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March 8, 1994

P21 94066

Dave Garchow
Director of Site Technical Support
Arizona Public Service Co.
Palo Verde
Phoenix, Az.

Dear Mr. Garchow:

This letter is in reference to the Consolidated 3707R series of Main Steam Safety Valve (MSSV) setpoint comparative testing between Furmanite's Trevitest and over-pressure testing.

This comparative testing came about due to the events that occurred during Unit 1 testing at Palo Verde between the dates 08/19/93 and 08/21/93. Furmanite had tested a total of 9 valves. Of the 9 valves tested, 8 were found outside of the ±1% tolerance. All 8 failures were failing on the low side, ranging from 1.8% to 5.4% low. 7 of the 8 valves were adjusted based on the Trevitest results. APS Engineers, Boris Bolf and Casey Corcoran, questioned the accuracy of the Trevitest results since all the valves had been tested and set at the Westinghouse test facility and were considered to be in the best possible condition. Since the APS Engineers questioned the difference between the two test methods, testing was halted and the 7 adjusted valves were considered inoperable. This is explained in more detail in the NRC Region V morning report MR #: 5-93-0063 dated September 14, 1993.

Palo Verde has 20 valves per unit with set pressures of 1250 psig, 1290 psig and 1315 psig. Initially, three spare valves were pulled from the APS warehouse and sent to Westinghouse's Western Service Center in Banning, California. These valves were tested by Westinghouse to determine setpoint. Once the setpoint was determined, the valves were tested with Trevitest. Although an offset between the two test methods was discovered, the test results seemed to correlate.

P21 94066
p.2

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Looking at the Trevitest setpoint equation, there is only one place where this offset can be attributed to. Given the setpoint equation that follows:

$$S_p = \frac{(R_S)\ (L/C)\ (\%F) - W}{MSA} + L_p$$

R_s = Recorder Scale
L_p = Line Pressure
MSA = Mean Seat Area
L/C = Load Cell Capacity
W = Rig Weight
%F = Percent Force

Of the six variables in the setpoint equation, the Mean Seat Area (MSA) is the only variable that is not directly measured. The MSA was originally determined by averaging the inside and outside dimensions of the nozzle to determine the Mean Seat Diameter (MSD). Once the MSD was determined, an MSA was calculated using the relationship; cross-sectional area = $\pi(D^2)/4$. The calculated MSA = 24.626 in^2.

Since there was an apparent offset between the two test methods and the MSA was the only variable that was calculated, the purpose of the comparative testing changed. The objective changed to determining if a MSA could be obtained to minimize the offset between Trevitest and over-pressure.

The initial plan was to test a large sample of valves and compare the Trevitest results against the over-pressure results. The over-pressure tests were averaged to obtain an average setpoint. Once the average setpoint was determined, the Trevitest equation was back-calculated to determine an MSA that better represented the over-pressure (MSAe). The calculation looks like the following:

$$MSA_e = \frac{F_{total}}{(S_{p\ avg} - L_p)}$$

MSAe values were obtained for all the valves tested and then averaged to obtain a total MSAe.

The total MSAe value was based on test results from 37 valves. 15 valves were tested for Palo Verde from 08/24/93 to 01/27/94. Also included were 22 valve informational testing results from Diablo Canyon dating back to 09/29/92.

P21 94066
P.3

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The results from the 37 valve tests indicate that the Trevitest results using a MSA = 23.046 in^2 reduces the offset between Trevitest and over-pressure. This MSA has been determined from actual test results and not by the physical dimensions of the nozzle.

Furmanite is changing our 3707R MSA value to 23.046 in^2. We recommend that this value be used for MSA in the setpoint determination for any future testing to be done using the Trevitest process.

If you have any questions, I can be reached through our Charlotte office at (704) 376-5224.

Sincerely,

Clark R. Turner
Project Engineer
Furmanite America, Inc.

Larry Horan
Vice-President, East Coast Operations
Furmanite America, Inc.