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

5/8/86

MEMORANDUM FOR: Hugh L. Thompson, Jr., Director
Division of Licensing

FROM: Robert M. Bernero, Director
Division of Systems Integration

SUBJECT: SAFETY IMPLICATIONS OF MAIN STEAM SAFETY VALVES (MSSVs) FLOW DEFICIENCY

Purpose and Background

The purpose of this memorandum is to identify the safety implications and potential consequences of MSSVs' flow deficiency.

During the last part of 1984 – through mid 1985, Wyle Laboratories conducted several full flow tests on two MSSVs manufactured by Crosby Valve and Gage Company. These two valves were chosen as a representative sample for the MSSVs that are to be installed on the Seabrook plant main steam lines. The purpose of the Wyle tests was to determine the adequacy of different discharge piping configurations. Test measurements indicated that the MSSVs (with the manufacturer's recommended guide ring settings), have a flow capacity of about 50% of their design values at the design pressure. The guide ring settings determine the force being exerted on the valve disc, thereby affecting the degree of valve lift and subsequently the discharge flow capacity of the valve. During the Wyle tests the guide ring settings of both valves were substantially adjusted ~~(150 notches downward)~~ in order to achieve the full flow capacities. Subsequent to the completion of the tests, the Public Service Company of New Hampshire, the owner of the Seabrook plant, concluded that in order to ensure full flow capacity of the plant's MSSVs they all should be adjusted downward by ~~150~~ 130 notches from the manufacturer's settings.

While the Seabrook experience shows a deficiency in the capacity adjustment of the Crosby spring loaded safety valves, it strongly suggests a similar deficiency in similar valves made by other manufacturers, since they all work on the same basic concept.

CONTACT: S. Diab, x29440

B/8

Safety Implications
Full flow testing of MSSVs is not normally performed by either reactor owners or valve manufacturers, nor is such testing an ASME requirement for capacity certification. Such certification is obtained through extrapolation from tests on much smaller valves at low pressures.

insert A

Based on the Seabrook experience and with the lack of sufficient data, it may be assumed that a number of deficient safety valves are installed in some operating plants and/or planned to be installed in plants yet to operate. ~~These valves~~ may be ~~installed~~ on the primary as well as ~~the secondary~~ sides ~~of the plant~~. It may also be assumed that the capacity of some of these deficient valves may be as low as 50% (as for the Seabrook plant) of the design flow, or even lower. With this potential deficiency, the design basis of the affected plants cannot be met. The design basis of every pressurized water reactor (PWR) requires that overpressure protection for the primary and secondary sides of the plant be provided so that the pressure may not rise above 110% of the design value during postulated events. PWR vendors perform sizing analyses intended to size the safety valves so that these valves have sufficient capacity to mitigate the most severe overpressurization event with sufficient margin. Generic transient analyses, as opposed to sizing analyses, performed by Westinghouse for the Westinghouse PWRs show that, for the worst overpressurization event, loss of load without condenser bypass, the MSSVs' peak relieving capacity required is about 80% of the nominal valve flow. It should also be noted that any flow degradation through the MSSVs increases the potential for the primary safety valve actuation and increases the load on these valves as well. This is because any relief through the MSSVs will remove heat from the reactor coolant, which would otherwise accumulate, expand, and overpressurize the primary system. There are no test data available to the staff that show if the valve flow would increase at high upstream pressure conditions and/or if the valve disc travel will be any higher. Therefore, it is not clear whether overpressurizations of this nature are self limiting.

With less than the required relieving capacity, the secondary side would be expected to be overpressurized, thus increasing the potential for steam side leaks or breaks. While the overpressurization described above would occur following a loss of load event, which is an anticipated operational occurrence, the consequences of that event may lead to a design basis with its associated severe consequences. While plants are licensed with a certain degree of risk attached to the potential of occurrence of their design basis events, the probability of occurrence of those events is sufficiently low. However, if a design basis event were to occur with a substantially higher likelihood or the plant were to be pressurized over its design pressure limits with sufficient frequency, then the plant cannot meet its design basis requirements.

Based on the limited information available about the adequacy of the safety valves for overpressurization, the staff has a reason to doubt that all the safety valves currently in use or planned for use would serve their intended safety function. Therefore, we suggest that the Division of Licensing send a request for additional information (RAI), per 10 CFR 50.54(f), to PWR plant owners. This RAI would request the plant owners to study the Seabrook experience and justify to the staff that their respective plants have sufficient overpressure protection. The owners' justification may rely on any combination of: (a) ~~plant experience or relevant~~ experience from which valve performance can be verified; (b) safety analysis assuming inadequate overpressure protection; or (c) valve testing.

Robert M. Bernero, Director
Division of Systems Integration

Enclosure:
Suggested 10 CFR 50.54(f) Letter

Insert A

Similar valves are installed on plant primary systems.

Problems of inadequate ring adjustments for primary safety valves were described during the EPRI testing program conducted in response to NUREG-0737, Item II.D.1. The problems were confined to valves manufactured by Dresser Industries. The effect of these inadequate adjustments were evaluated by the staff in 1982 and SERs justifying continued operation until EPRI verified ring settings could be implemented were issued to the affected plants. ~~Adequate primary~~ Ring settings that assure full valve relieving capacity are being verified for all PWRs as part of the plant specifi

Review of NUREG-0737, II.D.1
under MPA F-14.

Gary

Will you follow up on the [illegible] valve
and give me a call this afternoon?
I'm interested in knowing if something
was found to explain its initially high
~~the~~ lift point.

I've got an 11^{30} mtg. [illegible]

Mary

Fyrquel —— corrosive in nature

414 or Monel (guide)

TO :

FROM :

SUBJECT : REQUEST FOR ~~DST~~ DSRO PRIORITIZATION OF A GENERIC ISSUE ON THE RELIABILITY OF PWR MAIN STEAM SAFETY VALVES

In accordance with Enclosure 2 of NRR Office Letter No. to we are attaching the ~~information~~ required information ~~of the Office Letter entitled~~ ~~outlined in Enclosure 2~~ entitled "GENERIC ISSUE INFORMATION". We trust this is sufficient information for you to ~~prioritize~~ determine the priority of this issue ~~for~~ and appropriate NRR resources ~~for~~ allocation.

B/10

ENCLOSURE 2

GENERIC ISSUE INFORMATION

1. Suggested Title of Proposed Generic Issue or new requirement.

RELIABILITY OF PWR MAIN STEAM SAFETY VALVES (MSSV)

2. What is the known, suspected, or potential deficiency in the technical basis of existing staff guides or requirements?

The individual PWR plant FSARs assume credit for MSSV functional capability to provide overpressure protection for the secondary cooling system. This includes the ability to achieve full discharge flow at the proper setpoint, behave in a stable manner, and reclose at the proper reseat pressure. Because of inadequate valve certification and testing procedures, valve adjusting rings may be adjusted such that valve capacity, stability and blowdown may be adversely affected. The capability of the valve to be leak tight on reseating after discharge of liquid water due to steam generator overfill following steam generator tube rupture (SGTR may also be inadequate.

3. What present specific safety requirements (e.g., SRP, Regulatory Guide, Rule) appear to be inadequate or in doubt?

Inadequate capacity of the MSSV's may mean that FSAR Chapter 10 requirements for the Main Steam System are not met. Also, during some anticipated occurences the MSSVs provide heat removal from the primary system; therefore, inadequate capacity mean GDC 15 may not be met regarding primary system overpressure.

Should the MSSV's chatter, especially after SGTR and liquid overfill, and not reseat properly, Part 100 requirements may also be exceeded.

4. If a new requirement is proposed, what is the proposed requirement? Provide, to the extent possible, a value-impact assessment.

with regard to increasing valve capacity, The requirement may be to conduct tests on the various MSSV models in US PWRs. The most economical method would probably be through an owners group type of effort whereby prototypical tests would be conducted for the entire industry. There are several test facilities capable of performing such tests. The costs involved appear to be for the tests only since valve may be supplied by various utilities. No impact on plant outage length is expected.

With regard to increasing the ability of the MSSVs to function and properly reseat for liquid water discharge, the requirement may be to make hardware modifications to the valves. There are assist devices which can be added to safety valves which can eliminate problems due to unstable operation. These device could effectively stop valve chatter therefore minimizing seat damage such that the valves reseat properly. An alternative approach may be to increase the reliability of the atmospheric vents such that the MSSV are effectively never challenged with liquid.

5. What new information must be developed either to confirm the adequacy of the current technical bases or to define new requirements that would restore adequate protection?

New information which may be necessary to fully resolve this issue may include thermal-hydraulic system studies coupled with probabilistic risk studies of the secondary and primary systems to assess the impact of inadequate MSSV capacity.

6. What actions are being taken (if any) or should be taken on operating plants to correct the suggested deficiency? By whom (organization and individual) are these actions being taken?

NRR is planning to initiate 10 CFR 50.54f action (Generic Letter) to require immediate action by the PWR licensees to remedy the problem of inadequate capacity. An IE Information Notice or Bulletin action may also follow. This may result in NRR obtaining much of the information necessary to resolve this issue. The persons involved have been: Harold Gregg - RI, Gary Hammer and Frank Cherny - MEB, Mark Caruso and Dick Wessman - ORAB, Sammy Diab - RSB, Bob Baer and Mary Wegner - IE

7. If the issue is related to another generic issue, (e.g., TMI Action Plan Item) identify the generic issue and the area of issue overlap.

These issues are very much like those identified in TMI NUREG 0737, Item II.D.1 for primary system safety valves

8. Is anyone currently working on this issue? If so, name and organization.

NRR

Frank Cherny + Gary Hammer - DE/MEB
Sammy Diab - DSI/RSB
Mark Caruso + Dick Wessman - DL/ORAB

IE

Bob Baer + Mary Wegner - DEPER/EGCB

9. Name of person supplying information: Date provided.

Frank Cherny + Gary Hammer

10. Provide references as appropriate (Memoranda, NUREGs, SRPs, etc.)

The following references are attached:

(1) Letter from J. DeVincentis, PSNH to R. Starostecki, RI dated 1/17/85

(2) Memo from J. Durr, RI to R. Baer, IE dated 6/10/85

(3) Memo from D. Crutchfield, DL to H. Thompson, Jr., DL dated 8/2/85

(4) Letter from J. DeVincentis, PSNH to R. Starostecki, RI dated 8/27/85

(5) Memo from H. Thompson, Jr., DL to E. Jordan, IE dated 9/9/85

(6) Memo from F. Cherny, DE to G. Holahan, DL dated 9/9/85

(7) Memo from R. Bosnak, DE to D. Crutchfield, DL dated 9/27/85

(8) Letter from J. Williams, Jr., Toledo Edison to J. Stolz, DL dated 10/18/85

The following references are not attached:

(1) Letter from J. DeVincentis, PSNH to H. Gregg, RI dated 7/27/85 (Wyle Lab test data)

(2) ACRS Subcommittee on Reactor Operation Transcript of 9/10/85 meeting