass has been mooted by subsequent commitments to support the development and stocking of an alternative fish. Accordingly, whether the striped bass would persist is no longer a material issue.

As stated in the ER, Dominion has recognized that the effect on striped bass could warrant mitigation. Id. at ¶25, citing ER at 3-5-69. To resolve the VDGIF's concerns that formed the basis for the Intervenors' contention, Dominion has committed to actions to provide an alternative fish with tolerance to higher temperatures that would provide equivalent recreational fishing value, such as the Palmetto bass. Id. at ¶31. In correspondence with VDGIF, Dominion has committed that if Dominion receives approval and decides to construct an additional nuclear unit at the North Anna ESP site, Dominion will work with VDGIF to support a healthy and viable Lake Anna fishery and to assist in maintaining the successful recreational fishing venue. Id. The commitment includes providing financial assistance to aid in the development and stocking of a more thermally tolerant fish, like Palmetto bass or such other fish as VDGIF reasonably determines is most suitable to maintain an equally viable and enjoyable recreational fishery. Id. This commitment mitigates any impact on recreational fishing.

The recreational value provided by Palmetto bass is at least as good as striped bass. Id. at ¶32. Palmetto bass are similar to striped bass in appearance and habits (i.e., they are both open water fish), but are more tolerant of higher temperatures and tend to grow faster. Id. at ¶33. Palmetto bass currently thrive in southern reservoirs where the average water temperatures exceed the maximums predicted for Lake Anna. Id. at ¶34. Because the size of striped bass in Lake Anna under current conditions is already limited, Palmetto bass would likely grow as large as, or larger than, as striped bass currently do in Lake Anna. Id. at ¶33. Because VDGIF can stock an alternate fish and get the same, if not superior, recreational fishing value, the impact of increased temperature on the striped bass is not material.

Summary disposition of EC 3.3.2 is appropriate because there no longer exists a genuine dispute concerning any facts material to the foregoing matters. The Dominion commitment renders moot the issue raised in EC 3.3.2 by ensuring that, even if striped bass do not persist, an alternate fish will be stocked that has equivalent recreational fishing value.

V. CONCLUSION

For the forgoing reasons, the Board should grant the Applicant summary disposition with respect to the issues raised in Contention EC 3.3.2. In accordance with 10 C.F.R. § 2.323(b), counsel for Dominion has discussed this motion with counsel for the other parties in this proceeding in an attempt to resolve this issue.

Respectfully submitted,

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Dated April 22, 2005

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STATEMENT OF MATERIAL FACTS ON WHICH NO GENUINE DISPUTE EXISTS

Dominion Nuclear North Anna, LLC ("Dominion") submits, in support of its Motion for Summary Disposition of EC 3.3.2, this Statement of Material Facts as to which the Applicant contends that there is no genuine issue to be heard.

1. Dominion's Environmental Report ("ER") stated that thermal impacts on striped bass would be moderate and could warrant mitigation. ER at 3-5-69.

2. There is no striped bass population in the North Anna River downstream of the Dam that could be impacted by thermal discharges from additional nuclear units. Therefore, there would be no adverse impact on striped bass in the North Anna River from increased water temperature.

3. Dominion's application specifies dry cooling as the proposed cooling system for a fourth unit. Dry cooling towers result in no thermal discharge to Lake Anna. Therefore, there would be no potential for increased water temperature from the fourth unit as proposed.

4. Striped bass are non-indigenous to and do not reproduce in Lake Anna. Striped bass exist in Lake Anna only because they are stocked by the Virginia Department

of Game and Inland Fishes ("VDGIF") to provide opportunities for recreational fishing.

5. Dominion has performed thermal modeling of Lake Anna including an analysis considering the addition of Unit 3 with once through cooling. Dominion's ER states that the heat from a third unit could force striped bass up-lake in the summer and early fall, with an associated loss of growth, and that being confined to marginal habitat in the late summer could cause the striped bass to cease feeding. ER at 3-5-69.

6. The ER does not preclude the possibility of striped bass die-offs.

7. The only significance of the striped bass stocked in Lake Anna is its contribution to recreational fishing.

8. Lake Anna contains a number of fish that support recreational fishing. They include the largemouth bass, striped bass, and black crappie, and to a lesser extent, bluegill, white perch, channel catfish and walleye. Largemouth bass is the most sought species, pursued by about 69% of the anglers. Striped bass is sought by only about 15% of the anglers. Black crappie is the fish most frequently caught.

9. A loss of striped bass would not destabilize the recreational fishing in Lake Anna.

10. In other southern reservoirs, a hybrid referred to as the Palmetto bass, produced by crossing striped bass with white bass, has demonstrated adequate tolerance for higher temperatures and provides a popular recreational fishing opportunity equivalent to striped bass.

11. Dominion has committed that, in the event Dominion receives approval and decides to build an additional unit, it will assist VDGIF in developing and stocking Lake Anna with an alternate fish that provides an equivalent, if not superior, recreational fishing opportunity, such as Palmetto bass.

12. This commitment mitigates any impact on recreational fishing opportunities in Lake Anna.

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
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

CERTIFICATE OF SERVICE

I hereby certify that copies of "Dominion's Motion For Summary Disposition – Contention EC 3.3.2 – Impacts On Striped Bass In Lake Anna" were served on the persons listed below by deposit in the U.S. mail, first class, postage prepaid, and where indicated by an asterisk by electronic mail, this 22nd day of April, 2005.

*Administrative Judge
Alex S. Karlin, Chair
Atomic Safety and Licensing Board
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
ASK2@nrc.gov

*Administrative Judge
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5207 Creedmoor Road
Raleigh, NC 27612
TSE@nrc.gov
elleman@eos.ncsu.edu

*Administrative Judge
Dr. Richard F. Cole
Atomic Safety and Licensing Board
Mail Stop T-3 F23
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Washington, D.C. 20555-0001
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Atomic Safety and Licensing Board Panel
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

*Secretary
Att'n: Rulemakings and Adjudications Staff
Mail Stop O-16 C1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
secy@nrc.gov, hearingdocket@nrc.gov

Office of Commission Appellate Adjudication
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Washington, DC 20555-0001
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Robert B. Haemer

April 21, 2005

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**
	)	
(Early Site Permit for North Anna ESP Site)	)	**ASLBP No. 04-822-02-ESP**

AFFIDAVIT OF JOHN WILLIAM BOLIN, III IN SUPPORT OF DOMINION'S MOTION FOR SUMMARY DISPOSITION OF CONTENTION EC 3.3.2

County of Henrico)
) ss.
Commonwealth of Virginia)

I, John William Bolin, III, being duly sworn according to law, depose and say as follows.

BACKGROUND

1. My name is John William Bolin, III. I am the Manager, Environmental Biology, for Dominion Resources Services, Inc. My business address is 4111 Castlewood Road, Richmond, VA 23234.

2. I have a B.S. degree in Biology and Chemistry from the University of Alabama and pursued postgraduate studies with a general ecology emphasis at the University of Alabama. I have been employed at Dominion Virginia Power and then Dominion Resources Services, Inc. for nearly 33 years starting as the first Station Biologist and have been supervising aquatic and terrestrial monitoring for nearly all of those years. In addition to my professional qualifications, I am an avid outdoorsman having recreational sport-fished and hunted for better than 55 years. My father was also an avid fisherman and hunter and installed these virtues in me at a very early

age. Some of my fondest early childhood memories are of the whole family on fishing trips. I have fished for virtually all types of freshwater and saltwater fish in most all of the continental states. I also have helped to resurrect stressed fishing communities in both my professional and private life. I think these early beginnings probably resulted in my ultimate career choice.

3. I am past chair of two industry task-forces: (1) the Edison Electric Institute's Biologist's Task Force which has as its membership some 1200 industry biologists, and (2) the Avian Powerline Interaction Committee, which has as its membership biologists from 21 utilities worldwide, the United States Fish and Wildlife Service, and the Audubon Society. I am also currently serving as a member of the mid-Atlantic U.S. Fish and Wildlife Foundation Board, Friends of the Riverfront-Chesterfield County Board, Flora of Virginia Board, Governor's Invasive Species Technical Advisory Board, and The Important Birding Areas of Virginia, Technical Advisory Committee.

4. I am familiar with the application of Dominion Nuclear North Anna, LLC ("Dominion") for an Early Site Permit ("ESP") at the North Anna ESP site. I have been assisting with the preparation of Dominion's ESP application and its assessment of the potential environmental impacts at the North Anna site since 2002. I have participated in or supervised the environmental monitoring and sampling programs for the North Anna Power Station, including Lake Anna since before the start of operations of the two existing units. I am familiar with and have direct personal knowledge of the environmental monitoring of Lake Anna. I am also familiar with and supervised the environmental monitoring of the nearby reservoir associated with Dominion Virginia Power's Mount Storm power plant.

5. I have been directly responsible for the annual ecological studies of Lake Anna since 1987 and have been involved with the studies since 1973. In addition, I have also been directly responsible for the aquatic temperature monitoring of Lake Anna since 1977. All of these activities have resulted in the development of an understanding of the ecology of Lake Anna and how all of the "components," including the striped bass, affect each other both independently and synergistically.

6. I am providing this affidavit in support of Dominion's motion for summary disposition of Contention EC 3.3.2. My affidavit explains the impacts of the proposed reactors on the striped bass at Lake Anna and downstream arising from the water temperature increases predicted for operation of a third unit at North Anna Power Station. I have personal knowledge of the matters stated herein and believe them to be true and correct.

STRIPED BASS ARE STOCKED IN LAKE ANNA TO PROVIDE A RECREATIONAL FISHERY

7. Striped bass or rockfish (*Morone saxatilis*) is an anadromous species of fish, *i.e.* they spend most of their adult lives in the estuaries and oceans and, when sexually mature, they make spring spawning runs up into the tidal, freshwater reaches of rivers and other tributaries along the East Coast to reproduce. In the 1890's they were introduced to the West Coast and now are found along the coasts of Washington, Oregon and California. They need long stretches of flowing water downstream from the spawning sites for the eggs to float and mature and larvae to hatch at just the right place where food is readily available to the hatchlings.

8. Striped bass are not a threatened, endangered, or otherwise protected species. In fact, they are quite common. Survival of striped bass in Lake Anna is not important to protect or pre-

serve this species. They are commonly found in their natural habitat up and down the East and West Coasts.

9. Striped bass are naturally found in estuaries and even out into the ocean. They typically are found in areas where large schools of baitfish, such as menhaden, congregate. They can also be found around underwater obstructions which 'hold' baitfish such as bridge pilings made of rocks, hence their second common name – "rockfish." They are an anadromous fish which means they make a spring spawning run up into the tributaries along the entire East and West Coasts. Once they spawn, they then move back into the estuaries and the ocean.

10. When a couple of dams on the East Coast in the late 40's – early 50's were completed and impounded, several spring runs of striped bass were unintentionally captured in the newly impounded reservoirs. What was learned was that these fish could in fact survive in these fresh-water environs. Based on these observations, fisheries resource managers started to introduce striped bass into places where they would never have even dreamed of being before, especially in large freshwater impoundments. They have proven to be a valuable recreational fishery resources in spite of the fact that very often their 'living' requirements in certain seasons of the year are restricted and quite often they cannot reproduce.

11. Striped bass exist in Lake Anna only because they are stocked by the Virginia Department of Game and Inland Fisheries ("VDGIF") to support recreational fishing. They cannot reproduce in Lake Anna. Their spawning must be supported by flowing water in streams or estuaries. Streams, including the North Anna River, that flow into Lake Anna lack the flow, depth and length to support striped bass spawning runs.

12. As a result of there being no natural reproduction of striped bass in Lake Anna and very often stressed living conditions, the management calls for annual stocking of fingerlings. Stocking rates are largely dependent on total surface area of a lake. The stocking rate in Lake Anna varies from year to year and, to my knowledge, has been as low as 5 fish/surface acre and as high as around 30 fish/surface acre. This stocking rate equates to a range of some 45,000 fish to some 300,000 fish per year.

13. Striped bass would not exist in Lake Anna if they were not stocked. Striped bass spawning runs do not typically extend past the "Fall Line" where the relatively flat Atlantic Coastal Plain Physiographic Province transitions to the rocky Piedmont Physiographic Province. The Fall Line is just west of U.S. Route 1, about 25 river-miles downstream of the Dam. On the North Anna River, there are some severe rock impediments at the Fall Line that prevent anadromous fish from moving upstream past that point.

14. Since it was impounded, Lake Anna has become a popular recreational fishing destination, with the majority of fishermen seeking largemouth bass. To supplement the largemouth bass fishing opportunity, VDGIF stocks striped bass. They were first stocked in Lake Anna in 1972 and are stocked each year as fingerlings. As described above, they are stocked into Lake Anna, as well as many other reservoirs nationwide where there is adequate forage, strictly as a recreational resource. They grow quickly, are fairly easy for anglers to catch, offer an excellent fight on hook and line, and are excellent table fare.

THERE IS NO STRIPED BASS POPULATION OR FISHERY IN THE NORTH ANNA RIVER THAT WOULD BE AFFECTED BY THERMAL DISCHARGES

15. There is no striped bass population or fishery in the North Anna River between the Dam and the Fall Line, about 25 river-miles downstream of the Dam. As previously stated, there are

some severe rock impediments at the Fall Line that prevent striped bass from moving upstream past that point from their natural habitat in the Chesapeake Bay and estuaries, or from the tidally-affected portions of rivers in the Atlantic Coastal Plain during their spring spawning runs. We have monitored the fish in the North Anna River between the Dam and the Fall line for over thirty years. In that period, we have collected only one striped bass. Because the Fall Line obstructs upstream passage, it is my opinion that the solitary striped bass collected in the thirty years of monitoring of the North Anna River was a 'wash-over' from Lake Anna.

16. In addition, in the 1980's, when the hydroelectric generators were added to the Dam, we collected fish passing out of Lake Anna through the regular release points of the Dam at intervals over a two-year period. Preoperational sampling was initiated in November 1986 and continued until August 1987. Sixteen 24-hour samples were taken over this period; five fish were collected and none were striped bass. After the hydroelectric generators commenced operation, additional sampling was conducted from September 1987 to August 1988. Thirty-two 24-hour samples were collected; twenty more fish were collected and none of these were striped bass. This indicates that fish in Lake Anna avoid the area of the Dam's influence and that wash-over of striped bass into the North Anna River is very rare.

17. There is a small stretch of the North Anna River (about 2 river miles in length) below the Fall Line, before it joins the South Anna River to form the Pamunkey River. As previously stated, striped bass enter the tidal, freshwater portions of rivers to spawn in the spring. It is therefore possible that some striped bass might reach this small stretch of the North Anna river

during their spring spawning runs, though most striped bass spawning in the York watershed[1] would be found in the York River and lower reaches of the Pamunkey River. The thermal discharge from additional units would not affect striped bass that might be found below the Fall Line in the spring, because the temperature of water released from Lake Anna in the spring is on the order of 65 °F (well within the thermal tolerance of the striped bass), river flow is at its maximum, and any striped bass in the river are far downstream.

18. Therefore, based on the nature of striped bass, the study that was completed, and the monitoring in the North Anna River, there is no striped bass population or fishery in the North Anna River below the Dam that can be impacted by discharges from the Dam.

THE THERMAL IMPACT FROM ADDITIONAL UNITS ON STRIPED BASS IS REASONABLY CHARACTERIZED AS MODERATE

19. Lake Anna is currently a viable habitat for striped bass. We have noted in all our studies, as well as those of the game commission, that striped bass in Lake Anna grow very quickly when they are young (up to age 5), often exceeding the normal growth rates for striped bass as noted in the literature, but once they reach a certain size, about 7-10 pounds, their growth rate slows down. This slowdown is presumably because in the summer their preferred living habitat in Lake Anna is reduced and they do not forage as actively. Their preferred living space is reduced in the summer because of areas of high water temperatures and low dissolved oxygen. At high temperatures in summer more energy is expended in basic metabolism and less energy is avail-

[1] The North Anna and South Anna join to form the Pamunkey River, approximately 27 river miles below the Lake Anna Dam. The Pamunkey River flows on a generally southeasterly course for another 98.4 river miles until it is joined by the Mattaponi River, at West Point, Virginia, to form the York River. The York River flows into the Chesapeake Bay, about 15 miles north of Hampton Virginia.

able for growth. This effect is not uncommon in reservoirs throughout the South that have been stocked with striped bass.

20. Since 1972, Dominion has performed quarterly ecological surveys on Lake Anna and the North Anna River. The surveys on Lake Anna include electro-fishing at 9 stations and gill-netting at 6 stations. In addition to our work, the VDGIF does routine monitoring using the same methods. We submit an annual report to the Virginia Department of Environmental Quality and the VDGIF produces an internal annual report. Periodically, VDGIF also conducts a Creel Census of anglers to use as a gauge of the 'health' of the lake. The 2003 creel showed that the number of striped bass caught in Lake Anna exceeded most of the other reservoirs in the state.

21. In addition to our ongoing studies of Lake Anna for over 30 years discussed above, Dominion also funded several graduate student studies to further understand the summer habitat for striped bass in Lake Anna. One of these studies involved placing radio tags in striped bass and tracking their movements thus gaining an understanding of the fish and their movements. Once we had that understanding, we funded a second graduate study to determine if there was proper forage available to the striped bass in the summer months in their preferred living zone.

22. The monitoring data indicate that striped bass in Lake Anna are healthy and are available for anglers. In a nutshell, the data show that the striped bass in Lake Anna exceed the published growth rates until they reach about age 5 and then the growth rate slows down. The data also show that most of the fish move downlake in the fall and winter where there is abundant forage and then uplake in the spring and summer, again generally following the schools of forage fish and their preferred temperature range. Also, there is apparently a fairly stable cohort of fish that

occupies the area around the 'splits' (confluence of Pamunkey Stream and North Anna River arms of Lake Anna) year-round.

23. No die-offs of striped bass in Lake Anna have been reported, even during the recent drought, when lake temperatures reached as high as 93.2 °F. In July 1993, about three dozen striped bass were trapped in the Waste Heat Treatment Facility and perished after three weeks of hot, dry weather with both units operating over 90%. However, no die-offs have been reported in Lake Anna itself.

24. I have reviewed and am familiar with the temperature increases that are projected in Dominion's Environmental Report that may result if additional units were constructed at the ESP site using Dominion's base case assumptions described in Dominion's ESP application. Experience shows that striped bass have an ability to survive the stress arising from short-term increased water temperature. Striped bass at other Southern lakes and reservoirs often find cooler refuges, even in drought years. Surface temperatures in Lake Anna seasonally exceed the preferred temperature range for adult striped bass and these fish seek deeper, cooler water or cool tributaries in which to pass the summer. I expect striped bass will continue to find cooler refuges even after Unit 3 commences operations. This is a common phenomena at all Southern reservoirs where striped bass have been stocked as a recreational resource, and they continue to persist and provide angling opportunities. When the cool water becomes less available in late summer, research in southeastern reservoirs shows that the striped bass can tolerate higher temperatures for a month or more before die-offs begin to occur. For this reason and as described in the Dominion's Environmental Report ("ER") at page 3-5-69, it is my opinion that the most likely effects on striped bass will be a reduction in habitat during summer months, when they would be

forced to find refuge in the cooler upper portions of the lake, and an associated slowing in growth. However, die-offs are possible.

25. Section 5.3.2.2.2(c)(1) of the ER, which I helped prepare and which represents my opinion states that the impact on striped bass from increased thermal discharges from a third unit would be moderate and could warrant mitigation. ER at 3-5-69. An impact is described as moderate if the environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource. See, e.g., ER at 3-7-32.

26. The only important attribute of striped bass in Lake Anna is their contribution to recreational fishing. There is no commercial fishing in Lake Anna. As previously stated, the striped bass are present in Lake Anna only because they are stocked for recreational fishing.

27. Lake Anna contains a number of fish that support recreational fishing. They include the largemouth bass, striped bass, and black crappie, and to a lesser extent, bluegill, white perch, channel catfish and walleye.

28. Striped bass contribute to the Lake Anna recreational fishery resource because they are a more pelagic-type fish. As such, striped bass utilize the open areas of any water body as opposed to largemouth bass and other lake species which tend to be found along the near-shore areas. They are also attractive because they are often trophy size.

29. While a useful supplement to the lake species, striped bass are not essential to recreational fishing on Lake Anna. Largemouth bass are the most sought species, pursued by about 69% of the anglers. Striped bass are sought by only about 15% of the anglers. Black crappie are the fish most frequently caught.

30. In summary, striped bass are only one of a number of species that support recreational fishing, and are not the fish that is most sought after or most frequently caught. The species other than striped bass are warm water fish that would be little affected by the temperature increase. As explained in the ER, the Mount Storm Reservoir, which has higher water temperatures than projected for Lake Anna, supports thriving fisheries of these species, including hybrid striped bass. ER at 3-5-69. Many other southern reservoirs with temperatures in these ranges, including the Strom Thurmond reservoir, similarly support thriving recreational fisheries. Therefore, while an impact on striped bass would noticeably affect the recreational fishery (if not mitigated), it certainly would not destabilize it. Because the only significance of the thermal effects on striped bass is the impact on recreational fishing, it is my opinion that describing the impact on this stocked species as moderate is appropriate.

PALMETTO BASS WOULD PROVIDE AN EQUIVALENT RECREATIONAL FISHERY

31. As noted earlier in this affidavit, Dominion's ER states that the impact on striped bass could warrant mitigation. Because of the comments that Dominion received from the VDGIF that formed the basis for Intervenor's contentions, Dominion has discussed with the VDGIF mitigation measures that would resolve the VDGIF's concerns. As a result of these discussions, Dominion has committed to the VDGIF that if Dominion obtains approval and decides to construct and operate an additional nuclear unit at the North Anna site, it will work with the Department to support a healthy and viable Lake Anna fishery and to assist in maintaining its successful recreational fishing venue. Our commitment includes providing assistance to develop and stock a more thermally tolerant fish, such as a sterile white bass/striped bass hybrid, or such other fish as the Department reasonably determines to be the most suitable in maintaining an equally enjoyable environment. This commitment is made in a letter from Pamela Faggert, Do-

minion's Vice President and Chief Environmental Officer, to Gary Martel, Director, Fisheries, VDGIF, dated January 12, 2005, attached as Exhibit A hereto. I was personally involved in making and discussing this commitment with Mr. Martel.

32. Dominion's commitment identifies the sterile white bass/striped bass hybrid (commonly called the Palmetto bass) because it is an existing hybrid that could be stocked, is very similar to the striped bass and of equivalent value to recreational fishing, is more thermally tolerant than striped bass, and would be relatively unaffected by the projected temperature increases, and has been stocked very successfully in warm Southern Reservoirs. Based on my discussions with Mr. Martel, the Palmetto bass would be the expected replacement if Dominion were to proceed with the development of new units in the near term. There would possibly be a 'dual-fishery' of striped bass and Palmetto bass stocked in Lake Anna in addition to the existing and very successful largemouth bass and crappie fisheries.

33. Like striped bass, the Palmetto bass are more pelagic-type fish and utilize the open areas of any water body. Because the white bass (which is crossed with a striped bass to produce the Palmetto bass) are warm water fish, the Palmetto bass is more thermally tolerant than striped bass. The Palmetto bass tend to grow faster than the white bass, which in turn grow faster than the striped bass. Given that striped bass in Lake Anna do not grow as large as their open-ocean brethren, Palmetto bass would likely grow as large as the striped bass in Lake Anna currently do, or larger. The Palmetto bass are readily accessible to even the most novice fisherman and provide excellent hook-line resistance. They look similar to a striped bass but are thicker and more deep-bodied (football shaped).

34. The Palmetto bass has been used very successfully in many southern reservoirs and even river systems. For example, the Palmetto bass provide a successful fishery in the Mount Storm reservoir where surface temperatures average 93 °F to 96 °F in the summer, with peak temperatures of 98 to 99.5 °F in the vicinity of the outfalls. These conditions exceed those projected for Lake Anna with the additional units. Other Southeastern reservoirs maintain a successful Palmetto bass fishery and may be even warmer. The Southern Regional Aquaculture Center has reported that a temperature range of 4 to 33 °C (approximately 35 to 92 °F) is acceptable for the Palmetto bass.

35. Dominion's commitment does not restrict the replacement species to the Palmetto bass, because the fish to be stocked is properly the VDGIF's choice. Further, because an Early Site Permit would have a 20-year term, and therefore could be in effect for some time before construction of any new units, our commitment leaves to the VDGIF the selection of the fish that would be deemed the most suitable at the time. While the Palmetto bass currently are an attractive and available replacement, another species or hybrid may also emerge over the twenty-year life of the ESP that may be superior. For these reasons, Dominion has made a broad commitment to support the stocking of whatever fish the VDGIF determines at the time is most appropriate.

36. Dominion's commitment includes support for the development of a sterile Palmetto bass, if that is the VDGIF's choice of the fish to be introduced, to allay any concern that fish escaping the lake could interact with and dilute the native species in the Chesapeake Bay. It is also possible that the VDGIF could decide to stock a non-sterile hybrid if it were demonstrated that the hybrid would not be released to the Chesapeake. Such a demonstration may be possible, because over thirty years of monitoring has shown that striped bass passage out of Lake Anna toward the

Chesapeake is virtually non-existent. The same would be expected for the Palmetto bass, because Palmetto bass would behave similar to striped bass and avoid the areas of Lake Anna that lead to passage from the Dam. If an occasional non-sterile fish did find its way over the dam and down river to the Chesapeake, it would breed out (i.e., its progeny would revert to the native species within a few generations). Nevertheless, Dominion's commitment provides the necessary support for use of sterile hybrid if determined to be appropriate by the VDGIF.

37. VDGIF has responded favorably to Dominion's suggested alternative. The VDGIF's response, and a clarifying exchange of messages, are attached as Exhibit B hereto. The VDGIF has correctly pointed out that a readily available source of sterile hybrid bass has not been identified. Such a source does not currently exist because there is no current market demand for sterile Palmetto bass. However, processes to produce sterile hybrids have been developed for other fish, and I am aware of no impediment to developing a sterile Palmetto bass with the financial support that Dominion has committed to provide if additional units are constructed.

Further the affiant sayeth not.

John William Bolin, III

Sworn to before me this
20th day of April, 2005.
Crystal B Andrews
My Commission expires 3/31/09.
County of Henrico
State of Virginia

EXHIBIT A

Pamela F. Faggert
Vice President and Chief Environmental Officer
5000 Dominion Boulevard, Glen Allen, VA 23060
Phone: 804-273-3467

Dominion

January 12, 2005

Mr. Gary F. Martel
Director, Fisheries
Virginia Department of Game & Inland Fisheries
4010 West Broad Street
Richmond, VA 23230

Dear Mr. Martel:

You recently had several conversations with Bill Bolin of my staff regarding Dominion's application to the U.S. Nuclear Regulatory Commission (NRC) for an Early Site Permit at our North Anna Power Station site. As you know, this is a federal licensing action to obtain NRC's determination that the North Anna site is suitable for siting additional nuclear units. However, NRC issuance of an ESP would not constitute an approval to construct or operate new units; nor would it affect the need to obtain other environmental permits and other authorizations that would be required before any new units could be built and operated.

You had raised issues regarding the predicted increase in lake water temperature that would result from an additional unit and the potential impact on the lake's stocked striped bass population. To address your concern and to ensure that Lake Anna remains a healthy, viable fishery and a successful recreational venue, Dominion proposes the following commitment to the Department:

> If Dominion obtains approval and decides to construct and operate an additional nuclear unit at its North Anna site, the company will work with the Department to support a healthy and viable Lake Anna fishery and to assist in maintaining its successful recreational fishing venue. Our commitment includes providing financial assistance to aid in the development and stocking of a more thermally-tolerant species (such as a sterile white bass/striped bass hybrid), or such other species as the Department reasonably determines to be most suitable in maintaining an equally viable and enjoyable recreational fishery.

Please let us know whether this proposal is sufficient to resolve the Department's concerns, and if you have any questions regarding this statement or need additional information. Bill Bolin can be reached at 804-271-5304.

Sincerely,

Pamela F. Faggert

Pamela F. Faggert

Jwb642/sjb/word

DNNA 034811

EXHIBIT B

COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Department of Game and Inland Fisheries

William L. Woodfin, Jr.
Director

February 9, 2005

Ms. Pamela F. Faggert
Vice President & Chief Environmental Officer
Dominion Power
5000 Dominion Boulevard
Glen Allen, VA 23060

Dear Ms. Faggert:

Thank you for your letter of January 12. I have had my staff contact other states to review options for a thermally tolerant species to supplement and/or substitute for striped bass in Lake Anna. At this time, we have not been able to find a readily available source of sterile hybrid striped bass/white bass, nor have we been able to identify a replacement species that would substitute in a recreational fishery for striped bass. However, I do feel confident that with Dominion's commitment to the development of the sterile hybrid that we should be able to develop and utilize this option through either outside contracts or by utilizing facilities and staff within our department.

We are moving forward to begin either an internal or contractual development of hybrids and will work closely with Bill Bolin of your staff to coordinate such development. Again, thank you for getting in touch with us.

Sincerely,

Gary F. Martel
Director, Fisheries Division

GFM/fha

cc: J. W. Kauffman

DNNA 034861

Bill Bolin

To: Tony Banks/NUC/VANCPOWER@VANCPOWER

02/17/2005 02:15 PM

cc:

Subject: Re:

----- Forwarded by Bill Bolin/LR/FH/VANCPOWER on 02/17/2005 02:14 PM -----

"Gary Martel" <Gary.Martel@dgif.virginia.gov>

To: <Bill_Bolin@dom.com>

cc: "Charlie Sledd" <Charlie.Sledd@dgif.virginia.gov>, "John Kauffman" <John.Kauffman@dgif.virginia.gov>, "John Odenkirk" <John.Odenkirk@dgif.virginia.gov>

02/17/2005 12:06 PM

Subject: Re:

You are correct in pointing out that the sterile striped bass/white bass Hybrid is an acceptable replacement. I was not considering the hybrid as a species in my letter.

I would like to further point out that the standard non-sterile hybrid is actually preferable in the reservoir fishery, however there are significant concerns over possible out migration and genetic impact through breeding with the Chesapeake stocks. This is the reason that the sterile hybrid development is being evaluated. There has never been an evaluation of out migration of striped bass or hybrids from Lake Anna. Dominion may wish to consider this as an option if approved through ASMFC and the Chesapeake Bay Program, Living Resources Subcommittee.

Please contact me if I can provide further clarification or if other questions arise.

Gary

>>> <Bill_Bolin@dom.com> 02/17/05 10:19AM >>>
Gary ,

Your letter of February 9, 2005 to Dominion states "nor have we been able to identify a replacement species that would substitute in a recreational fishery for striped bass". As we discussed today, please confirm our understanding that this statement refers to replacement species other than

the hybrid white bass/striped bass (i.e. that a sterile hybrid white bass/striped bass would be considered a replacement species that could substitute in North Anna's recreational fishery for the striped bass). Your confirmation of this understanding in an email response to this message would be greatly appreciated. Could you respond with the "Reply with History" feature so that this message and your reply are kept together? Thanks

Bill

March 31, 2005

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**
	)	
(Early Site Permit for North Anna ESP Site)	)	**ASLBP No. 04-822-02-ESP**

PATRICK J. RYAN AFFIDAVIT IN SUPPORT OF
DOMINION'S MOTION FOR SUMMARY DISPOSITION OF CONTENTION EC 3.3.2

County of San Francisco)
) ss.
State of California)

I, Patrick J. Ryan, being duly sworn according to law, depose and say as follows:

BACKGROUND

1. My name is Patrick J. Ryan, Ph.D. I am Manager, Geotechnical and Hydraulic Engineering Services Group for Bechtel Corporation. My business address is 50 Beale St , San Francisco, CA 94105.

2. My professional and educational experience is summarized in the curriculum vitae attached to this affidavit. I hold a B.S. and M.S. in Civil Engineering from the University of Melbourne, Australia, and a Ph.D. in Civil Engineering from the Massachusetts Institute of Technology ("MIT"). I have over thirty years of professional experience in the analysis and studies of hydraulic and hydrologic engineering, including cooling pond studies for over a dozen projects. I am a licensed Civil Engineer in the State of California.

3. I am familiar with the Dominion's application for an Early Site Permit ("ESP") at the North Anna site. Bechtel Power Corporation, a subsidiary of Bechtel Corporation, is the Architect-Engineering firm retained by Dominion to assist with the preparation of the ESP application. I have been working on this project and assisting with the preparation of Dominion's ESP application assessment of the site selection and thermal modeling since 2002. I am familiar with and have direct personal knowledge of the thermal modeling of Lake Anna performed for this ESP application, and also participated in the development of the model that was used by MIT to support the licensing of the existing units at North Anna Power Station.

4. I am providing this affidavit in support of Dominion's motion for summary disposition of Contention EC 3.3.2. My affidavit explains the thermal modeling that has been performed to predict the increase in lake temperatures that would result from additional units. I have personal knowledge of the matters stated herein and believe them to be true and correct.

COOLING SCENARIO FOR GREATEST THERMAL DISCHARGE UNDER THE ASSUMPTIONS IN DOMINION'S ESP APPLICATION

5. To predict the maximum temperature increase that would result if additional units were constructed at the ESP site, the limiting scenario is that the existing Units 1 and 2 would continue to operate with their once-through cooling systems and that new Units 3 and 4 would operate with the cooling systems proposed in the application (referred to as the "base case").

6. Dominion's base case specifies that Unit 3 would employ a once-through cooling system using the North Anna Reservoir as the cooling water supply and the Waste Heat Treatment Facility as the primary heat sink for the normal plant cooling, and Unit 4 would employ a closed-cycle dry cooling system.

7. To maximize the thermal discharges under Dominion's base case, the model simulations assume all units to be operating continuously at full load. The Plant Parameter Envelope ("PPE") bounding values for summer conditions of the once-through circulating water flow rate of 2540 cubic feet per second ("cfs") and a condenser temperature rise of 18 °F, equivalent to 1.03×10^{10} Btu/hr of heat load, were used to define the waste heat discharge from the new Unit 3. The heat load from the existing units was modeled using their rated cooling water flow rate of 4246 cfs and condenser temperature rise of 14.1 °F, which represents approximately 1.35×10^{10} Btu/hr of heat load. Since the closed-cycle dry cooling tower system functions independently from the lake, no heat load from Unit 4 is included.

THERMAL MODELING OF LAKE ANNA

8. The Lake Anna Cooling Pond Model was used to predict the temperature increase that would result if additional units were constructed at the ESP Site. The Lake Anna Cooling Pond Model is a numerical model that simulates mathematically the heat transfer and mass transfer processes in the Waste Heat Treatment Facility and the North Anna Reservoir. The hydrothermal processes simulated include:

1. Heat gains and losses as driven by meteorological conditions and lake temperatures at the air-water interface,
2. Waste heat inputs from plant discharges to the lake, and
3. Forced circulation in the lake induced by the cooling water intake flow at upper end of the North Anna Reservoir and discharge flow via the Waste Heat Treatment Facility to the Lake near the Dam.

The model predicts daily average water temperature variation in the Lake in response to changes in daily average air temperature, relative humidity, wind speed, solar radiation, cloud cover,

cooling water intake flow, and waste heat load released from the plant to the cooling pond system.

9. To predict the temperature increase that would result if additional units were constructed at the ESP site, I supervised the performance of long-term model simulations using 42 years (January 1961 to May 2003) of historical meteorological data from Richmond Airport, and reviewed the results. The predicted daily average lake water temperature from the 42 years of model simulations were used to assess the temperature increase in the North Anna Reservoir and the Waste Heat Treatment Facility due to the addition of Units 3 and 4.

10. The model was calibrated using historical data from 1996 to 2001. These data include the meteorological data from Richmond Airport, observed lake temperature at 4 locations, and the cooling water discharge flow rate and heat content from the operation records of Units 1 and 2.

11. The goal of calibration is to improve the ability of the model to represent the real system by adjusting one or more selected model parameters that cannot be measured directly. With the North Anna Cooling Pond Model, my team's goal for the calibration was to minimize the mean error between the predicted and observed surface temperature in the lake at 4 locations, chosen as diagnostic control points: the discharge channel, Dike 3 on the Waste Heat Treatment Facility side of the discharge to the Lake, Burrus Point, and the intake. Only one factor, the wind adjustment factor (the factor that governs the evaporative flux, a major component of the heat losses at the air-water interface), was adjusted. The evaporation equation incorporated in the MIT model was developed as part of my thesis work at MIT with the specific intent of accounting for buoyancy effects above the cooling pond surface on the mass transfer (evaporation) at the water/air interface. The equation works well for heavily loaded cooling ponds (~ 1 Mwe /acre),

but tends to overestimate evaporation on ponds with lower heat loads, and "wind adjustment factors" in the range of 0.75 have typically been used. Even with the addition of Unit 3, and allowing for ineffective lake surface area, the heat load on Lake Anna is less than 0.5 Mwe/acre, and hence it is reasonable to expect a wind adjustment factor in the 0.75 to 1.0 range. This is the only calibration factor used in the model..

The model was considered calibrated when the mean errors of the daily surface temperature, defined as the mean of the differences between daily predicted temperature minus the corresponding observed temperature, at the 4 control points, were minimized while varying the wind adjustment factor within a reasonable range. The best results were obtained for a wind adjustment factor of 0.75 in the WHTF and 0.85 in Lake Anna, which is in line with historical values.

12. The mean error produced by the calibrated model varied from – 0.4 °F at Burrus Point to 1.1 °F at the discharge channel. The standard deviation was in the range of 1.5 °F to 2.0 °F. Graphical comparisons of the model predictions and observations were made, which demonstrated that the model accurately captures the seasonal variation of the surface temperature at the four control points. The peak temperature was also modeled with excellent overall accuracy. Therefore, I concluded that the model can be used to reliably predict the thermal impact of the new units.

13. In addition to being calibrated, the model was validated. The calibrated model as described above was validated for another time period, 1978 to 1983. The goal of validation is to exercise the model over a different time period with different meteorological conditions to assess the model's predictive ability. The wind adjustment factors were not changed during the validation process.

14. The model was validated using Richmond Airport meteorological data and the plant's operating data of 1978 to 1983 to simulate the lake temperature changes. As in the model calibration, the predicted daily surface temperature was compared with observations of the same period at the four diagnostic control points. The mean error was found to vary from 0.8 °F at Burrus Point to 1.7 °F at the discharge canal, i.e. the model tends to slightly overpredict the lake temperatures. The standard deviation is in the range of 1.3 °F to 2.4 °F. These are very reasonable agreements between the prediction and observations, and give me confidence the model can be used as a prediction tool to evaluate the thermal impact of the new units.

TEMPERATURE INCREASES IN LAKE ANNA PREDICTED FOR THE ADDITION OF THE THIRD UNIT UNDER DOMINION'S BASE CASE ASSUMPTIONS

15. Based on 42 years of model simulation, the average temperature increase in Lake Anna due to Unit 3 was predicted to vary from 6 °F at Dike 3 on the Waste Heat Treatment Facility side, 5.4 °F near the Dam, 5.2 °F near Burrus Point, 5 °F near Thurman Island, and 4.5 °F near the intake. The temperature at the intake is considered to be representative of mid-lake conditions, while the temperature at Burrus Point is considered representative of the lower lake. Average annual surface temperatures would range from 70.5 to 74 °F. The average surface temperature of the lake in the summer months (July and August) would be about 90 °F. The surface temperature in the intake area (representative of mid-lake conditions) is projected to exceed 90 °F eight days a year on average, in the July to September period.

16. Based on 42 years of model simulation, the maximum surface temperature in the lake due to the addition of the third unit is predicted to vary from 97 °F at the Dam, 96 °F near Burrus Point, 95.1 °F near Thurman Island, and 94 °F near the intake. This represents an increase due to Unit 3 of 2.8 F near the intake and 3.8 F at Burrus Point. These maximum surface temperatures will not

occur every year. For example, the model predicts that 95 °F would be exceeded in the Burrus Point area (representative of lower lake conditions) only one year out of 42, and only in six days of that year. In any given year, the maximum surface temperature typically occurs for a few weeks in either the month of July or August. These maximum surface temperatures represent maximums that occurred in a particular year out of the entire 42-year period simulated by the Lake Anna Cooling Pond Model. Values for other years will be less.

17. Vertical temperature profiles measured in Lake Anna, with Units 1&2 operating, indicate relatively well mixed conditions (< 4 °F stratification between surface and bottom) in the Fall and Winter, with average temperature profiles showing stratification of approximately 10 °F developing in the Spring, and increasing in the Summer to approximately 20 °F. near the Dam. Peak temperatures indicate an additional stratification of 5-10 °F (i.e., the temperature can be 25-30 °F cooler at the bottom of the lake near the dam when the surface temperature is at its peak). Temperature monitoring results of Lake Anna show only a slight decrease in temperature of about 3 °F from the surface over the first 28 feet of depth. The temperature profiles near the Dam and near the intake are shown in Figures 5.3-3 and 5.3-4 of Dominion's Environmental Report.

18. The model reproduces these stratification phenomena reasonably well, albeit with a slightly lower stratification (8-13 °F versus the 10-20 °F in average temperature stratification observed in the Spring and Summer). The model develops a uniform temperature prediction for the first 28 feet of depth. Because temperature monitoring results show a relatively small decrease in temperature for the first 28 feet, this approximation is satisfactory, but the actual temperatures will tend to vary from the predicted uniform temperature in the first 28 feet of depth and will tend to be up to a few degrees less than predicted. There will typically be quite a good match near the

surface, but the actual temperatures will tend to be less than the predicted temperatures at a depth of about 28 ft. Although the model is well-calibrated, it tends to slightly overpredict average temperature; therefore, the predicted temperature is not the mean between the actual surface temperature and the actual temperature at 28 feet, but is probably closer to the actual surface temperature and greater than actual temperature in the 14 to 28 foot depth range. I conclude the predicted temperature is bounding to the temperature of the striped bass habitat. The model indicates that the addition of Unit 3 will reduce the level of stratification in the Summer, primarily by increasing the temperature of the deeper waters. This is physically reasonable, due to the higher level of mixing expected in the discharge to the Lake through Dike 3.

NO IMPACT ON LAKE TEMPERATURE FROM A FOURTH UNIT UNDER DOMINION'S BASE CASE ASSUMPTION

19. Unit 4, using a dry cooling system, would have no thermal impacts on Lake Anna.

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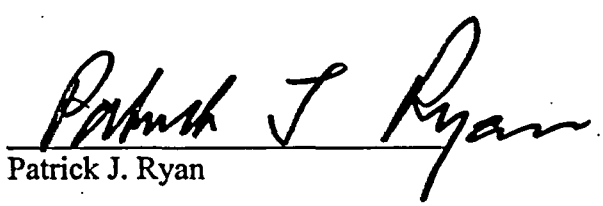

Patrick J. Ryan

JURAT

State of: CALIFORNIA)
) S. S.
County of: SAN FRANCISCO)

Patrick Ryan, subscribed and sworn (affirmed) to before me on the 31st day of March 2005.

Toni Tranter

Toni Tranter

NOTARY SEAL

PATRICK J. RYAN — **MANAGER, GEOTECHNICAL & HYDRAULIC ENGINEERING SERVICES**

EDUCATION:

B.S., Civil Engineering
University of Melbourne, Australia, 1963

M.S., Civil Engineering
University of Melbourne, Australia, 1968

Ph.D., Civil Engineering Massachusetts Institute of Technology, 1973

SUMMARY:

30 Years: Waste and Heat disposal studies, including design and analysis of cooling ponds, spray canals and outfalls, design and review of coastal protection works, analysis and modeling of surface and ground water flows and contaminant transport.

1 Year : Deep water marine pipeline study.

6 Years: Research in heat disposal and reservoir behavior including the behavior of thermal outfalls and evaporation from cooling lakes/ponds.

2 Years: Design, construction and operation of hydrologic network in Papua, New Guinea.

1 Year: Maintenance and minor construction for roads and harbors in Papua, New Guinea.

EXPERIENCE:

January 1995 - Present: As Manager of Geotechnical and Hydraulic Engineering Services (G&HES), Dr. Ryan has the overall responsibility for the company-wide application of geologic and hydrologic services and hydraulic and geotechnical engineering. Bechtel's G&HES group consists of about 50 professionals and support staff located in three of Bechtel's Regional Offices and in the London and Brisbane Offices.

Besides his functional and administrative management responsibilities, Dr. Ryan also provides project oversight and planning, and marketing of the capabilities of G&HES. In addition, he provides technical direction and technical review on Bechtel projects which involve environmental hydraulic and coastal engineering studies.

August 1994 – January 1995: As Manager of Bechtel's Hydraulics/Hydrology Group, Dr. Ryan managed and directed the analysis and studies performed by a 26-member team of highly trained and experienced hydraulic and hydrologic engineering specialists. The Group performs a wide variety of tasks related to water resources development, the design of hydroelectric, thermal power and LNG plants, fisheries and waste isolation systems. Capabilities of the Group include numerical simulation of fluid flow, development of flood hydrographs, water resource assessment, and conceptual design and hydraulic

analysis for coastal structures, intake and outlet works, penstocks, spillways, power tunnels, gates, valves and surge chambers, and thermal modeling for streams, rivers, estuaries and reservoirs. The Group performs field studies to collect data required for modeling and installs and monitors instrumentation. Because of their association with field studies, the group maintains information files on instrumentation and recommends state-of-the-art equipment for use on Bechtel monitoring or data collection projects.

1979 - July 1994: As Chief Hydrologic Engineer in Bechtel's Hydraulics/Hydrology Group, Dr. Ryan was responsible for siting evaluations for major projects, including the preparation of safety analyses and environmental reports (SAR and ER) for nuclear power projects; hydrologic studies related to power, mining and other industrial proposals, including site evaluation, waste and heat disposal studies, flood studies, water availability and reliability analyses, and river and reservoir regulation and sedimentation studies. He was also responsible for the development of ground water models and the modeling of ground water flow including contaminant transport for the design of hazardous-waste containment systems as well as for general water-resource projects.

1984 - 1986: Dr. Ryan directed the physical and computer model studies for the tailing disposal work for the Quartz Hill Project. Work included model development and application, plus interaction with Federal and State Agencies.

1978 - 1979: During this period, Dr. Ryan worked as a Marine Survey Specialist with Bechtel. He was a member of the team investigating routes for a gas pipeline between Algeria and Spain. He performed theoretical studies and supervised field investigations.

1974 - 1978: As Chief Hydrothermal Engineer in Bechtel's Hydraulics/Hydrology Group, Dr. Ryan was responsible for cooling water studies and coastal protection studies for steam electric power plants, including the design of cooling ponds and spray canals, intake and discharge structures for once-through systems, thermal plume studies and blowdown disposal systems; reservoir studies including thermal stratification and aeration studies; coastal protection studies.

1973 - 1974: At the Oak Ridge National Laboratory, Dr. Ryan was employed as head of Thermal Hydraulics group in Environmental Impact Reports Project. He was responsible for reviewing heat dissipation aspects of ER's for Nuclear Power Plants, and writing these sections of EIS for AEC.

1967 - 1973: During this period Dr. Ryan carried out research at the Massachusetts Institute of Technology Department of Civil Engineering, and the University of Melbourne in Australia, on the behavior of cooling ponds and stratified lakes.

1964 - 1967: As an engineer for the Hydrographic Survey Section, Australian Department of Works, Port Moresby, Papua, Mr. Ryan was responsible for the design, construction and operation of a hydrologic network in Papua-New Guinea. Later he was in charge of maintenance and minor construction of roads, storm water drainage and harbor facilities.

PROFESSIONAL DATA:

Dr. Ryan is a member of the American Society of Civil Engineers and the International Association for Hydraulic Research. He was Chairman of the ASCE Hydraulic Division Executive Committee in 1984; from 1974-1978 he was Chairman of American Nuclear Society work group 2.9, involving the supply of water for nuclear plants, and a Member of the Advisory Review Committee on Power Spray Cooling to the National Science Foundation; he was awarded the 1973 Hilgard Prize (ASCE Hydraulics Award), and the 1984 ASCE Huber Research Prize. In 1971, 1972 and 1975 Dr. Ryan was an invited lecturer at the MIT Summer Course on Engineering Aspects of Heat Disposal. In 1988 he lectured at the NATO Advanced Study Institute on Physical Models. He is a member of the Dean's Advisory Council for the UCLA College of Engineering, and the Industrial Advisory Board for the Civil and Environmental Engineering Department at CalPoly. He has written and presented over 20 papers in the area of stratified lakes, cooling ponds and heat disposal. Dr. Ryan is a registered professional engineer (civil) in the State of California.

RELEVANT EXPERIENCE:

Since 1974 Dr. Ryan has been responsible for all cooling water studies performed by Bechtel including the following cooling ponds, spray canals, and cooling water outfalls.

Cholla Plant	-	a 360 acre cooling lake in Arizona
North Anna Project	-	a 9000 acre cooling lake in Virginia
Four Corners Project	-	a 1200 acre cooling pond in New Mexico
Nipsco Project	-	a cooling tower/cooling pond/spray pond project in Indiana
South Texas Project	-	an 8000 acre cooling pond near Bay City, Texas
Midland Project	-	an 880 acre cooling pond in Michigan
Big Stone Project	-	a 400 acre cooling pond in Montana
Martin Pond	-	a 6500 acre cooling pond in Florida
Damietta Project	-	Modeling of stagnant stratified river as a cooling pond.
Sultan Project	-	Modeling of a stratified lake in Washington
Greenwood Project	-	Modeling of a spray canal in Michigan

In addition to the above studies, Dr. Ryan directed emergency cooling pond transient studies for the Arkansas, Midland, Callaway and Limerick projects and also directed field and model studies for the cooling water outfall investigation for the Diablo Canyon Nuclear Plant in California.

AWARDS:

Named a Bechtel Fellow in 1990
ASCE Hilgard Prize for Paper on Reservoir Behavior, 1973
ASCE Huber Research Prize for work on evaporation from heated water surfaces, 1984

PUBLICATIONS OF PATRICK J. RYAN

Ryan, P. J., and A. N. Findikakis, "Marine Disposal of Tailings in a Stratified Fjord," presented at 25th International Conference on Coastal Engineering, Orlando, Florida, September 1996.

Lee, C. L., and P. J. Ryan, "Mixing of Thermal Discharges at Low Froude Numbers," National Conference on Hydraulic Engineering, Buffalo, New York, August 1994.

Ryan, P. J., and Kubanis, S. A., "Environmental Considerations for International Projects in Coastal Waters," 17th Annual Energy-Sources Technology Conference, New Orleans, January 1994.

Locher, F. A., Ryan, P. J., Bird, V. C., and Steiner, P., "Debris Removal from a Low-Velocity Inclined Screen," presented at 13th USCOLD Annual Meeting, Chattanooga, Tennessee, May 1993.

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Ryan, P. J., "Marine Intakes for Aquaculture," 23rd International Conference on Coastal Engineering, Venice, Italy, October 1992.

Namikas, D., Ryan, P. J., Locher, F. A., "Seawater Delivery for Use in Aquaculture Development," to be presented at ASCE Hydraulics '91, August, Nashville, Tennessee

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Ryan, P. J., Tu, S., "Field Verification of a Physical Model of a Thermal Discharge," presented at the International Conference on Physical Modelling of Transport & Dispersion, Boston, August 1990.

Ryan, P. J., Ng, K. Y., "Circulation and Transport Modelling in a Semi-Enclosed Embayment," presented at 22nd International Conference on Coastal Engineering, Delft, Holland, July 1990.

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Ismail, N. I., Wiegel, R. L., Ryan, P. J., and Tu, S. W., "Mixing of Thermal Discharges in Coastal Waters," presented at 21st International Conference on Coastal Engineering, Spain, June 1988.

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Ryan, P. J., Tu, S. W., Ismail, N., and Wiegel, R. L., "Verification of a Physical Model of a Coastal Discharge," Proceedings of ASCE National Conference in Hydraulic Engineering, Williamsburg, VA, August 1987.

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Ryan, P. J., "Behavior of Sediment Laden Plumes on Steep Slopes," Proceedings of ASCE Water Forum 1986 Conference, Long Beach, CA, August 1986.

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