RAS 12109

August 7, 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
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DOMINION'S SECOND 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 and an affidavit from Dr. Patrick J. Ryan, until recently the Manager, Geotechnical and Hydraulic Engineering Services Group of Bechtel Corporation, parent corporation of the engineering consultant to Dominion ("Ryan Aff.").

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

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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 alleges that:

> 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.

Id. at 276.

On June 16, 2005, the Board granted Dominion's first motion for summary disposition to the extent it pertained to the thermal impacts from a fourth unit. Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna Site), *Memorandum and Order (Granting in Part and Denying in Part Summary Disposition on EC 3.3.2 – Impacts on Striped Bass in Lake Anna),* slip op. at 10-11 (June 16, 2005). In ruling on Dominion's first motion for summary disposition, the Board also stated "The Intervenors agree there are no striped bass between the Lake Anna Dam and the Fall Line," but denied Dominion's motion as it pertained to striped bass in the North Anna River because Dominion had not shown whether the thermal discharges from an additional reactor could impact the striped bass population along the 2-mile stretch of the North Anna River below the Fall Line. Id. at 9. Therefore, the admitted contention has been reduced to the impacts

[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").

on striped bass in Lake Anna and in the North Anna River downstream of the Fall Line arising from the effect of increased water temperature due to operation of a third unit.[2]

In October 2005, Dominion notified the NRC that it was revising its proposed cooling method for a third unit. See Letter from Eugene S. Grecheck, Vice President - Nuclear Support Services to NRC (Nov. 22, 2005). The revised proposal would use a closed cycle cooling system employing a combination of wet and dry cooling towers, which would not only eliminate any significant thermal impacts but also reduce water consumption as compared with the once through cooling system originally proposed. During a teleconference on February 22, 2006, Dominion and the Intervenors agreed that a second motion for summary disposition of EC 3.3.2 would be filed after the NRC issues its draft environmental impact statement supplement. (Tr. at 461). On March 1, 2006, the Board ordered that motions for summary disposition of Contention 3.3.2 "be filed within 30 days after the Supplemental Draft EIS is made available." Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna Site), *Revised Scheduling Order*, slip op. at 3 (March 1, 2006).

On April 13, 2006, Dominion submitted to the NRC Revision 6 to its ESP application to revise the approach for cooling Unit 3 to be a closed-cycle system.[3] On July 6, 2006, the NRC Staff made available the Supplemental Draft EIS, NUREG-1811, Supp. 1 (July 2006) ("SDEIS").

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[2] With respect to downstream effects, the Board ruled that "that the synergistic impacts of flow and temperature are within the scope of this contention to the extent that they relate to impacts on striped bass." Board Order of June 16, 2005 at 10 f.n. 15. As discussed later in this motion, Unit 3 would cause no measurable or perceptible temperature increase below the Fall Line (and as Intervenors admitted, striped bass are only found in the North Anna River below the Fall Line); therefore, without a temperature impact there can be no synergistic impacts on striped bass.

[3] Revision 6 revised Section 3 of the ESP Application, the Environmental Report ("ER"), to reflect the decision to use closed-cycle cooling for the third unit. Revision 7, issued June 21, 2006, and Revision 8, issued July 31, 2006, made changes to portions of the ESP Application unrelated to the matters at issue here. All page citations to the ER in this motion refer to the current Revision 8.

Because Dominion's application specifies closed-cycle cooling for the third unit (i.e., there would be negligible thermal discharge to Lake Anna from the third unit), no genuine dispute remains. Accordingly, the Applicant is entitled to summary disposition of EC 3.3.2 as a matter of law.

III. LEGAL BASIS FOR SUMMARY DISPOSITION

The legal standards for summary disposition were described in Dominion's first motion for summary disposition as summarized in the Board's Order of June 16, 2005. Dominion Nuclear North Anna, LLC (Early Site Permit for North Anna Site), *Memorandum and Order (Granting in Part and Denying in Part Summary Disposition on EC 3.3.2 – Impacts on Striped Bass in Lake Anna),* slip op. at 4-6. These standards will not be reiterated here.

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

Dominion is entitled to summary disposition of EC 3.3.2 because there remains no genuine issue as to any material fact relevant to the contention. With closed cycle cooling, there would be no thermal impact on striped bass either in Lake Anna or downstream, resulting from the addition of a third unit as proposed by Dominion.

Dominion has revised its proposal for the third unit to use closed cycle cooling, employing a combination of wet and dry cooling towers. ER at 3-3-57 to 3-3-60. There would be some blowdown from the wet cooling towers (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. This would result in a minuscule temperature increase of less than a tenth degree F at the end of the discharge canal in the cooler months, which would dissipate within a short distance of

travel in the Waste Heat Treatment Facility ("WHTF"). ER at 3-5-59; Ryan Aff. at 9. The miniscule temperature increase in the discharge canal would be even less, about a hundredth degree F, in the hotter months. ER at 3-5-58; Ryan Aff. at 8. The blowdown from Unit 3 would have no effect on temperature in Lake Anna, and therefore no thermal impact on aquatic communities including striped bass in Lake Anna. ER at 3-5-63; Ryan Aff. at 10.

For purposes of determining whether reduction in Lake level would have any impact on evaporative loss, Dominion also very conservatively calculated whether any decrease in Lake level, and therefore surface area, resulting from Unit 3 water consumption would increase Lake temperature. Most of the time, when the level of Lake Anna equals 250 feet MSL, there would be no change in Lake volume and therefore no change in Lake temperature associated with evaporative loss from Unit 3 operation. Ryan Aff. at 12. During periods when Lake level is below 250 feet MSL, such as during periods of drought, the additional evaporative loss from Unit 3 operation would reduce Lake volume but would result in negligible warming of the Lake. On average, this temperature increase 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. SDEIS 5-12. The increase in Lake temperature attributable to the maximum decrease in Lake level due to the addition of Unit 3 would be on the order of 0.3°F, for about 3 weeks out of the 24 years during periods of prolonged drought. Ryan Aff. at 13.

Because there is no significant increase in water temperature in Lake Anna, there can be no significant increase in water temperature downstream of the Dam. Even assuming the maximum 0.3°F increase in Lake temperature (which as discussed above occurs only about 3 weeks out of 24 years during periods of prolonged drought), there would be no measurable or percepti-

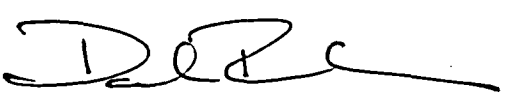
ble increase in the river temperature in the vicinity of the Fall Line. Ryan Aff. at 13. Therefore, Unit 3 as proposed would have no thermal impact on striped bass in the North Anna River (which, as Intervenors have admitted, are found in the River only below the Fall Line). With no measurable or perceptible temperature increase below the Fall Line, there is no thermal impact from Unit 3 to combine with any flow effect to produce a synergistic impact on striped bass in the North Anna River.

Because Unit 3 would not significantly contribute to the current thermal impacts to Lake Anna, the NRC Staff has concluded that the thermal impacts to striped bass 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.

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 August 7, 2006

Counsel for Dominion Nuclear North Anna, LLC

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

STATEMENT OF MATERIAL FACTS ON WHICH NO GENUINE DISPUTE EXISTS

Dominion Nuclear North Anna, LLC ("Dominion") submits, in support of its second motion for summary disposition of EC 3.3.2, this statement of material facts as to which Dominion contends that there is no genuine issue to be heard.

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.

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.

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.

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 Facil-

ity ("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.

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.

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 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.

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.

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.

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CERTIFICATE OF SERVICE

I hereby certify that copies of "Dominion's Second Motion For Summary Disposition Of 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 7th day of August, 2006.

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*Administrative Judge
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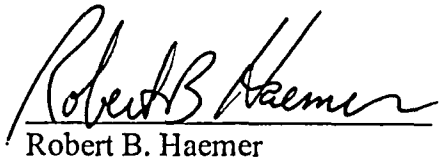

Robert B. Haemer

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

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

City of Melbourne	)	
	)	ss.
State of Victoria	)	

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 employed by and until recently was 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.

Patrick J Ryan

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 second motion for summary disposition of Contention EC 3.3.2. My affidavit explains there would be no significant impact on Lake temperatures that would result from adding a third unit with closed cycle cooling. 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 FOR A THIRD UNIT

5. To predict the maximum temperature increase that would result if a third unit was 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 Unit 3 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 closed-cycle cooling system using a combination of wet and dry cooling towers. In that system, pumps would circulate water in a closed loop of cooling water. The Plant Parameter Envelope ("PPE") bounding values for summer conditions of the closed cycle cooling assume equivalent to 1.03×10^{10} Btu/hr of heat

Robert J Ryan

load. That heat load was used to define the waste heat discharge from the new Unit 3. Except for blowdown, this heat load is dissipated in the closed-cycle cooling system cooling towers.

7. Blowdown from the circulating water and service water cooling systems of Unit 3 would be discharged to an outfall structure located at the head of the WHTF discharge canal at a flow rate no greater than 5.57×10^3 gpm (12.4 cfs). There, it would mix with the 4246 cfs of circulating water from Units 1 and 2.

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

8. Based on an average ambient lake temperature of 85°F during the summer months when the thermal impact would be most critical, the heat load from the existing units would be approximately 1.35×10^{10} Btu/hr, using the rated cooling water flow rate of 4246 cfs and condenser temperature rise of 14.1 °F for the existing units. Comparing the existing units with the third unit using a maximum blowdown flow rate of 12.4 cfs and maximum discharge temperature of 100°F for Unit 3, the third unit would add about 0.3 percent of heat content to the WHTF during these summer months. Therefore, in the summer months, the average water temperature increase due to the third unit is estimated to be less than a hundredth of a degree Fahrenheit at the end of the discharge canal where fully mixed condition of the two flow streams would be expected.

9. In the cooler months when the average lake temperature is lower in the 60°F range, a conservative estimate of the heat load associated with the new units would increase to about 1.1 $\times 10^8$ Btu/hr due to the potentially higher temperature difference between the ambient lake water and the blowdown flow. The corresponding water temperature increase at the end of the

Rakesh T Ryan

discharge canal due to the new units would be less than a tenth of a degree Fahrenheit in the cooler months.

10. Whether the small water temperature increase due to the new units is one-hundredth of a degree in hotter months or one-tenth of a degree in cooler months, any resulting increase would dissipate to an undetectable level within a short distance of travel in the WHTF. Consequently, the blowdown from Unit 3 cooling towers would cause no perceptible increase in the temperature of the water in Lake Anna or downstream.

NEGLIGIBLE TEMPERATURE INCREASES IN LAKE ANNA PREDICTED FROM ANY DECREASE IN WATER VOLUME IN LAKE ANNA

11. The operation of wet cooling towers for heat dissipation of Unit 3 results in some increase in evaporative loss. In addition to evaluating the thermal impacts of blowdown, I have also considered whether any decrease in the volume of Lake Anna (and therefore surface area) as a result of evaporative loss might result in a temperature increase in the Lake.

12. Most of time, the level of Lake Anna equals or exceeds 250 feet MSL. When the level of Lake Anna equals or exceeds 250 feet MSL, the dam discharge rate is adjusted to maintain Lake level. During these periods, additional evaporative loss associated with the operation of Unit 3 will not result in any change in Lake level. Therefore, most of the time, there would be no change in Lake volume and no change in Lake temperature associated with additional evaporative loss associated with operation of Unit 3.

13. During the periods when Lake level is below 250 feet MSL, such as during periods of drought, the additional evaporative loss from the wet cooling towers for Unit 3 would reduce the water volume. This decrease in Lake volume would result in negligible warming of the Lake. I

Robert J Ryan

have conservatively calculated that, on average, the increase in Lake temperature that would occur as a result of Unit 3 evaporative loss when Lake level is below 250 ft MSL would be less than 0.1°F. I have also conservatively calculated that 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, for about 3 weeks out of 24 years during periods of prolonged drought. Even assuming the maximum 0.3°F increase in Lake temperature, there would be no measurable or perceptible increase in the river temperature in the area of the Fall Line – *i.e.*, during periods of warm ambient temperatures such as from late spring, through summer to early fall, the maximum increase would be less than one-tenth of a degree; and during periods of cooler temperatures such as the early spring and winter, the maximum increase would be no more than 0.15°F.

Further the affiant sayeth not.

Patrick J. Ryan

Sworn to before me this
28th day of July, 2006.

PETER ZOUPA
Notary Public
Melbourne Victoria
Australia

My Commission is not
limited by time

PATRICK J. RYAN SPECIALIST IN HYDRAULIC ENGINEERING

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:

July 2006 to Present: Technical Specialist in Hydraulic Engineering

January 1995 – June 2006: 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

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