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WESTERN MASSACHUSETTS ELECTRIC COMPANY
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October 25, 1985

Docket No. 50-213
B11834

Director of Nuclear Reactor Regulation
Attn: Mr. John A. Zwolinski, Chief
Operating Reactors Branch #5
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) J. F. Opeka letter to the Honorable N. J. Palladino, dated September 30, 1985.

Gentlemen:

Haddam Neck Plant
Environmental Qualification of Electrical Equipment
Justifications for Continued Operation

On October 22, 1985, Connecticut Yankee Atomic Power Company (CYAPCO) was verbally requested by the NRC Staff to supplement our justifications for continued operation (JCOs) related to the twenty (20) reactor coolant system loop resistance temperature detectors (RTDs) and fourteen (14) valve motor operators which are not yet fully environmentally qualified. This request was necessitated by the NRC Staff's desire to have our JCOs more closely correspond to the NRC Staff's review criteria. The JCOs submitted in Reference (1) have been revised and are included in Attachment No. 1.

We trust that this submittal adequately responds to the NRC Staff's verbal request.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY

J. F. Opeka
J. F. Opeka
Senior Vice President

C. F. Sears
By: C. F. Sears
Vice President

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Docket No. 50-213

Attachment No. 1

Haddam Neck Plant

Supplemented Justifications for Continued Operation

October, 1985

SYSTEM: Residual Heat Removal (RHR)

VALVES:
780 - Loop #1 RHR pump suction inboard stop valve
781 - Loop #1 RHR pump suction outboard stop valve
803 - Loop #2 RHR pump discharge outboard stop valve
804 - Loop #2 RHR pump discharge inboard stop valve

SAFETY FUNCTION AND JUSTIFICATION FOR CONTINUED OPERATION:

Normal functions of the Residual Heat Removal (RHR) System are: (1) remove residual heat from the reactor core and reduce the temperature of the reactor coolant system during plant cooldown, and (2) transfer water from the refueling canal back to the refueling water storage tank after a refueling operation. Additional functions of the RHR system after a loss of coolant accident are (1) to provide water to the core cooling system (core deluge), and (2) to cool and circulate spilled water from the reactor containment sump through the residual heat exchangers and back to the reactor coolant system, either at low pressure or via the HPSI or charging pumps for the high-head recirculation mode.

The residual heat removal system consists of two residual heat exchangers, two residual heat removal pumps and the associated piping, valves, and instrumentation necessary for operational control. During plant shutdown, reactor coolant flows from the reactor coolant system to the residual heat removal pumps, through the tube side of the residual heat exchangers and back to the reactor coolant system. The inlet line to the residual heat removal system loop starts at the hot leg of loop 1. The return line connects to the cold leg of loop 2. Heat loads are transferred by the residual heat exchangers to the component cooling water system.

Remotely operated double valving is provided to isolate the residual heat removal system inlet and outlet piping from the reactor coolant system. An electrical interlock between the reactor coolant system loop 4 pressure channels and the inboard set of valves prevents the valves from being opened when reactor coolant system pressure exceeds residual heat removal system design pressure. A similar pressure interlock exists for the outboard valves. These motor operated valves are closed when the reactor is at power and remain closed unless the RHR system is manually placed in operation.

Following a design basis LOCA, portions of the RHR system are utilized to establish long-term cooling. The RHR pumps are aligned to take suction from the containment sump. Flow is directed through the RHR heat exchangers, where heat is transferred to the service water system and to the ultimate heat sink, and then injected back into the reactor coolant system. Recirculated water is returned to the reactor coolant system by different means, depending on RCS pressure. If RCS pressure is lower than 145 psig, the recirculated water is injected into the RCS via the core deluge valves (MOVs 871 A and B) on the reactor vessel head. If RCS pressure is greater than 145 psig, water is pumped by the RHR pumps to the suction side of the charging pumps, where it is injected into the RCS at higher pressure (high head recirculation). None of these design basis scenarios depends on the operation of MOVs 780, 781, 803, or 804.

Post-accident operation of MOVs 780, 781, 803 and 804 would be required only in certain accident scenarios. First, in the event of a small break LOCA where RCS pressure remains above that which would permit low pressure recirculation cooling, the RCS must be cooled and depressurized utilizing auxiliary feedwater to the point where normal RHR cooling can be initiated. This is necessary because eventually the auxiliary feedwater supply will be exhausted and the recirculated flow alone is not sufficient to remove decay heat. Similarly, if conditions are such that cooling of the core is accomplished by supplying cool water via the safety injection system and venting from the pressurizer power operated relief valves, long-term cooling will eventually need to be established by use of the RHR system in its normal cooling mode.

Although the manufacturer of these valves has indicated that the motor operators were designed to function in the required containment environment, complete documented qualification test data has not been made available. Partial test data for similar valves and information provided by the manufacturer provide a basis for having a high level of confidence that these valves will function when required. The only credible failure mode for these valves once they have completed their safety function (i.e., the valves open) is one where the motor operator continues to operate against the backseat until the circuit trips due to overload or motor failure. This type of failure would not preclude the fulfillment of the safety function of these valves or result in the degradation of any safety function. With any valve in the open position, the valve position indication in the control room could conceivably indicate that the valve is closed or not fully opened. Alternative instrumentation (e.g., in-core thermocouples, RHR flow, RHR pump motor current) which is either qualified or not located in a harsh environment is available in the control room to preclude the operator from being misled by inaccurate valve position indication.

Connecticut Yankee Atomic Power Company takes no credit for the automatic operation of this equipment from a safety injection signal (SIS) and in all cases the valve functions are those of long-term cooling operations rather than any short-term requirements.

SYSTEM: High Pressure Safety Injection and Low Pressure Safety Injection (Core Deluge)

VALVES:
861A - Cold Leg Injection Valve, Loop 1
861B - Cold Leg Injection Valve, Loop 2
861C - Cold Leg Injection Valve, Loop 3
861D - Cold Leg Injection Valve, Loop 4
871A - Core Deluge Injection Valve
871B - Core Deluge Injection Valve

SAFETY FUNCTION AND JUSTIFICATION FOR CONTINUED OPERATION:

The high pressure safety injection system and the low pressure safety injection, or core deluge system, in conjunction with the residual heat removal system, comprise the emergency core cooling system (ECCS). These systems automatically deliver borated water to the reactor vessel for cooling the core following a loss of coolant incident.

The high pressure safety injection system consists of two trains of equal capacity. The high pressure safety injection pumps draw water from the refueling water storage tank and inject it into the reactor coolant system via four injection lines, one in each RCS loop.

The core deluge system consists of two separate trains of equal capacity. Two low pressure safety injection pumps take suction from the refueling water storage tank and discharge to the reactor vessel through four spare control rod mechanism housings and external piping directly over the core.

Valves 861A through D are motor operated injection valves in the high pressure safety injection system; one valve is located in each of the four injection lines. Valves 871A and B are motor operated injection valves for the core deluge system; both are located over the reactor vessel head and each valve serves two core deluge injection ports.

Operation of the emergency core cooling system is initiated automatically by an actuation signal generated as a result of two out of three low pressurizer pressure signals. These signals are backed up by a high containment pressure signal which will also initiate emergency core cooling. The emergency core cooling signal starts all pumps and actuates all valves to inject borated water into the core within one minute from the start of a postulated LOCA. The system may also be actuated manually from the main control room.

The manufacturer of these motor operators has indicated that this equipment was designed to function in the applicable containment environment; however, complete documented qualification test data is not available. Nonetheless, based upon partial test data for similar valves and information provided by the manufacturer, we have a high degree of confidence that these six (6) MOVs will achieve their safety position in the first ten (10) seconds of the accident thereby completing their safety function prior to exposure to the accident environment. The only credible failure mode for these valves once they have completed their safety function (i.e., the valves open) is one where the motor operator continues to operate against the backseat until the circuit trips due to overload or motor

failure. This type of failure would not preclude the fulfillment of the safety function of these valves or result in the degradation of any safety function. With any valve in the open position, the valve position indication in the control room could conceivably indicate that the valve is closed or not fully opened. Alternative instrumentation (e.g., containment water level, in-core thermocouples, RCS pressure, pressurizer water level, HPSI and LPSI pump motor currents) which is either qualified or not located in a harsh environment is available in the control room to preclude the operator from being misled by inaccurate valve position indication. In addition, EOP 3.1-4 requires the valve breakers to be locked open after the valves are opened. These valves are not exposed to a harsh environment in the event of a high energy line break outside containment.

SYSTEM: Reactor Coolant System

VALVES: 298 - Auxiliary Pressurizer Spray
567 - Power Operated Relief Valve (PORV) Block Valve
569 - PORV Block Valve

SAFETY FUNCTION AND JUSTIFICATION
FOR CONTINUED OPERATION:

MOV 298:

Normally, the pressurizer spray which is used for pressure suppression of the pressurizer is supplied from the driving force of reactor coolant flow from either number three or number four reactor coolant pump. MOV 298 is the remote controlled motor operated valve between the charging header in the reactor containment building and the pressurizer spray header. MOV 298 would be used to effect pressurizer spray only if neither of these loops had pumps in operation. The need for pressurizer spray can also be reduced by use of the power operated relief valve on the pressurizer.

The present operator for MOV 298 has design specifications that meet the accident conditions for most instances that are likely to exist in the containment. Operation of MOV 298 may be required for breaks inside containment that are smaller than 0.005 $ft.^2$ Since these breaks are very small, the environmental conditions that will exist inside containment are significantly less severe than would exist for the design basis large-break LOCA. Even in the unlikely event that such a small-break LOCA did occur, we have a high degree of confidence that this valve will function properly based upon partial test data and information provided by the manufacturer. If this valve fails to open, RCS pressure can be reduced by throttling of the charging pumps. Failure of MOV 298 in this manner would not degrade other safety functions. If the valve position indication in the control room indicated that this valve was open, alternative qualified instrumentation (e.g., pressurizer pressure) is available in the control room to preclude the operator from being misled by inaccurate valve position indication.

MOVs 567 and 569:

MOVs 567 and 569 are motor operated block valves associated with the pressurizer power operated relief valves (PORVs). These valves are normally closed and remain closed for most design basis accident scenarios. These MOVs serve as isolation valves for the PORVs.

The PORVs and associated block valves are arranged in fully redundant parallel trains (MOV 567 with PORV 568, and MOV 569 with PORV 570), thus no single failure can completely disable this pressurizer relief path. Additionally, even if both trains were to fail, there are three code safety valves which are fully capable of mitigating all design basis overpressure transients.

The only scenarios for which operation of the valves are required would be during a small break LOCA or when core cooling is accomplished by injecting water into the RCS via the safety injection system and relieving water and/or steam through the pressurizer PORVs. In the event of a small break LOCA in which RCS pressure remains above that which would permit low-head recirculation, it is necessary to cooldown and depressurize the RCS to the point where RHR cooling can be initiated before the auxiliary feedwater supply is exhausted. Similarly, for example, in the event of a complete loss of main and auxiliary feedwater, core cooling is accomplished by injecting cool water into the RCS using either the charging or high pressure safety injection pumps and decay heat is removed by relieving water and/or steam by manual opening of the PORVs and block valves. This process would continue until the RCS has been cooled and depressurized to the point where RHR can be used to provide long-term cooling.

In all scenarios for which operation of these valves might be required, the environmental conditions would be significantly less severe than the qualification parameters which are established by predicted containment response to the design basis large break LOCA or main steam line break. Thus, we expect that these valves will function when required.

For the case where core cooling is accomplished by injecting cool water into the RCS and decay heat is removed by relieving water and/or steam by manual opening of the PORVs and block valves, a harsh environment does not exist inside containment until after these valves are opened. Therefore, failure of these valves at that time for environmental qualification reasons is not a concern. If either or both of the block valves did not close subsequent to the completion of this phase of core cooling, the qualified PORVs would accomplish the required safety function. Failure of the block valves to close would not degrade other safety functions. In addition, a qualified acoustic monitor (which is downstream of both the PORVs and block valves) exists to provide information to the operator regarding accomplishment of the safety functon.

In the event of a small-break LOCA, partial test data and information provided by the manufacturer of these valves provide a basis for having a high level of confidence that these valves will function when required. The only credible failure mode for these valves once they have completed their safety function (i.e., the valves open) is one where the motor operator continues to operate against the backseat until the circuit trips due to overload or motor failure. This type of failure would not preclude the fulfillment of the safety function of these valves or result in the degradation of any safety function. With any valve in the open position, the valve position indication in the control room could conceivably indicate that the valve is closed or not fully opened. Alternative instrumentation (e.g., acoustic monitor, pressurizer pressure, in-core thermocouples) which is either qualified or not located in a harsh environment is available in the control room to preclude the operator from being misled by inaccurate valve position indication.

SYSTEM: Chemical and Volume Control System (CVCS)

VALVE: 200-Letdown Isolation

SAFETY FUNCTION AND JUSTIFICATION FOR CONTINUED OPERATION:

During normal operation, the letdown system takes coolant from the loop 1 cold leg, cools and depressurizes the water, passes it through filters and demineralizes, then collects the coolant in the volume control tank.

MOV 200 is an isolation valve in the letdown line associated with the chemical and volume control system. This valve is located inside containment, and automatically closes on either a high containment pressure or safety injection signal to minimize the loss of primary system inventory in the event of an accident. Other than isolation purposes, this valve has no accident safety function.

Since this valve is located inside containment, it is subjected to a harsh environment only in the event of a high energy line break inside containment. There is a high degree of confidence that this valve would be capable of performing its intended function since, in the case of a large break LOCA, the valve would receive a signa' to close within 10 seconds and would likely complete its safety function before environmental peaks occur.

Should this valve fail to close, there are three air-operated valves (202, 203, and 204) located outside containment which could be closed to isolate t letdown line. Since these valves are located outside containment, they wo not be exposed to the same harsh environment that caused the failure of MOV 200.

The only credible failure mode for this valve once it has completed its safety function (i.e., the valve closes) is one where the motor operator continues to operate against the seat of the valve until the circuit trips due to overload or motor failure. This type of failure would not preclude the fulfillment of the safety function of this valve or result in the degradation of any safety function. With this valve in the closed position, the valve position indication in the control room could conceivably indicate that the valve is open or not fully closed. Alternative instrumentation (e.g., letdown flow) which is not located in a harsh environment is available in the control room to preclude the operator from being misled by inaccurate valve position indication. In addition, EOP 3.1-4 requires the valve breakers to be locked open after MOV 200 is closed.

SYSTEM: Reactor Coolant System

COMPONENTS: RCS Loop Resistance Temperature Detectors (RTDs)

SAFETY FUNCTION AND JUSTIFICATION
FOR CONTINUED OPERATION:

The function of these temperature elements is to determine T_{cold} and T_{avg}. The failure cf one or more of these devices is an unlikely event. However, if one or more failures should occur, these devices are backed up by the in-core thermocouples and the subcooled margin monitor.

The in-core thermocouples consist of inorganic material and are not exposed to accident conditions more severe than normal operating conditions. As such, they are outside the scope of 10CFR50.49 but will, nonetheless, be operational during a design basis accident. All associated electrical equiment (e.g., cabling, cabinets) outside the reactor vessel and potentially exposed to a harsh environment is qualified pursuant to 10CFR50.49. The existing subcooled margin monitor is likewise qualified.

The failure of any or all of the RTDs will not degrade other safety functions. The operator will not be misled by inaccurate RTD temperature indications since other means (e.g., in-core thermocouples) exist to measure RCS temperatures as directed by the existing Emergency Operating Procedures.