

March 4, 1985

Docket No. 50-271

Mr. R. W. Capstick
Licensing Engineer
Vermont Yankee Nuclear Power Corporation
1671 Worcester Road
Framingham, Massachusetts 01701

Dear Mr. Capstick:

SUBJECT: VERIFY QUALIFICATION OF ACCUMULATORS
ON ADS VALVES (II.K.3.28, MPA F-55)

Re: Vermont Yankee Nuclear Power Station

We have completed our review of your submittals dated January 18 and January 25, 1980, May 15, 1981, December 5, 1983, September 7, 1984, and January 24, 1985. The NRC staff, with the assistance of Brookhaven National Laboratory, has prepared the enclosed Safety Evaluation in which we conclude that you have verified the qualification for the ADS accumulator systems at Vermont Yankee Nuclear Power Station and have satisfactorily addressed the requirements of II.K.3.28.

Sincerely,

Original signed by/

Domenic B. Vassallo, Chief
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Enclosure:
As stated

cc w/enclosure:
See next page

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

TMI ACTION PLAN II.K.3.28 VERIFY QUALIFICATION

OF ACCUMULATORS ON ADS VALVES

1.0 Background

Safety analysis reports claim that air or nitrogen accumulators for the automatic depressurization system (ADS) valves are provided with sufficient capability to cycle the valves open five times at design pressures. General Electric (GE) has also stated that the emergency core cooling (ECC) systems are designed to withstand a hostile environment and still perform their function for 100 days following an accident. Licensees and applicants must demonstrate that the ADS valves, accumulators, and associated equipment and instrumentation meet the requirements specified in the plant's FSAR and are capable of performing their functions during and following exposure to hostile environments, taking no credit for non-safety-related equipment or instrumentation. Additionally, air (or nitrogen) leakage through valves must be accounted for in order to assure that enough inventory of compressed air is available to cycle the ADS valves. If this cannot be demonstrated, it must be shown that the accumulator design is still acceptable.

The commitment to satisfy the requirement of TMI action Item II.K.3.28 for Vermont Yankee is discussed in the licensee's submittals dated January 18, 1980, January 25, 1980, and May 15, 1981, and their response to the requests for additional information dated December 5, 1983, September 7, 1984, and January 24, 1985.

2.0 Discussion

At Vermont Yankee, there are four target rock valves in the ADS, each with its own accumulator system. The individual accumulator system consists of a soft seated check valve, a 1.4 gallon accumulator, solenoid valve, and interconnecting piping. These systems are normally fed from a safety rated instrument air system which normally takes air from the containment atmosphere. Provision has been made to enable suction from outside of containment to permit continued operation after an accident or line rupture inside containment. The accumulators were sized to insure a minimum of two valve actuations at 70% of drywell design pressure within a short time of accident or loss of pneumatic supply (10 minutes). According to the licensee letters of May 15, 1981 and December 5, 1983, there is no requirement for long-term (up to 100 days) capability for ADS.

3.0 Demonstration of Qualification

3.1 Number of Actuations

The licensee's letter of December 5, 1983 states that the accumulators are sized and tested so that they will provide a minimum of two actuations of the ADS valves at 70% of containment design pressure. The test procedure described below insures that this capability is available for three hours following a loss of instrument air supply.

3.2 Leakage Criteria

The minimum pressure required to actuate the ADS valves twice at 70% of containment design pressure is 64 psig. Therefore, the leakage criterion is less than 26 psi in three hours starting from 90 psig. Seismic events and harsh environments should not increase this leakage rate since the accumulator systems are designed for these events.

3.3 Periodic Leak Testing

The licensee has a plant procedure (OP-4028-ADS Air Supply Accumulator Surveillance) which is used to perform leak tests on the accumulator system during each refueling outage. A brief description of this procedure was given in the letter of December 5, 1983 as follows:

- o Install a pressure gauge in place of the accumulator drain plug.
- o Repressurize the accumulator system and re-isolate it from the compressors.
- o Open pipe union upstream of check valve and insure vent path.
- o Record time and pressure.
- o Acceptance criteria is minimum of 64 psig after three hours.
- o Return system to original configuration.

3.4 Seismic and Environmental Qualification

The licensee's letter of December 5, 1983 states that a seismic review was conducted, and a support upgrade was performed in order to insure that the ADS accumulator system is seismically qualified. This includes all piping and components from the check valve to the S/RV solenoids. The letter of January 25, 1980 indicates that the entire containment instrument air system is also Class I seismically qualified. The letter of December 5, 1983 also states that the only components susceptible to damage in a harsh environment are the solenoids and the seats of the check valves. The "ASCO" solenoids used are environmentally qualified for post LOCA seismic conditions per IEEE-323-1974, IEEE-383-1972, and II-344-1975. The Nupro check valves are designed for 350F service in an accumulated radiation environment of 105 rads.

4.0 Evaluation

4.1 The licensee has defined and verified the number of times the ADS valves are capable of cycling using only the accumulators, and the length of time the accumulators are capable of performing their function following an accident. The licensee does not believe that there is a long-term requirement for ADS at Vermont Yankee and has provided justification as to why three hours or less is sufficient.

The licensee has evaluated the original design basis for the ADS as defined in the FSAR. Section 6.5 of the FSAR states:

"Automatic depressurization is provided to automatically reduce nuclear system pressure if a break has occurred and vessel water level is not maintained by the HPCIS and the other water addition systems. Rapid depressurization of the nuclear system is desirable to permit flow from the core spray system and LPCIS to enter the vessel, so that the temperature rise in the core is limited."

After 10 minutes, operator action to place RHR into torus cooling (and shutdown cooling as needed) is assumed. After this, ADS valves need not remain open to keep the vessel from repressurizing, as temperature will be kept low enough by RHR cooling. Therefore, for these breaks, accumulators should provide operability for 10 minutes.

In the FSAR analysis, the ADS valves need to be actuated only once when the automatic control signal calls for it. The original design basis for the accumulators was to provide for two operations of each ADS valve when the containment atmosphere is at accident pressure. Thus, there is a 100% conservatism in accumulator design basis.

According to the General Electric analysis a 5 lift criteria can be interpreted as the criteria for an atmospheric test of ADS accumulator size. The Target Rock SRVs require about 28 psi differential pressure above drywell back pressure to operate. Therefore, a test done with atmospheric pressure in the drywell shows the capability by an increased number of lifts (GE calculated to be 5) to be equivalent to 2 lifts under accident drywell back pressure conditions. GE has specified that an accumulator of one-gallon capacity will provide a final pressure of 70 psig after five actuations, starting from 90 psig. Vermont Yankee's ADS accumulators have a capacity of over 1.4 gallons each.

In addition, four valves and accumulators are provided showing a 25% conservatism in the ADS design basis to allow for single failure in that each relief valve provides 33 1/3% of the necessary capacity.

The staff finds that the ADS accumulator system is capable of performing its function as defined in the original design basis as set forth in the FSAR and in addition the licensee has provided supporting information for Vermont Yankee's long term cooling capability. This is acceptable.

Attachment 1 describes Vermont Yankee's present long-term core cooling capability for the full spectrum of loss-of-coolant accidents. The function of the ADS valves for each accident scenario is also listed.

In summary, after the present three (3) hour ADS qualification time, only very small breaks require augmented shutdown cooling beyond the decay heat removal afforded by the break flow.

For the very small LOCA, a leak slightly greater than the capability of the Reactor Core Isolation Cooling (RCIC) System was reviewed. In this case, the decay heat would not be removed adequately by the break flow for many hours. After initial depressurization, the RHR Shutdown Cooling Subsystem would normally be placed in service. If the RHR Shutdown Cooling Subsystem is not available, and a seismic event is postulated that interrupts the gas supply to the ADS accumulators, there are several options available:

- Restore RHR shutdown cooling by local repair or operator action.
- Continue to operate the High Pressure Coolant Injection (HPCI) System as required. If normal building ventilation cannot be restored, portable fans could be utilized to provide emergency cooling to the HPCI Room.
- Restore the nitrogen gas supply to the ADS accumulators. According to the original design, the instrument air piping in the drywell and portions outside are seismically qualified. Repairs outside the drywell could be accomplished.

The licensee believes that the long-term cooling requirement as defined by 10 CFR 50.46 has been satisfied and that the ADS accumulators are capable of performing their intended functions as defined in the FSAR, and therefore the "100 day" capability is not required. However, in the event that the initial accumulator gas volume is exhausted, nitrogen gas supply capability for the ADS accumulators could be supplied by the Liquid Nitrogen Storage Tank and Backup Nitrogen Gas Cylinder Station. The Liquid Nitrogen Storage Tank is located outside the Reactor Building, has a capacity of 15,000 gallons and provides system operating pressure of 90-110 psig. The backup nitrogen gas cylinder station is located outside the Reactor Building and is comprised of 18 high pressure cylinders. Further, an additional potential backup supply to the accumulators is a compressed air source which can be cross-connected to the Nitrogen Supply System Piping.

The licensee has demonstrated that the ADS valves, accumulators and associated equipment and instrumentation are capable of performing their functions during and following exposure to hostile environments that result from postulated events specified in the FSAR, taking no credit for non-safety-related equipment or instrumentation. They have also demonstrated that for design basis accidents Vermont Yankee has the capability for long-term cooling. The staff finds this acceptable.

4.2 A basis for the allowable leakage criteria was provided. Although it would be more conservative to assume an increased leakage rate after a seismic event or an accident, the licensee has examined the effects of these events on the leakage rate and concluded that there will be no increase in the leakage rate. An accumulator pressure of 64 psig will provide at least two (2) actuations of the ADS valves at containment atmosphere accident pressure (70% of containment design pressure). The licensee's test procedure ensures that an accumulator pressure of at least 64 psig can be maintained for three hours after a loss of instrument air supply. The staff finds this acceptable.

4.3 The licensee has developed a plant procedure for periodic (each refueling outage) leak testing of the accumulator system. The staff finds the specified period for these tests acceptable. The method is also acceptable for determining the leakage rate of the accumulator system. The licensee states that there is a procedure that requires that all mechanical joints be checked ("snooped") for leakage and tightened as necessary after the accumulator drain plug is installed. The staff finds this acceptable.

4.4 The licensee has provided statements acceptable to the staff confirming the following:

1. That the ADS valves, accumulators, and piping out to and including the isolation check valve are seismically and environmentally qualified.
2. That the accumulators and associated equipment are capable of performing their functions during and following an accident situation, while taking no credit for non-safety related equipment and instrumentation.

5.0 Conclusions

Based on the evaluations given in Sections 4.1, 4.2, 4.3 and 4.4 above the staff concludes that the licensee has verified qualification for the ADS accumulator systems at Vermont Yankee.

Principal Contributor: J. Lombardo

Dated: March 4, 1985

VERMONT YANKEE LONG-TERM CORE COOLING
FOLLOWING ACCIDENTS

- Limiting Design Assumptions:
1. Loss of off-site power (10CFR50, Appendix A, Criterion 35).
 2. Seismic event concurrent or following accident (10CFR50, Appendix A, Criterion 2).
 3. Worst case single active failure. For long-term core cooling, this would involve a failure such that shutdown cooling mode of RHR was not available (e.g., inboard isolation valve MOV 10-18 fails to open) (10CFR50, Appendix A, Criterion 35).

<u>Accident</u>	<u>Core Cooling Options</u>
1. DBA (LOCA) [Flow out break cools core]	- LPCI/CS only (ADS & SDC are not necessary).
2. Small Break (LOCA) (HPCI Capacity) [Flow out break cools core]	- HPCI or ADS - Short-Term. - LPCI/CS only Long-Term (ADS and SDC are not required long-term).
3a. Very Small (LOCA) No Core Damage [Leak so small that flow out hole at depressurized conditions is not enough to cool core. Another shutdown cooling path is required.]	- HPCI or ADS - Short-Term. - Long-Term Options. <ul style="list-style-type: none"> o Enter Drywell and Open MOV10-18. o Operate HPCI until decay heat matches break flow heat loss (Note 1). o Restore ADS accumulator nitrogen gas supply.
3b. Very Small or (NON-LOCA) Core Damage - TMI Source Term	- HPCI or ADS - Short-Term. - Long-Term - Not within present design capability.

NOTE:

1. For accident (3a), the Reactor Building is accessible. Although the electrical equipment associated with HPCI is not qualified for extended turbine operation without building ventilation, portable fans could be utilized to provide emergency cooling to the HPCI Room.