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

MEMORANDUM FOR: Commissioner John Ahearne

FROM: H. R. Denton, Director
Office of Nuclear Reactor Regulation

THRU: L. V. Gossick, Executive Director for Operations

SUBJECT: LER TRENDS

Your memorandum to R. J. Mattson on the above subject dated April 19, 1979, cited the briefing given on operational data by Dr. W. Vesely on the same date. At this briefing, Dr. Vesely reported that an analysis of LER's related to valve failure indicated that a common problem was the leaving of valves incorrectly aligned (open or closed) following maintenance. The probability cited for this type of failure was 10^{-2} per maintenance act. Your memorandum asked: (1) if we had a preliminary list of other similarly high probability failures, and (2) if we had developed or knew of a mechanism for automatically detecting and alarming such safety violations.

In summary: (1) We do not have a list, but are aware of some high failure rates shown by LERs and are studying these items; (2) Systems exist for automatic detection and alarming of incorrect valve positions; the degree of sophistication of such systems has been increasing on recent designs.

1. With regard to the first question, we do not have a formal preliminary list of "other similarly high probability failures." We are aware, however, that LER's seem to indicate a higher incidence of failures of some components than we would like to see. These include: (1) valves and valve operators, (2) pumps, (3) control rods and drive mechanisms, (4) instrumentation and control components, (5) circuit breakers, and (6) diesel generators. On April 24, 1979, Mr. Gossick appointed a task force on "Operational Safety Data Analysis and Evaluation," with Mr. D. Davis of NRR as chairman. Some time ago, RES initiated (Ref. 1) a major LER Evaluation Program which has as its goal the extraction of component failure data from the NRC LER file, including studies of human-caused failures and multiple failure occurrences. Dr. Vesely's briefing to you on April 19, 1979, was the first result of this program. Items one through five cited above will be analyzed first in approximately that order and other items are likely to be added to the program later. Similarly, an evaluation of diesel generator LER's will be included in the Task Action Plan A-44, Station Blackout, when it is developed. A recent study of diesel-generator reliability (Ref. 2) was performed under the Technical Assistance Program. The results of these programs, when available. will be considered in reassessment of the adequacy of existing system designs and safety criteria.

2. All nuclear plant designs include a control room annunciator system which automatically indicates and alarms abnormal plant conditions, including the incorrect position of some (but not all) critical valves. Technical Specifications and the supporting administrative procedures are relied on to assure that these other critical valves are correctly positioned.

   Various types of valves are used in nuclear power plants: motor operated valves (MOV's), manual valves (MV's), flow control valves (FCV's - either air or hydraulically operated), and solenoid valves (SV's). Most of the valves used in engineered safety feature systems are MOV's or MV's. MOV's are all provided with position sensing limit switches integral with the motor operator which are used in the valve motor control circuitry and for remote position indication (open or closed). FCV's are provided with continuous position sensors used in the flow control circuitry and for remote reading (% open). MV's and SV's are not usually provided with position sensing devices, although the position indication of SV's is sometimes derived indirectly from the energized or deenergized status of the solenoid. However, all these valve types can be modified to provide position sensing devices; these devices then could be used to provide input to an automatic incorrect valve position indication and alarm system.

Monitoring is required of all safety systems, including indication when they are bypassed or otherwise inoperable. This include incorrectly positioned valves. The requirements are contained in Criterion XIV of Appendix B to 10 CFR Part 50 (Enclosure 1), Section 4.13 of IEEE Std 279-1971 (Enclosure 2), and Regulatory Guide 1.47 (Enclosure 3). It should be noted that only RG 1.47, which provides the most explicit requirements, includes a requirement for automatic indication of inoperable status at the system level. This guide was issued in 1973 and is applicable to plants with CP applications docketed after issuance of the guide. However, our reviews of CP's and OL's to which this guide is not applicable have attained a measure of conformance to its requirements, the degree depending on the degree of conformance of the original design and its stage of completion at the time the guide was issued. In this regard, the status monitoring system design for Watts Bar Units 1 and 2 is probably the most advanced design proposed to date. The monitor is completely computerized and includes audible alarms, and light displays indicating system status, cathoderay tube graphic display, alarm recorder, and interrogation capability for the operator to determine the status of components of the monitored systems. Enclosure 4, Section 7.7.1.3.6 of the Watts Bar FSAR, provides a more detailed description of this system.

In addition to monitoring the positions of critical valves, we require that some be interlocked so that signals initiating their safety functions also act to place the valves in their correct positions if they are not there already.

In view of the Three Mile Island incident, we are considering both the need for revision of existing requirements for safety system status monitoring systems

and interlocks, and also the need for backfitting of the revised requirements to operating plants and plants now in licensing review.

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

References

1. Memorandum from A. R. Buhl to NRR Division Directors dated October 30, 1978, LER, Evaluation Program: Draft Report on ECCS Valve Failure Rate Analysis.

2. NUREG CR 0660, Enhancement of On-Site Emergency Diesel Generator Reliability.

Enclosures:

1. Criterion XIV, Inspection Test and Operating Status, of Appendix B to 10 CFR Part 50.

2. Section 4.13, Indication of Bypasses, of IEEE Std 279-1971.

3. R.G. 1.47, Bypassed and Inoperable Station Indication for Nuclear Power Plant Safety Systems.

4. Section 7.7.1.3.6, Safety System Status Monitoring System, Watts Bar FSAR.

cc: Chairman Hendrie
Commissioner Gilinsky
Commissioner Kennedy
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