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NOTE TO: Frank J. Miraglia, Associate Director
for Inspection and Technical Assessment, NRR

FROM: Ashok Thadani, Director
Division of Systems Technology, NRR

SUBJECT: DPV CONCERNING CONTAINMENT ISOLAION VALVES AT ZION

In your note to me dated July 27, 1989, regarding the above subject you asked for information regarding the technical rationale for time to fuel damage from the onset of a LOCA in the Appendex K analysis. Specifically: (1) the temperature and pressure effects experienced by fuel early in a LOCA event; and, (2) why entry into DNBR does not result in fuel failure. Wayne Hodges' note to me dated August 10, 1989, (Enclosure 1) addressed these issues.

With regard to (1) above, analysis indicates that there is potential for fuel pin rupture during the LOCA blowdown (7 seconds) for very high power pins. However, for fuel pin powers that exist for current designs no blowdown rupture is predicted. Thus, fuel pin rupture during blowdown is not a problem for existing designs but should be checked for future designs.

With regard to (2) above, the main contributors to "fuel cladding rupture" are high pressure across cladding and high cladding temperature. While entry into departure from nucleate boiling (DNB) significantly reduces the heat transfer resulting in rapid cladding temperature rise, the heat transfer is not zero and the temperature rise is not instantaneous. Thus, it is not physically possible for the cladding to instantaneously rupture upon entry into DNBR because of LOCA conditions. Experimental data confirms this conclusion.

The fuel criteria described in Chapter 4 of the Standard Review Plan (SRP) could be interpreted to apply to LOCA analyses in the absense of staff practice. However, staff practice has never to our knowledge been to assume fuel failure upon inception of DNB for LOCA analyses. Perhaps, the SRP should be revised to more clearly describe staff practice, but I do not believe the effort to be worth the cost in staff resources.

Based upon these analyses and discussions with several staff experts, I do not believe that rupture of high burnup fuel pins during the blowdown transient to be credible for existing fuel designs. However, it is appropriate to verify that blowdown rupture does not occur for future designs.

You also requested comments regarding the applicability of Reg Guides, SRP's and BTP's cited in the reviews of the Zion amendment. Jack Kudrick, SPLB, and Ted Quay, PD31, looked into this (See Enclosures 2 and 3, respectively).

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Regarding Reg Guides, SRP"s and BTP's cited in the subject DPV, the major reference within the DPV is BTP CSB 6-4. This BTP is referenced in SRP Section 6.2.4, Containment Isolation Section. The focus of the DPV only addresses the BTP, however, to present a complete picture of the staff's position SRP 6.2.4 and how BTP CSB 6-4 is referenced need be considered. In particular SRP 6.2.4 states that for lines which provide an open path from the containment to the environs; eg., the containment purge and vent lines, isolation valve closure times "on the order of" 5 seconds or less may be necessary. Note that the intent must be taken as a goal but does not preclude closure times greater than 5 seconds.

Subsection n of SRP 6.2.4 is relevant to the DPV regarding dose analysis. Subsection n states:

> "...regarding the size of the purge system used during normal plant operation and the justification by acceptable dose consequence analysis, may be waived if the applicant commits to limit the use of the purge system to less than 90 hours per year while the plant is in the startup, power, hot standby and hot shutdown modes of operations."

Enclosure 3 provides discussion on Reg Guides and the SRP regarding the subject DPV's contentions on the release of fission products to the containment and subsequently to the environment through open purge valves. The bottom line of this discussion is that although the staff has used the "instantaneous" source term in accidents such as LOCA, its use was to ensure that containment isolation features incorporated either fast acting valves or features that would ensure containment integrity was not compromised during operation (e.g., dual doors on personnel locks). This simplified approach was never intended to be applied to purge valves except for those valves that were extremely slow closing (e.g., 2 minutes). No opening in containment during operations could be justified using the simplified instantaneous source term assumption. Specifically, no purge/vent system design could be found acceptable and without such systems, plant operations would be extremely restricted. Although the SRP specifies 5 seconds, the staff accepted closure times up to 15 seconds based on informal discussions we had with Research on their severe accident analyses. We were told that even for closure times up to 20 seconds that no substantial releases would occur.

The above discussion more properly reflects the staff view on purging. It does not indicate that the staff during the development of the SRP believed that the consequences of purging at the time of a LOCA would result in the impact asserted in the DPV.

A. Thadani

Ashok Thadani, Director
Division of Systems Technology

Enclosures:
1. Note from W. Hodges on DPV, dated August 10, 1989
2. Note from J. Kudrick on DPV, dated August 8, 1989
3. Note from T. Quay on DPV, dated August 10, 1989