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SUBJECT: Forwards results of suppression pool temp transient analysis.In-plant test will be conducted to measure difference between local & bulk pool temps during main steam valve discharge.

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Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
SUPPRESSION POOL TEMPERATURE TRANSIENT
ANALYSIS AND IN-PLANT SRV TEST

The purpose of this letter is to transmit the results of the suppression pool temperature transient analysis for WNP-2, and to advise you that we will perform an in-plant test to measure the difference between local and bulk pool temperatures during main steam relief valve discharge. Both of these were identified as open items during the Containment Systems Branch review meeting in Richland in September 1981, and in the draft SER for WNP-2.

Results of the pool temperature transient analysis are contained in the attached Report No. 14057-U(D)-1, "Suppression Pool Temperature Analysis", prepared for Washington Public Power Supply System Nuclear Project No. 2 by Stone and Webster Engineering Corporation. This analysis indicates that for the cases evaluated, the maximum suppression pool peak bulk temperature is 198°F. For wetwell airspace pressure of 0 psi gage, this is 35°F below saturation temperature at the quencher centerline elevation, and thus allows for a local-to-bulk temperature difference of 15°F, in accordance with the acceptance criteria of draft NUREG 0783 for steam mass flow rates of less than 42 $lbs/ft^2/sec$.

NUREG 0763 provides guidelines for determining whether plant-specific tests may be required to measure SRV discharge loads and pool temperature gradients. The stated policy is that new plant-specific tests will be required if plant parameters affecting loads and temperature distribution are substantially different from those previously tested. According to NUREG 0763, "applicants may be able to demonstrate that discharge conditions in their plants are sufficiently similar to conditions previously tested to obviate the need for any new tests or to curtail the scope of tests."

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Plant parameters defined in NUREG 0763 which must be evaluated for similarity to parameters previously tested are as follows:

1. discharge device geometry
2. discharge line parameters: line length, area, volume, quencher submergence, vacuum breaker size, available pool area per quencher.
3. steam flow rate
4. quencher location and orientation, and pool geometry
5. structural characteristics of containment

In-plant tests performed in the Caorso plant in Italy and in the Tokai plant in Japan are directly applicable to WNP-2. Both Caorso and Tokai have Mark II containments geometrically similar to WNP-2, with SRV discharge line parameters and quencher geometry essentially identical to WNP-2. The bottom of both the Caorso and Tokai containments are flat, while the WNP-2 containment has a trapezoidal-shaped bottom. The Caorso containment is reinforced concrete, while Tokai utilizes a steel containment similar to WNP-2.

Data from both the Caorso and Tokai tests have been extensively evaluated on our behalf by Burns and Roe, Inc. Of the two in-plant tests, Caorso has been the most thoroughly investigated due to the availability of data through the Mark II Owners group.

The quencher air clearing load definition for WNP-2 was based on detailed analysis of data from the in-plant SRV tests in Caorso, and confirmed by evaluation of data from the Tokai tests. Differences between the Caorso plant conditions, and WNP-2, were accounted for in the load definition report submitted to the NRC in August 1980 ("SRV Loads-Improved Definition and Application Methodology for Mark II Containments"). NRC review of the SRV load definition for WNP-2 considered all of the plant parameters identified above which could affect quencher air clearing loads. Differences between Coarso and WNP-2 plant parameters were addressed by the Supply System in response to NRC questions during the licensing process. Following discussions with the NRC during the Containment Systems Branch review meetings in Richland in September 1981, some modifications to the SRV load definition were made to account for minor differences in these parameters.

A summary of comparisons of the Caorso and WNP-2 significant plant parameters potentially affecting the quencher air-clearing load is provided below:

<u>Quencher Geometry</u>

The Caorso and WNP-2 quenchers are essentially identical. (See FSAR question 22.053).

<u>SRV Discharge Line</u>

SRV discharge line lengths, areas, volumes, and quencher submergence for Caorso and WNP-2 are similar. Minor differences are accounted for in the response to CSB issue #47 from the September 1981 review of WNP-2.)

Vacuum Breaker Size

The SRV discharge line vacuum breakers affect the reflood transient within the SRV line, and therefore the internal water level within the line for a subsequent SRV actuation. The Caorso test conditions included a diversity of SRV line initial water levels. Since the WNP-2 SRV load definition envelopes the loads observed at Caorso, differences in vacuum breakers are accounted for. (See FSAR questions 22.054, 22.057, and the response to CSB issue #47 from the September 1981 review of WNP-2.)

Pool Area per Quencher

The pool surface area per quencher for WNP-2 is slightly larger in WNP-2 than in Caorso. This difference would have no significant effect on the quencher air clearing load. (See FSAR question 022.107, and the response to CSB issue #47 from the September 1981 review of WNP-2.)

Steam Flow Rate

The steam flow rates in WNP-2 range from 236 to 252 lbm/sec. Steam flow rates in the Caorso tests ranged from 238 to 244 lbm/sec. The Caorso steam flow rates were within 1% of the flow rates for the six lowest setpoint SRV's at WNP-2, and within 2.5% of the flow rates for the highest setpoint SRV at WNP-2. These differences are not significant.

Quencher Location and Orientation

Quenchers at both Caorso and WNP-2 are arranged around the suppression pool in an inner circle and an outer circle. The outer quenchers in WNP-2 are farther away from the containment wall (9.95 feet) than the outer discharging quencher in the Caorso tests (7.5 feet). Since bubble pressure attenuates with distance, using Caorso test pressures applied directly to the WNP-2 containment is conservative.

Pool Geometry

Except for the trapezoidal-shaped bottom on WNP-2, Caorso and Tokai have essentially identical geometries to WNP-2. Since the magnitude of the SRV quencher air clearing loads acting on the containment wall have been found to be primarily a function of proximity of containment to the quencher, the effect of the shape of the pool bottom is not significant.

Structural Characteristics of Containment

Fluid/structure interaction (FSI) effects during the Caorso tests and the analytical methods used to extract rigid wall pressures from the test measurements are discussed in detail in the SRV load definition report submitted to NRC. As shown therein, the analytical model used to predict boundary pressures in a Mark II containment is in good agreement with Caorso test measurements. Also discussed is the application of FSI effects to the

steel containment structure of WNP-2. Differences between Caorso structural characteristics and WNP-2 are thus accounted for in the SRV load definition. (Also, see FSAR question 22.063.)

Based on this comparison of plant parameters, only minor differences between WNP-2 and Caorso are found to exist, and these differences are conservatively accounted for in the SRV load definition for WNP-2. We have concluded that an in-plant test to confirm the adequacy of the quencher air-clearing load would not substantially add to the body of knowledge already obtained from other in-plant tests, and is therefore not required for WNP-2, per the guidelines of NUREG 0763.

Suppression pool temperature response was also measured in the Caorso tests. As previously mentioned, the only significant difference between WNP-2 and Caorso which could conceivably affect pool temperature gradients is the shape of the pool bottom. Since the local-to-bulk pool temperature difference measured in the Caorso tests, as reported in NEDO-24798, was only 5°F, it does not appear likely that the temperature difference for WNP-2 would approach the allowable value of 15°F determined from the attached report. However, because the NRC has questioned the influence of the trapezoidal-shaped pool bottom on flow characteristics and temperature distribution in the suppression pool during SRV discharge, and because of uncertainties which would be associated with a purely analytical approach to this problem, the Supply System commits to conducting an in-plant test to measure the local-to-bulk temperature difference. Local temperature will be measured by temperature sensors mounted on the containment wall opposite the discharging quencher, in accordance with the guidelines of draft NUREG 0783. The existing suppression pool temperature monitoring system will be utilized in these tests, for measurement of both local and bulk pool temperatures.

G. D. Bouchey
Deputy Director
Safety and Security

EAF:kjf

Enclosure: Report No. 14057-U(D)-1
"Suppression Pool Temperature Analysis"

cc:	R. Auluck - NRC	(w/1 attachment)
	EF Beckett - Nuclear Projects Inc.	(w/o attachment)
	WS Chin - BPA	(w/o attachment)
	AI Cygelman - B&R Site (954W)	(w/o attachment)
	F. Eltawila - NRC	(w/1 attachment)
	R. Feil - Resident Inspector	(w/o attachment)
	JA Forrest - B&R RO	(w/o attachment)
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