AEOD/E207

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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MEMORANDUM FOR: Carlyle Michelson, Director
Office for Analysis and Evaluation
of Operational Data

FROM: Eugene V. Imbro
Office for Analysis and Evaluation
of Operational Data

SUBJECT: LER 50-336/81-26: INVESTIGATION OF THE RELATIVE FREQUENCY OF VALVE OVERTRAVEL ANOMALIES THAT COULD RESULT IN A POTENTIAL CENTRIFUGAL PUMP RUNOUT EXCEEDING NPSH

At the Millstone Nuclear Power Station, Unit 2, LER 81-26 describes an event where seven of the eight high pressure safety injection (HPSI) motor-operated valves overtravel from ¼ to one inch further than the required position. The LER states that valve overtravel results in smaller HPSI pump runout margins. The overtravel was caused by the variable coastdown of the Limitorque motor-operated valves and the small margin of acceptable valve position. It was noted in this LER that valve 2-SI-616 overtraveled on four successive test days (after being reset each time), and valves 2-SI-626 and 627 each overtraveled on two separate test days during recent adjustments in June 1981.

The HPSI safety injection valves have regularly overtraveled in the yearly surveillance test at Millstone. In 1979 (LER 79-41), valves 2-SI-616 and 626 overtraveled by 3% and in 1980 (LER 80-41), MOV 2-SI-616 overtraveled by ¼ inch.[1] Apparently, frustrated by the repeated surveillance failures of the valve to cycle to a correct opening, the licensee manually opened the valves to the required position and set each "fully open" limit switch in the Limitorque motor operator to be electrically open at this point to prevent any further remote opening of valves. In this configuration, the valve can be closed remotely. If, during power operation, the valve is inadvertently in the closed position, it will open on an SIAS, but again, may overtravel.

The HPSI injection valves are two-inch nominal pipe size globe valves with 3½ turns between the full closed and full open position. There are two marks corresponding to a minimum and maximum acceptable technical specification flow rate. The two reference marks are on an approximate two-inch diameter circle so that one inch of overtravel would result in about 5% change in valve stem travel.

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[1] The technical specification requiring the valve travel test became effective in spring 1978.

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The valve operator is a Limitorque-type SMB-00 powered by an AC electric motor with both limit and torque switches to define the potential valve stem travel. On valve closure, the torque switch should provide the initial cut-off of electrical power with the thermal overload device as a backup. (After the valve has seated, stem travel has virtually ceased and closing torque is increasing rapidly.) On full opening of the valve, the limit switch should first cut-off electricity to the motor operator before the valve stem starts to reach the limit of its travel in the full open position and the torque switch is activated. A Limitorque adjustment manual implies that the "fully open" limit switch can be activated from 90 to 100% of the valve's full open position. The desired valve opening necessary to get acceptable HPSI flow for the injection valves at Millstone 2 is 2½ turns or a "fully open" limit switch setting of about 71% of valve stem travel. Limit switch adjustments in this vicinity are somewhat more difficult to set than at the recommended 90-100% position. Further, all Limitorque actuators are designed to reach full motor speed before applying torque to turn the valve stem. This results in an impact to the valve stem at energization that should result in less precise initial stem movement. In addition, the motor speed during valve movement is not constant but is load dependent and may be influenced by the relative valve packing tightness on the test date. Also, there is a certain amount of play or lost motion in the worm gear linkage to the limit switch. Finally, the Limitorque operator is relatively large in comparison to the HPSI valve it is driving. Each of these conditions further exacerbate the difficulty in reaching repeatable valve positions while trying to stop valve movement in a narrow band at about 70% of stem travel. (The acceptable range of HPSI flows is on average 157 to 168.75 gpm per injection line.)

To continue the investigation of valve overtravel conditions, an LER search was performed to determine how prevalent valve overtravel conditions are within the nuclear industry. The search span was limited to calendar years 1980 and 1981 and used combinations of code and text searches sufficiently generalized to capture 188 LERs in this time frame. Each of these LERs was read and only two of these events involved valve overtravel situations; they were the two known LERs submitted by Millstone 2.

The relevant Millstone technical specifications were compared to the Combustion Engineering standard technical specifications and the technical specifications of each of the other seven Combustion Engineering designed plants to determine if there was something unique in the Millstone 2 technical specifications that caused the valve overtravel to be reported. Although the technical specifications are somewhat different, most required verification that each ECCS throttle valve would actuate to its correct position on an SIAS once per 18 months. The exceptions are Palisades and Ft. Calhoun, these require testing during each refueling outage. Apparently, overtravel of ECCS throttle valves is unique to Millstone 2.

Finally, each of the resident inspectors at the Combustion Engineering plants was contacted. The intent of the survey was to determine the correct position of the HPSI injection valves following a SIAS at other CE plants and to determine if the pump runout problem at Millstone 2 could be an unrecognized generic problem at the other CE sites. The salient points of this survey were:

1. The HPSI injection valves go full open on a SIAS.[2] Only at Millstone 2 are the valves required to open to a throttled position. This is probably due to unusually low HPSI system line losses. (There may have been an interface problem between CE and the A/E during plant construction.)

2. At all CE plants, a provision exists whereby some of the containment spray flow discharged from the containment spray HXs can be diverted into the HPSI pump suction lines. If inadequate NPSH is postulated on recirculation flow, the containment spray system could provide a source of cool water to the HPSI pump suction.

3. Each plant has some indicating device; e.g., a low suction pressure alarm, HPSI pump amperage, etc., together with a flowmeter on each HPSI leg to inform the operator of a pump runout condition.

We have discussed our observations and findings in a series of telephone conversations with site personnel at Millstone 2. The licensee is continuing to study the problem to determine a satisfactory method for restoring remote position operability to these valves. Neither the resident inspector nor AEOD observe a safety problem in operation of the facility with the HPSI injection valves manually open to the technical specification position. A possible corrective action could be the installation of a flow restricting device; e.g., another orifice or a more restrictive flowmeter orifice or a different plug or reduced trim on the HPSI injection valves. In any case, it is expected that the final configuration will be identical with the other CE plants, i.e., the rated HPSI flow is achieved at the full open HPSI valve position. No further AEOD action is required.

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[2] The CE design basis for the HPSI system is such that pump NPSH requirements would not be exceeded during post-LOCA recirculation flow from the containment sump with the injection valves wide open.

Millstone 2

LER SCREENING/DISPOSITION SHEET

Docket No. 336 LER No. 81-206/032-0

Engineer:	FSA 8/13/81	JLP 8/25/81	DMBRO FER
1. Add'l Info. Required? (circle one)	Yes (No)	Yes (No)	~~Yes~~ No
If YES, describe			IF VALVES OPEN FULLY WILL NPSH REQUIREMENTS BE EXCEEDED AFTER A LOCA
2. Is this event significant? (Appendix A) (Circle one)	Yes (No)	Yes (No)	~~Yes~~ No
If yes, why?			A-5,8
3. Abnormal Occurrence? (Appendix B) (Circle one)	Yes (No)	Yes (No)	Yes ~~No~~
If yes, why?			
4. Reportable to NEA? (Appendix C) (Circle One)	Yes (No)	Yes (No)	Yes ~~No~~
If yes, why?			
5. Recommended Action: Category(circle one)	I II III (IV)	I II III (IV)	Follow-up Eng Eval. possible I (II) III IV

6. Lead Engineer (NSSS) Disposition (Category III only):
Lead Engineer: _____ Category: I II IV Comments: _____

7. Final Action/Disposition Tambury -- look into this one further. How prevalent is this practice? Category II -- common cause failure potential?

Director, AEOD Date 11/8/81