FES NRC Corr File

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Public Service Company of Colorado
P. O. Box 361, Platteville, CO 80651

June 2, 1978
Fort St. Vrain
Unit No. 1
P-78092

Mr. Richard P. Denise
Assistant Director for Project Management
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket No. 50-267

Subject: Dewpoint Moisture Monitor Response Testing

Gentlemen:

In a letter dated March 3, 1976, reference number P-76072, the Public Service Company of Colorado agreed to completing Dew Point Moisture Monitor (DPMM) response testing at reactor power levels of 5%, 25%, and 100%. Testing at 5% and 25% power has been completed and the results submitted to the NRC in correspondence reference number P-77144, dated June 30, 1977.

In the Safety Evaluation issued in conjunction with Amendment No. 18 to the Fort St. Vrain facility operating license, the NRC indicated that because it appeared that the facility would be limited to operating at a maximum of 70% of rated reactor power for an extended period of time, it would be appropriate to determine the DPMM response times at 70% power, in addition to the response times at 100% power.

At a meeting held in Bethesda on April 19 and 20, 1978, the subject of DPMM response testing at 70% reactor power as a substitute for that testing committed to at 100% power, was discussed. The following provides a basis for performing such testing at 70% reactor power.

Discussion

The expected system conditions at 70% and 100% reactor power that affect the response time of the DPMM's are as follows:

Reactor Power (%)	70	100
Primary System Pressure (psia)	650	700
Core Outlet Temperature (°F)	1325	1445
Core Inlet Temperature (°F)	660	700
He Circulator ΔP (psi)	5.5	9.5*

*Based upon a minimum ΔP across the reactor core and orifice valve assembly.

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Expected Response Times - Design Conditions

The expected DPMM response time for the design basis steam leak accident is as follows, based on the helium circulator ΔP listed above:

Reactor Power (%)	70	100
Nominal Response Time - High Level Monitors (sec)	9.8	8.5
Nominal Response Time - Low Level Monitors (sec)	6.1	5.0

The calculation of these response times are based on the methods and flow coefficients given in the RT-355C report, Appendix A, GA-A13823. The higher nominal response time for all six of the low-level detectors compared to the nominal response time for just MT-1118 and MT-1122 reported in RT-355C is due to lower expected moisture concentrations for some of the low-level detectors. The even numbered low-level detectors (MT-1116, -1118, -1120, and -1122) are paired two detectors per penetration. The odd numbered low-level detectors (MT-1117 and -1121) are installed as single detectors per penetration. The single detector per penetration results in slightly lower inlet sample line temperatures than the two detectors per penetration (130°F vs. 155°F). The lower sample line temperature forces a lower sample moisture concentration which, in turn, produces a longer fogging time and overall response time.

It should be noted that the difference in response times at 70% and 100% power is relatively small and the response curve in the 50% to 100% power range is relatively straight. Since the response curve is basically straight and the difference in response times is small, any extrapolation of the 70% power data to 100% conditions can be accomplished with a high degree of confidence inthe indicated results.

Expected Response Times - Test Conditions

During moisture injection testing, the DPMM response times will be higher than that calculated for a design basis steam leak accident during normal reactor operation. This is due to the inability, under test conditions, to attain moisture concentrations in the sample flow to the detector of 3000 to 6000 vpm corresponding to a design basis steam leak during normal operation at 70% reactor power. There are several reasons for this, as discussed below.

The test apparatus used to perform the tests has a limited ability to inject moisture. During the RT-355C test, sample concentrations of approximately 2200 vpm at 325 psia were achieved. The sample passes through a cold (~100°F) PCRV penetration to the rake sample line. At the same saturation temperature (cold PCRV temperature) and a reactor pressure at 70% powerof about 650 psia,

the moisture content of the sample is reduced to about 1100 vpm. Additionally, the covers of the penetration housing will be removed during testing. This results in air circulation in the penetrations with the inlet sample lines reduced from normal expected temperatures to about 100°F. This also limits sample concentrations during testing to about 1100 vpm.

Because of the limitations inherent in the moisture injection apparatus, a more meaningful test can be run at 70% power than at 100% power.

Based upon the above, the nominal expected response times for an injection test at 70% reactor power with circulator ΔP equal to 5.5 psid, detector flow rate equal to 62.5 scc/sec and the bypass valve regulating are:

	Nominal Value
High Level Detectors (sec)	11.4
Low Level Detectors (sec)	9.3

Moisture Injection Testing and Acceptance Criteria for 70% Reactor Power Operation

It is proposed to perform 15 moisture injection tests at 70% reactor power as follows:

a. Base test: Test each of the six low-level and two high-level monitors.

b. Show repeatability: Test each high-level monitor twice more. Base test of the six low levels will demonstrate repeatability.

c. Restricted flow test: Test one low level from each loop and one high level monitor with a detector flow of 40 scc/sec and the bypass valve at the minimum stop position.

A factor in establishing the total number of moisture injections is the desirability of adding as little moisture as possible to the primary coolant. It is estimated that 15 injections, plus 3 to 5 aborted injections, would result in the equivalent of 1.2 ppm (volume) water increase in the primary coolant taking no credit for cleanup during the testing period.

The sample supply flow rate from the moisture injection apparatus will be adjusted to be slightly higher than the normal sample supply flows from the rake which are about 2400 scc/sec for the high-level detectors and 5000 scc/sec for the low-level detectors. All other detectors with supply lines from the rake used for testing will be valved off to assure nondilution of the moisture injection.

The acceptance criteria for the moisture injection tests at 70% reactor power based upon the nominal response time established for the test conditions with a plus 35% and minus 25% tolerance are as follows:

		Nominal Value-Sec	Acceptance Range - Sec	Assumed Sample To Mirror Concentration Difference - vpm
Nonrestricted flow (62.5 scc/sec detector flow and bypass valve regulating)	High Level	11.4	8.5 - 16.0	1000
	Low Level	9.3	7.0 - 13.0	1300
Restricted flow (40 scc/sec detector flow and bypass vale at minimum stop position)	High Level	17.5	13.0 - 24.0	1000
	Low Level	13.5	10.0 - 18.5	1300

Basis for Conducting Moisture Injection Testing at 70% as Opposed to 100% Reactor Power

The predicted response times for the DPMM's are essentially the same for a design basis steam leak accident for 70% and 100% reactor power, as can be seen from Figure 3 of the RT-355C test report. Thus, conducting the test at 70% reactor power essentially provides verification for the protective system operation up to 100% reactor power operation.

A second consideration is that moisture will be introduced into the primary coolant system during the tests. It is estimated the quantity will be equivalent to 1.2 ppm (volume) of the PCRV helium inventory. Oxidation of graphite components will be reduced at the lower temperatures encountered with 70% power operation, than at the 100% power temperatures.

Third, the sample flow rates from the rake are lower at 70% as opposed to 100% reactor power operation. At 100% power operation the expected sample flow rates are 3300 and 7000 scc/sec for the high-level and low-level detectors, respectively. This assumes a circulator ΔP of 9.5 psid. While the test apparatus in the RT-355C test was demonstrated to have a flow capacity in excess of these flow rates, the additional margin for conductance of the tests at 70% power is considered an asset.

We request the NRC concur with substitution of the 70% DPMM response testing for that previously agreed to be completed at 100% power, in writing, at the earliest possible date, so we may accomplish the testing before August 1, 1978.

If there are any questions, please let us know as quickly as possible.

Very truly yours,

PUBLIC SERVICE COMPANY OF COLORADO

Frederic E. Swart

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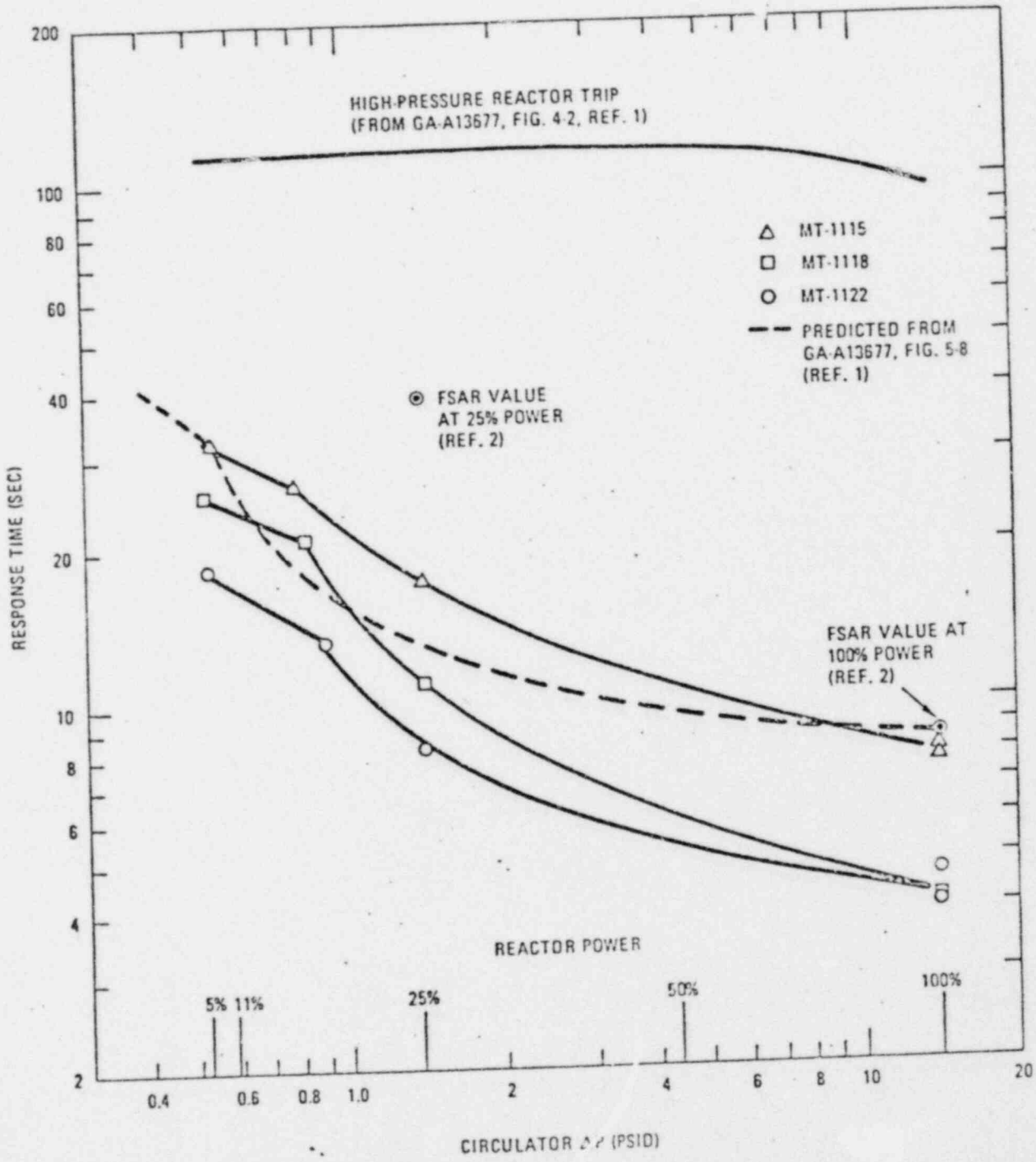

Fig. 3. Adjusted total response times from test data