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

THREE MILE ISLAND NUCLEAR STATION, UNIT 1
SUPPLEMENTAL SAFETY EVALUATION
CONTAINMENT PURGE AND VENT (MPA B-24)

Background

Generic concerns with venting and purging of containments (multiplant action (MPA) B-24) were provided to the licensee in an NRC letter dated November 29, 1978. The staff has issued safety evaluations on various aspects of MPA B-24 in letters dated April 30, 1982 and November 2, 1982, based on information provided by the licensee (referenced in the staff's letters). Some aspects of MPA B-24 remained unresolved as documented in the staff's letter from J. Stolz to H. Hukill, July 8, 1983. The open issues may be summarized as follows:

1. Conformance to Standard Review Plan Section 6.2.4, Rev. 1, and Branch Technical Position CSB 6-4, Rev. 1.

   (a) Protection of structures/components downstream of purge isolation valves.

   (b) Adoption of limits on primary coolant activity, i.e., Standard Technical Specification (STS) limits, or

   - limit purging to 90 hours per year, or
   - provide an analysis of airborne radiation released as a result of a LOCA, including the amount of air/steam released.

   (c) Debris screens for purge lines.

   (d) Leak Testing of resilient seals and periodic replacement of seals.

2. Valve Operability Technical Specifications

   - Surveillance tests on closure time from 30 deg. open

   - Allowing purging only for pressure control and safety related reasons

   - Operability requirements for modes 1, 2, 3 and 4

Also the staff requested an analysis of ECCS backpressure with purge and vent valves open.

The staff has reviewed the licensees responses to these issues in letters dated October 19, November 24 and December 19, 1983, June 5, September 26, December 3, 1984, and March 15, 1985, from H. Hukill (GPUN) to J. Stolz (NRC). The staff's evaluation follows.

Evaluation

1. Conformance to Standard Review Plan Section 6.2.4, Rev. 1, and Branch Technical Position CSB 6.4, Rev. 1.

   (a) The Staff requested an analysis of the provisions made to protect structures and safety-related equipment located downstream of the purge isolation valves against loss of function due to the environment created by the escaping air and steam following a LOCA.

   The licensee performed an analysis that demonstrated that the downstream ductwork of the reactor building purge exhaust and supply systems will withstand the post-LOCA environment with the purge valves limited to 30 deg. open and a closure time of 3.5 sec. This analysis demonstrates that there will be no hostile environmental for safety-related equipment or structures downstream of the purge valves. The staff has reviewed the methodology and assumptions used in this analysis and finds them to be acceptable.

   (b) In Technical Specification Change Request (TSCR) 116, Rev. 1 and its supplement (November 24, 1983 and June 5, 194) the licensee has proposed TSs that are consistent with the STSs on primary coolant activity. The staff's evaluation of the TS submittal will be provided separately. However, as far as MPA B-24 is concerned, the staff finds that concerns with primary coolant activity are adequately resolved by the licensee's commitment to provide TSs that are consistent with the STSs. Accordingly, as stated in the staff's July 8, 1983 letter, the licensee need not limit purging to 90 hours per year or provide an analysis of airborne radiation released as a result of a LOCA, and the staff's generic evaluation of the purge dose contribution to LOCA doses is applicable. The generic evaluation is attached.

   Although the amount of purging need not be limited to 90 hours per year, the staff maintains that purging should be limited as much as possible. The proposed TSs identify those activities for which purging is permitted, and require that, to the extent practicable, containment entries for the activities noted shall be scheduled to coincide in order to minimize instances of purging. For example, preventive maintenance should be scheduled when the containment is to be purged for one of the activities noted. The actual amount of purging during the next cycle of operation is to be reported to the NRC as described in licensee's letter dated March 15, 1985, to enable the staff to review the efficacy of the proposed purging program. The staff finds the licensee's commitments and proposed TS conditions acceptable and in accordance with the requirements of MPA B-24.

   (c) In the September 24, 1984 submittal the licensee has committed to install debris screens, before cycle 6 startup, to ensure that purge isolation valve closure would not be prevented by debris which could potentially become entrained in the escaping air and steam following a LOCA. The licensee committed to the NRC guidelines on the debris screens contained in NRC memorandum from W. Butler, CSB, to L. Rubenstein, DSI, dated March 4, 1981. These commitments meet the guidelines of MPA B-24 and are acceptable.

(d) The licensee has agreed to leak test the purge/vent isolation valves at three-month intervals. The staff finds this commitment acceptable because it complies with the recommendations of MPA B-24.

The TSCR states that the valve seats (resilient seals) will be replaced at the first refueling following 5 years of service, as a minimum. The licensees' proposed replacement time will be reviewed as part of the review of TSCR 116. However, the commitment to a periodic replacement meets the guidelines of MPA B-24 and resolves this issue with respect to MPA B-24.

2. Valve Operability Technical Specifications

The licensee has proposed TSs on valve operability in TSCR 116, Rev. 1, dated November 24, 1983 as supplemented June 5, 1984. These submittals are currently under staff review but the licensee's submittals meet the guidelines of MPA B-24. In particular, the licensee has proposed:

- to perform surveillance tests on closure time from 30 degrees open
- to allow purging only for pressure control and safety related reasons
- to include operability requirements for modes 1, 2, 3 and 4.

Accordingly, the staff considers this issue resolved with respect to MPA B-24.

In response to the staff's request for an analysis of the effect of initially open purge/vent valves on the ECCS backpressure, the licensee provided CONTEMPT computer code comparisons of the most severe accident sequence for ECCS performance with and without initially open purge/vent valves. The results of this analysis showed that the peak pressure with purge/vent valves initially open was 0.2 psi lower than the case without purge/vent valves open. The staff reviewed the methodology and assumptions used in this analysis and finds them acceptable. The staff concludes that this small pressure decrease will not significantly erode the margin between the current peak clad temperature calculation of 2079 deg. F and the 2200 deg. F. upper limit on the peak clad temperature.

Conclusion

The purge and vent system design and operating practices for TMI-1 comply with the recommendations of MPA B-24, and are, therefore, acceptable to the staff.

Attachment:
Generic Evaluation of the Radiological
Consequences of Accidents while Purging
or Venting at Power

This Safety Evaluation was prepared by O. Thompson, Division of Licensing based on input from:

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GENERIC EVALUATION OF THE RADIOLOGICAL CONSEQUENCES
OF ACCIDENTS WHILE PURGING OR VENTING AT POWER
MULTI PLANT ACTION ITEM B-24

The release of radioactivity through vent or purge valves from a potential large LOCA at power has been considered generically to assure that such events do not constitute an undue hazard to the people residing around operating reactor sites. To evaluate the radiological consequences of such accidents, the following assumptions have been made:

a. vent and purge valve isolation signals, circuitry and purge valve actuation are reliable;

b. purge system isolation valve closure times are generally sufficient to prevent the release of activity associated with fuel failures that could follow a large break (a total accident elapsed time of about 15 seconds or less);

c. maximum allowable coolant iodine equilibrium and spiking activity limits do not exceed those contained in Standard Technical Specifications (STS);

d. fission products generated by pipe breaks are reflective of coolant activity and fuel failures estimated using 10 CFR Part 50, Appendix K, analys s techniques; and

e. radiological consequences of accidents while purging or venting would be bounded by those produced by a large break.

A large number of staff evaluations of the radiological consequences of LOCA's have been performed for construction permit, operating license, operating license amendment, and Systematic Evaluation Program reviews. In addition, a generic assessment of the amount of radioactivity that could be released while venting and purging from a spectrum of pipe breaks through the range of purge valve sizes utilized by industry has been made. In virtually all cases, the contribution through vent or purge valves is estimated to be of the order of 2 percent, or less, of the Exclusion Area Boundary (EAB) and outer boundary of the Low Population Zone (LPZ) doses that would occur from a large break LOCA in which a source term indicative of a substantial melt of the core with subsequent release of appreciable quantities of fission products is assumed.* For dose assessments in which only activity in primary coolant systems would be released, or for events in which fuel failures indicative of 10 CFR Part 50, Appendix K, LOCA analyses are indicated, EAB and LPZ dose estimates are substantially less than dose estimates made for a large break LOCA assuming a substantial fuel melt. Since the magnitude of the vent or purge contribution to severe LOCA dose estimates is small compared to other LOCA scenarios within design bases, we conclude that the consequences of such accidents are within applicable dose guidelines.

A generic assessment of the radiological consequences of large break accidents, including a resulting severe LOCA of the type hypothesized for site suitability purposes, while venting or purging at power indicates that the dose contribution through open valves is small. Therefore, we find total accident radiological consequences of such accidents would be less than the dose guidelines of 10 CFR Part 100.

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*Estimates based upon SRP analysis techniques and 10 CFR Part 100.11.