UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
before the
ATOMIC SAFETY AND LICENSING BOARD

In the Matter of VERMONT YANKEE NUCLEAR POWER CORPORATION (Vermont Yankee Nuclear Power Station)	Docket No. 50-271-OLA (Spent Fuel Pool Expansion)

Sworn Written Rebuttal Testimony of
Donald A. Reid, John T. Herron, Jay K. Thayer,
Christopher H. Hansen, and Paul A. Bergeron,
Submitted by Vermont Yankee Nuclear Power Corporation
Pursuant to 10 C.F.R. § 2.1113(a)

1. The " Affidavit of Dale G. Bridenbaugh and Steven C. Sholly" (hereinafter Intervenor's Affidavit) at paragraph 9 states: "If the decay heat removal function fails, the integrity of the spent fuel cladding cannot be maintained." This statement is not exactly correct as written, and Vermont Yankee offers the following clarification.

The scenario described implies that as soon as the decay heat removal function fails, the integrity of the spent fuel cladding cannot be maintained and a radiological release will result. Such an implication is misleading. In accordance with VYNPC calculations summarized in a June 11, 1987 letter to the NRC (FVY 87-65), the temperature rise in the fuel pool, assuming loss of all cooling, was conservatively calculated to be 3.2°F/hr (42 days after shutdown of nuclear reaction for last offload). Without the very conservative assumptions of the NRC Standard Review Plan

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NUREG 0800 (SRP), heatup is calculated to be less than 2°F/hr (after 42 days). Assuming 3°F/hr rise and an initial fuel pool temperature of 150°F, it would take approximately 20 hours before the pool even started to boil. Assuming no makeup water to the pool, the maximum boiloff would be 16.6 GPM per Letter VYNPC to USNRC on March 2, 1988 (FVY 88-17). Actually, it would be less, since that calculation was based on 21 days after shutdown.

Therefore, considering that there is approximately 235,000 gallons of water in the fuel pool, of which approximately 165,000 gallons are above the top of the spent fuel assemblies, it would take several days (about 6.9 days) for the water to boiloff to the point of first exposing the spent fuel assemblies and longer to cause fuel cladding damage. There would be many actions that could be taken to mitigate the event during this scenario.

2. The Intervenor's Affidavit at paragraph 11 states: "The SFPCS is a . . . non Class 1E system." This is not exactly true and Vermont Yankee offers the following clarification:

The Spent Fuel Pool Cooling System (SFPCS) at VY receives electrical power from emergency busses capable of being powered by the emergency diesel generators in the event of a loss of offsite power. This system is classified and maintained as "safety class electrical", a term that is used at Vermont Yankee to describe electrical systems and components that are required to support key safety systems.

Class 1E is a similar designation for electrical systems designed in accordance with the provisions of IEEE Standard 308. This standard was developed after Vermont Yankee was designed and licensed; however, "safety class electrical" as used at VY and "Class 1E," referring to IEEE 308 are synonomous terms.

3. The Intervenors Affidavit at paragraph 11 states, "The two trains of the SFPCS are headered together on the suction side of the pumps and at the discharge of the heat exchangers." Vermont Yankee offers the following clarification of that statement. The discharge of the SFPCS pumps are also cross-connected, thereby allowing either pump to supply either or both heat exchangers. (FSAR Figure 10.5-1)(All FSAR citations are to the most recently updated FSAR dated November 30, 1988.)

4. In the same paragraph, Intervenors Affidavit states : "Heat from the RBCCWS is rejected to the ultimate heat sink via the residual heat removal service water system." This is in error. Heat from the Reactor Building Closed Cooling Water System (RBCCW) at VY is taken by the Service Water System (SW), which is a different system from the Residual Heat Removal Service Water System (RHRSW), as is clearly shown in FSAR Figure 10.6-1A.

5. The Intervenors Affidavit at paragraph 11, footnote 10 states:" . . . the NRC Staff estimates that the normal heat generation rate is 10.1 MBtu/hr and the abnormal heat generation rate (for a full core offload) is 21.46 MBtu/hr." Vermont Yankee offers the following clarification to this statement.

These figures are based upon 6 days of decay following reactor shutdown and the assumptions stated in the SRP. Using similar assumptions except for determining the decay heat following 10 days of decay, Vermont Yankee calculated 9.1 MBtu/Hr for normal heat generation and 18.26 MBtu/Hr for the abnormal heat generation rates. (VYNPC written testimony at page 11.) The calculations are, in fact, the same, as set forth in Figure 2 of our letter to the Staff dated March 2, 1988 (FVY 88-17), a copy of which is attached.

6. The Intervenor's Affidavit at Paragraph 13 states: "Use of the RHR system to provide routine backup to an inadequate spent fuel cooling system is not, however, in accord with the intent of the design process which allows cooling of the spent fuel pool by the RHR system . . .".

Vermont Yankee concurs that the RHR system was not intended to be used as a routine backup for the SFPCS. The system has never been operated in that mode, and the application to increase spent fuel storage to 2870 assemblies does not propose to operate in that manner - with or without the enhanced spent fuel pool cooling system. However, it would be imprudent not to recognize the capability of the RHR to be used in that manner should some entirely unanticipated event occur that affected the capability of the SFPCS.

7. The Intervenor's Affidavit at Paragraph 16 states: "According to an NRC Staff evaluation, the Vermont Yankee SFPCS does not have sufficient capacity to cool the normal spent fuel pool heat load and maintain the pool water temperature below 140°F in the event of single active

failure." While this statement was true at one time, it is misleading because the Staff conclusion referred to was based on the use of a one pump - one heat exchanger mode, and subsequently the NRC Staff agreed with Vermont Yankee that the proper single failure analysis employs a one pump - two heat exchanger mode, and on this basis the Staff concurred that the VY SFPCS had sufficient cooling capacity.

The exact history that NECNP omits is this: When the original application was submitted (VYNPC letter to USNRC April 25, 1986) and the answers to the USNRC were developed (VYNPC Letter to USNRC - November 24, 1986), Vermont Yankee calculated the decay heat load requirements and corresponding capacity of the spent fuel pool cooling system based on the following assumptions:

150°F maximum fuel pool temperature

One spent fuel pool cooling train consisted of 1 pump and 1heat exchanger

83% capacity factor for 18 months

This led to a calculation of 42 days from shutdown to ability to restart, on the assumption that the 1 pump-1 heat exchanger was the appropriate single active failure mode.

The NRC's calculation of decay heat load requirments and corresponding capacity of the spent fuel pool cooling system (NRC Staff response to NECNP's First Set of Interrogatories and Docketed Request to the NRC Staff August 5, 1987) were based on the following assumptions:

140°F Maximum fuel pool temperature

One spent fuel pool cooling train consisted of 1 pump and 1 heat exchanger

100% capacity factor for 18 months

This led to the Staff's calculation of 69 days required from shutdown to restart, on the same assumption about the appropriate single failure mode. This result led to a reassessment of what was in fact the correct single failure mode (and resulting maximum system heat removal capacity after a single active failure).

As a result of discussions with the NRC, Vermont Yankee reevaluated the decay heat load

requirements and reevaluated the corresponding capacity of the Spent Fuel Pool Cooling System based on the following assumptions (VYNPC letter to USNRC March 2, 1988):

150°F maximum fuel pool temperature

One spent fuel pool cooling train consisted of 1 pump and 2 heat exchangers

100% capacity factor for 18 months.

The results (VYNPC letter to USNRC March 2, 1988) of the reevaluation clearly indicate that both the existing spent fuel pool cooling system as well as the enhanced spent fuel pool cooling system are sufficient to remove all normal heat loads even considering single failure cases. The Staff agreed, upon reanalysis, that the appropriate one pump -two heat exchanger mode was correct. (see NRC's Response to NECNP's first interrogatories, 12/27/88, response to question 5.) The SFPCS can maintain the temperature of the spent fuel pool below 150°F using one pump and two heat exchangers. The 150°F limit is in accordance with the Technical Specifications for Vermont Yankee. For the case of a full core off-load the RHR system is used to cool the spent fuel pool, and it has the capability to also keep the spent fuel pool temperature below 150°F.

8. The Intervenor's Affidavit at paragraph 17 states: "the licensee has identified the *most benign* single failure possible." This assertion is wrong. The single active failure that has the greatest effect on the capability of the SFPCS to cool the spent fuel pool is the loss of one of the SFPCS pumps.[1] (See also paragraph 9 below). With the loss of one pump the system would still have one pump and two heat exchangers, which has been shown capable of maintaining the spent fuel pool temperature below the required limit of 150°F after 10 days of decay. (Letter VYNPC to

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1 When considering the single failure criterion, the loss of one of the two SFPCS pumps was determined to have the greatest effect on the capability of the SFPCS to cool the spent fuel pool. The most limiting scenario that would cause this event would be a loss of normal power coincident with the loss of one of the two emergency diesel generators. This scenario would result in the availability of two SW pumps, one RBCCW pump, and one SFPCS pump (among others).

USNRC dated March 2, 1988). This capability was proven using an SRP based heat load analysis and methods that yielded results comparable to the heat loads calculated by NRC staff as documented in "NRC Staff response to NECNP's First set of Interrogatories and Document Request to NRC Staff," dated August 5, 1987. Thus the most limiting single active failure has been identified and evaluated.

9. The Intervenor's Affidavit at paragraph 18 states: "There are several postulated single failures for Vermont Yankee which would result in the availability of only one train of engineered Safety Features (ESF) equipment (i.e., 1 train of RHR, 1 train of Service Water, 1 SFPCS pump, and 1 SFPCS heat exchanger) being available." This testimony is not correct. The Service Water System is designed such that any of the four service water pumps can supply any portion of the system. Further, even under design basis accident conditions, any two pumps are capable of supplying the required cooling capacity (FSAR Section 10.6.5). Two service water pumps are powered electrically from each of the two Emergency Diesel Generators, thus making service water independent from the "postulated single failures" noted by the Intervenors. This is clearly shown in VY FSAR Section 10.6 and Figure 10.6-1A. The Reactor Building Closed Cooling Water System (RBCCW), which is the cooling loop between service water and the Spent Fuel Pool Cooling System (SFPCS), is also not a train-aligned system, that is to say, either pump can provide cooling flow to either or both heat exchangers, as is clearly shown in VY FSAR Section 10.9 and Figure 10.9-1. As we described earlier, the SFPCS is also not a train-aligned system, see VY FSAR Section 10.5 and Figure 10.5-1. Therefore, even with the "postulated single failures" noted in the Intervenor's Affidavit, two SFPCS heat exchangers and at least one SFPCS pump are always available, and receive sufficient flow, for heat removal from the Spent Fuel Pool.

10. The Intervenor's Affidavit at Paragraph 19 states:"Under these failure conditions, only one train of service water will be available. Thus the fact that the SFPCS heat exchangers can be cross connected is largely irrelevent since one of the two SFPCS heat exchangers will not have water flowing past the secondary side of the heat exchanger . . . ."

As we demonstrated in the prior paragraph, this assertion is simply erroneous.

11. The Intervenor's Affidavit at paragraph 21, footnote 20 states: "The Staff concluded that the service water system is therefore not an acceptable Seismic Category I makeup source of water for the spent fuel pool. . . . The cooling tower deep basin alternate cooling cell's seismic classification is not adressed in the updated FSAR. In addition piping from the alternate cooling cell to the service water system pumps would also have to be Seismic Category I, and appropriate isolation valves would have to be provided. The NRC Staff has concluded that the alternate cooling cell is not an acceptable Seismic Category I makeup source for the spent fuel pool." This assertion is not true. What is true is that, as of the time of the NRC Staff statement referred to, the Staff had not reached any final conclusions. In fact, the service water system is a fully qualified seismic makeup system (FSAR Sections 10.6 and 12), and we believe the Staff now to concur.

In particular, the cooling tower deep basin is a Seismic Category I structure. (FSAR Section 10.8.3) The piping from the deep basin to the RHR service water pumps is Seismic Category I (FSAR Appendix A). The fire water system is not a seismically qualified system, but is isolated from the service water system by a normally closed manual valve (FSAR Figure 10-6.1A). The fire water piping and valve making the connection to the Service Water System are seismically qualified Category I (FSAR Appendix A). (Also VYNPC letter to USNRC dated March 2, 1988, FVY 88-17).

12. The Intervenor's Affidavit at paragraph 21, footnote 21 states: "The Staff has not demonstrated, however, that the conditions required to render this makeup pathway fully Seismic Category I . . . have been met for the existing SFPCS or for the proposed enhanced system." Vermont Yankee offers the following clarification to these statements. The enhanced Spent Fuel Pool Cooling System has been designed to provide a Seismic Category I makeup path to the spent fuel pool.The system description for the enhanced system (VYNPC letter to NRC dated June 7, 1988), included a Figure A-1 that clearly shows a valved connection to the Seismic Category I service water system. This path, when installed, provides a fully Seismic Category I fuel pool makeup path independent of the existing seismic makeup path described in our clarification to footnote 20 above.

13. For the reasons set forth in the two prior paragraphs, the bases for the conclusion stated in Intervenor's Affidavit Paragraph 21 and 22 are invalid.

14. The Intervenor's Affidavit at paragraph 23 states: ". . . given the most critical active single failure, the configuration of the Vermont Yankee SFPCS is . . . one pump and one heat exchanger . . . ."

As demonstrated above, this conclusion is wrong as a matter of readily demonstrated fact. The single active failure that has the greatest effect on the capability of the SFPCS to cool the spent fuel pool is the loss of one of the two SFPCS pumps. Because of the cross- connect design of both the service water system and the RBCCW system, cooling water will always be available to both SFPCS heat exchangers.

15. The Intervenor's Affidavit at Paragraph 26 states "In footnote 4 of its November 10, 1988 filing, the licensee states that prior to restart of the reactor there is no requirement of redundant RHR trains on the reactor. This is quite likely incorrect." Vermont Yankee offers the following clarification of this statement.

Footnote 4 from the November 10, 1988 Memorandum of VYNPS in response to Memorandum and Order of 10/24/88 and Motion for Leave to File the Same is correct. Per Tech Spec Section 3.5.A.1 " both . . . the LPCI subystems [Mode of RHR System] are required to be operable prior to Reactor startup mode from the cold shutdown condition," During shutdown/refueling operations, Tech Spec Sections 3.5.H.3 and 4 govern operability requirements of the Core and Containment Cooling Subsystems (including RHR). These provisions do not require availability of both RHR trains before the plant can proceed from cold shutdown to refueling.

16. The Intervenor's Affidavit at paragraph 28 states : "This [referring to the drawings submitted to the Staff on the Emergency Standby Subsystem] provides no information on electrical design for the enhanced system's pumps, leaving critical design questions unanswered (e.g., Are there any single-failure points among the AC and DC power supplies for valves in the system?)." While the information referred to was not on the drawings, it was contained in the balance of the

materials submitted to the Staff. In particular, the pumps for the Emergency Standby Subsystem will be powered by separate AC and DC busses. There are no "single-failure points" among the AC and DC power supplies for valves that would be more limiting than a pump failure. In addition, the new system will be designed and installed as Seismic Category I and will tie into portions of the existing SFPCS (suction - 8" FPC-1B, discharge - 6" FPC-22) which are presently qualified as Seismic Category I. The new system will be physically located in the Reactor Building, a Seismic Category I structure, designed to withstand wind forces and missile impacts (FSAR Section 5.3.3.3). The new system design will also protect each train from common effects caused by fire, flooding, and missiles (VYNPC letter to USNRC dated March 2, 1988).

17. Based upon the above clarifications and corrections to the information presented by the Intervenors, it is clear that the requested license amendment satisfies all applicable USNRC requirements and therefore the Board should approve the license amendment permitting storage of an additional 870 fuel assemblies in the spent fuel pool at Vermont Yankee.

Donald A. Reid

John T. Herron

Jay K. Thayer

Christopher H. Hansen

Paul A. Bergeron

State of Vermont

_____ ss.

Then personally appeared Donald A. Reid, who being first duly sworn, made oath that the foregoing statements are true, this 2nd of March 1989, before me.

Notary Public
My Commission expires 2/10/90

BLAIRE M. McCUE NOTARY PUBLIC WINDHAM COUNTY, VERMONT

State of Vermont

_____ ss.

Then personally appeared John T. Herron, who being first duly sworn, made oath that the foregoing statements are true, this 2nd of March 1989, before me.

Notary Public
My Commission expires 2/10/90

BLAIRE M. McCUE NOTARY PUBLIC WINDHAM COUNTY, VERMONT

Commonwealth of Massachusetts:
Worcester ss.

Then personally appeared Jay K. Thayer, who being first duly sworn, made oath that the foregoing statements are true, this 20 of March, 1989, before me:

Notary Public
My Commission expires 10-16-92

Commonwealth of Massachusetts:
Worcester ss.

Then personally appeared Christopher H. Hansen, who being first duly sworn, made oath that the foregoing statements are true, this 20 of March, 1989, before me:

Notary Public
My Commission expires 10-16-92

Commonwealth of Massachusetts:
Worcester ss.

Then personally appeared Paul A. Bergeron, who being first duly sworn, made oath that the foregoing statements are true, this 20 of March, 1989, before me:

Notary Public
My Commission expires 10-16-92

HEAT LOAD COMPARISON

NRC		VY	
DAYS	HEAT LOAD	DAYS	HEAT LOAD
6.25	10.17 MBTU/HR	6	10.35 MBTU/HR
6.92	9.91	7	9.93
7.92	9.58	8	9.59
8.92	9.31	9	9.32
9.92	9.09	10	9.1

FIGURE #2

VYN-123
ASLB - Special

CERTIFICATE OF SERVICE

I, R. K. Gad III, hereby certify that on March 20, 1989, I made service of the within "Vermont Yankee Nuclear Power Corporation's Motion to Strike the State of Vermont's So-Called 'Rebuttal' Testimony;" "Vermont Yankee Nuclear Power Corporation's Requested Findings of Fact and Rulings of Law;" and "Sworn Written Rebuttal Testimony of Donald A. Reid, John T. Herron, Jay K. Thayer, Christopher H. Hansen, and Paul A. Bergeron, Submitted by Vermont Yankee Nuclear Power Corporation Pursuant to 10 C.F.R. § 2.1113(A)" in the indicated manner to:

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