NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 665-5000

August 18, 1988

Docket No. 50-336
B13001
Re: TMI Action
Item II.D.1

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Torque Switch Set Points of MOVs 2-RC-403 and 2-RC-405

In an April 20, 1988 letter,(1) Northeast Nuclear Energy Company (NNECO) supplied information regarding MOVATS testing of the pilot-operated relief valve (PORV) block valves (2-RC-403 and 2-RC-405) at Millstone Unit No. 2. NNECO stated that MOVs 2-RC-403 and 2-RC-405 were set to close with actuator output torques of 74.2 and 76.5 foot-pounds, respectively.

The Staff has since raised the question why NNECO does not set the PORV block valves at the closed setting of 82 foot-pounds, which was proven adequate through in situ differential pressure tests conducted for the Electric Power Research Institute (EPRI) on PORV block MOVs.(2) The Staff requested that NNECO document the justification for our lower actuator torque outputs by describing the differences between the Millstone Unit No. 2 PORV block valves and the PORV block valves tested for EPRI, specifically differences in port area and stem thread efficiencies. The purpose of this letter is to provide that documentation.

There are two reasons why the Millstone Unit No. 2 valves require less output torque than the EPRI MOV:

---

(1) E. J. Mroczka letter to U.S. Nuclear Regulatory Commission, "Relief and Safety Valve Testing," dated April 20, 1988.

(2) EPRI-Marshall Electric Motor-Operated Valve (Block Valve) Interim Test Data Report--EPRI NP-2514-LD, dated July 1982.

A046
1/0

1. The MOVs have smaller port areas and, as such, require 21 percent less stem force to overcome seat friction due to a differential pressure of 2250 psi.

2. The Millstone Unit No. 2 MOVs have stems which convert output torque to stem thrust 69 percent more efficiently.

An evaluation of the EPRI test report shows that MOVs 2-RC-403 and 2-RC-405 have been set to deliver more than sufficient thrusts (safety factor = 1.93) to allow them to perform their intended safety functions when compared to actual differential pressure test data taken on similar valves for EPRI.

Discussion

The valve tested for EPRI was a 3-inch, 1500-pound Velan gate/Limitorque SMB-00-15 MOV with a port diameter of 2.75 inches and a 1 1/8 x 1/3 x 2/3 stem. This MOV operated successfully with a minimum closed output torque of 82 foot-pounds. The Millstone Unit No. 2 PORV block MOVs are 2.5-inch, 2500-pound Velan gate/Limitorque SMB-000-5 MOVs with port diameters of 2.25 inches and 1 1/8 x 1/5 x 1/5 stems.

o Seat Areas

The 3-inch, 1500-pound Velan gate valve has a seat area of 5.940 square inches, while the 2.5-inch, 2500-pound Velan gate valve has a seat area of 3.976 square inches. Stem force needed to overcome seat friction due to differential pressure is linearly related to seat area. Although the 3-inch valve has a seat area which is 49 percent larger than the 2.5-inch valve, a direct comparison of the above two valves at a delta pressure of 2250 psi favors the small valve by only 21 percent. This is due to the "piston effect" forces applied to the stem by internal valve pressure.

Both of the above valves have 1.125-inch diameter stems with stem areas of .994 square inches. At 2250 psi the "piston effect" would yield an outward stem force of 2237 pounds on both valves, or about 40 percent of the total force needed to close against a delta pressure of 2250 psi. This reduces the effect of seat area differences between the valves.

o Stem Nut Efficiencies

The MOV tested for EPRI has a double-lead stem (1/3-inch pitch, 2/3-inch lead), while the Millstone Unit No. 2 MOVs are single lead (1/5-inch pitch, 1/5-inch lead). Generally, the larger the lead, the less efficiently the screw will convert torque-to-axial force (stem thrust). A comparison of stem factors (stem factor = torque/thrust) shows that the Millstone Unit No. 2 MOVs have stems which convert a given torque to a thrust that is 69 percent higher than the MOV tested for EPRI.

Comparison of the differential pressure operational capabilities of the Millstone Unit No. 2 MOVs and that of the MOV tested for EPRI requires first to determine the minimum required stem thrust to close each valve at the same differential pressure, and then to determine what the individual actuator torque output is required to deliver that thrust.

An output torque of 82 foot-pounds and stem factor of .0179 will yield a stem thrust of 4581 pounds in the EPRI MOV. Since the Millstone Unit No. 2 MOV is smaller, it will require 21 percent less force to operate against the same differential pressure than the EPRI MOV, or 3619 pounds. The Millstone Unit No. 2 MOVs have stem factors of .0106 so that a torque of 38.4 foot-pounds is all that is needed to deliver a stem force of 76.5 foot-pounds. This yields a safety factor of 74.2/38.4 = 1.93 when compared to the EPRI test data.

Opening differential pressure minimum thrust requirements are about 10 percent of those required to close the Millstone Unit No. 2 MOVs at 2250 psi. This is due to the "piston effect" of internal valve pressure on the stem. As seen above, the "piston effect" is a force of 2237 pounds always forcing the stem (and disk) out of the seat. This force acts against the actuator while closing the valve and assists the actuator while opening the valve.

The above information shows that MOVs 2-RC-403 and 2-RC-405 have been set to deliver more than sufficient thrusts to allow them to perform their intended safety functions when compared to actual differential pressure test data taken on similar valves for EPRI. We trust the foregoing information fully satisfies the Staff's concerns.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

EJ Mroczka

E. J. Mroczka
Senior Vice President

W D Romberg

By: W. D. Romberg
Vice President

cc: W. T. Russell, Region I Administrator
D. H. Jaffe, NRC Project Manager, Millstone Unit No. 2
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2, and 3