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

APR 27 1978

NOTE TO: R. Tedesco, Assistant Director for Plant Systems, DSS

THRU: G. Lainas, Chief, Containment Systems Branch, DSS

J. Kudrick, Section A Leader, Containment Systems Branch, DSS

FROM: T. M. Su, Containment Systems Branch, DSS

SUBJECT: COMMENTS ON THE "REPORT ON BWR BLOWDOWN EXPERIENCE"

Per your request, I have reviewed the Report on BWR Blowdown Experience. The following summarizes my comments on that report:

1. Discussion should include the recent development in load increases due to SRV consecutive actuation. (GE's Part 21 notification).

2. With respect to the discussion on the structural capability, discussion should also include those structures such as SRV line supports whose structural capability cannot be related to the material fatigue cycles.

3. Correct pages 17, 18 and 20 as marked. Copy of these marked-up pages is attached.

4. Finally, I believe that it may be the right time to surface the quencher device as the possible fix for SRV related pool dynamic loads; e.g., load increase due to consecutive actuation as indicated in Item 1 above.

T. M. Su
Containment Systems Branch
Division of Systems Safety

Enclosure:
As Stated

cc: G. Lainas
J. Kudrick
T. Su

Contact:
T. Su, CSB
492-7711

Thus, it is concluded that these BWR pressure relief system events are not likely to significantly affect the reactor vessel fatigue life even if they were to continue to occur at a frequency even greater than that indicated by operating experience.

3.2 Pressure Suppression Pool Dynamic Loading Considerations

The steam discharge from an SRV is routed through piping from the drywell to the suppression pool (Figure 5). There, the steam is condensed and the energy is absorbed by the heat capacity of the suppression pool. Prior to SRV actuation, the SRV discharge piping between the SRV and the suppression pool is filled with air and the SRV discharge piping below the surface of the suppression pool is filled with water.

During an SRV actuation, high pressure steam compresses the air column and accelerates the water leg in the submerged section of the discharge line. When the water leg has been discharge, the compressed air is released into the pool. The air bubble expands in the pool causing a short duration, high pressure load on the
structures and components.
suppression chamber (torus) walls. The momentum of the displaced
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low amplitude pressure oscillations on the torus walls, which continu for the remainder of the blowdown event. Pressure loads on the torus walls are transmitted through the structure to the torus supports and

~~to piping attached to the torus~~. In addition to the ~~pressure~~ vibratory loads ~~on the torus boundary,~~ flow through the discharge lines create reaction forces on the piping supports, and the pool motion induced by the discharge flow causes drag loads on the structures and components located within the pool.

As the steam discharge continues, the temperature of the suppression pool will rise as the energy of the steam is absorbed by the pool. At a point referred to as the "threshhold temperature", ~~if the discharge continues~~ the steam condensation process would become vigorously unstable and the pressure oscillations could increase ~~by a factor of ten or more~~. This effect is referred to as the steam quenching vibration phenomenon. The threshhold temperature for this phenomenon ~~is primarily a function of the discharge flow rate and~~ is considered to occur where the bulk pool temperature is on the order of 150°F to 170°F.

A large number of pressure relief system actuations have occurred in both domestic and foreign BWR facilities. In a number of cases, typic early in the life of a given facility, localized damage to the discharge line restraints in the suppression pool and to the suppression pool baffles has occurred. The cause of this localized damage has be attributed to the reaction loads and to the pressure forces generated during the discharge of the air bubble. In these cases, the affected structures were repaired such that additional structural capacity was provided. In no case did this localized damage result in a loss of containment function or a release of radioactivity.

has become an integral part of the review of construction permit and operating license applications for all BWR pressure suppression containment designs (i.e., Mark I, II, and III).

As a result of generic suppression pool hydrodynamic concerns, owners groups were formed by utilities with plants utilizing the Mark I and Mark II containment designs. Through these groups, generic, analytical and experimental programs have been developed to address SRV loads. For the operating facilities, the SRV related tasks of the Mark I containment Long Term Program are intended to improve the quantification of SRV loads, to confirm the suppression chamber structural margins, and to confirm the adequacy of the suppression pool temperature limits.

The staff believes that there is no immediate (i.e., short term) potential hazard for the major structures from the vibratory loads associated with SRV operation due to the slowly progressive nature of the material fatigue mode of failure associated with cyclic loadings. Based upon the test results and analyses reported by the General Electric Company in "Steam Vent Clearing Phenomena and Structural Response of the BWR Torus," NEDO 10859 April 1973, substantial fatigue life margin is available in the torus structure to accommodate the potential SRV operations that may occur during the conduct of the LTP. The Mark I Owners Group has recently performed additional in-plant tests at the Monticello facility to identify and quantify the stresses in the torus structures associated with SRV operation. The need for structural modifications to provide

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