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

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MEMORANDUM FOR: Victor Stello, Deputy Executive Director for Regional Operations and Generic Requirements

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

SUBJECT: POSITION ON A MSLB IN SUPERPIPE CONCURRENT WITH A SINGLE ACTIVE FAILURE

The Westinghouse analysis of a main steam line break (MSLB) has for years predicted that saturated steam would be expelled from the break. Recently Westinghouse has determined that under a certain accident scenario, namely a break in a main steam line (MSL) combined with uncovery of the steam generator tubes, superheated steam would be expelled from the break and thus result in higher environmental conditions for the area of the plant containing the break. The resulting temperature and pressure could thus exceed the temperature and pressure for which safety-related equipment in the area was qualified.

The revised Westinghouse scenario has caused the staff to re-review the guidelines which are used in evaluating such breaks. For the Catawba application it was found that while the MSLs meet SRP Section 3.6.2 (superpipe) Duke had considered the one square foot break defined in SRP Section 3.6.1 and in addition had included a single active failure in their analysis.

The staff added the arbitrary one square foot break in SRP Section 3.6.1 to cause safety-related equipment in the area to be protected from the jet impingement and environmental effects of the break. As the break was intended to define necessary separation for the safety-related equipment, taking a single active failure was not considered to be necessary.

The Enclosure sets forth the staff's practices for making license decisions concerning a MSLB in superpipe. The SRP is silent on whether one should postulate a single active failure concurrent with such a break. The Enclosure clarifies the staff's position that one need not postulate a single active failure. This clarifies a staff interpretation that has been used for a number of years. Since neither the SRP nor the staff's interpretation are changing I do not believe this is a matter for CRGR review.

Harold R. Denton, Director
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Enclosure: As Stated

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See next page

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APR 2 ▸ 1985

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POSITION PAPER REGARDING A MSLB CONCURRENT WITH A SINGLE ACTIVE FAILURE

Background

The Westinghouse analysis of a main steam line break (MSLB) has for years predicted that saturated steam would be expelled from the break. Recently Westinghouse has determined that under a certain accident scenario, a break in a main steam line (MSL) combined with uncovery of the steam generator tubes, superheated steam would be expelled from the break and thus result in higher environmental conditions for the area of the plant containing the break. The resulting temperature and pressure could thus exceed the temperature and pressure for which safety-related equipment in the area was qualified.

The purpose of this paper is to consider the MSLB outside containment for Westinghouse plants and to present the staff position which should apply.

Discussion

The revised Westinghouse accident scenario was first applied to the Catawba application. For that design the four MSLs exit containment by way of two valve houses, two MSLs pass through one of the valve houses and the other two MSLs pass through the second valve house. After exiting the two valve houses the four MSLs remain outside of any intervening structures up to the turbine building wall. Consequently, for the Catawba design, the valve houses are the only areas of the plant outside of containment which could sustain a MSLB and which contain safety-related equipment.

Duke presented the results of a sensitivity analysis of a MSLB in the valve house. The utility concluded that for a spectrum of breaks one square foot or less and considering a single active failure, the turbine driven auxiliary feed water pump fails to operate, the steam generator tubes would become uncovered and superheated steam would be expelled from the break. The resulting environmental condition would exceed the conditions analyzed for the saturated condition.

Duke however concluded that the safety-related equipment in the valve house would perform its function before the valve house environment exceeds the temperature and pressure for which the equipment was qualified or that the equipment could function in the more stringent environment. For the Catawba plant, the Auxiliary Systems Branch (ASB) agreed that the Duke methodology was conservative. ASB also concurred with the Equipment Qualifications Branch (EQB) license condition that requires further analysis by Duke for operation of the Catawba plant beyond March 31, 1985.

Based on the Catawba information, ASB concluded that the staff's position regarding a MSLB where superpipe is involved, should be reevaluated. The MSLs in the valve house are designed to the break exclusion criteria of SRP 3.6.2 (superpipe). The concept of superpipe was originally developed for boiling water reactors (BWR) to deal with the MSLs between the outer isolation valve and containment. The consequences of failing this section of the MSL concurrent with a single active failure of the inner isolation valve is an unacceptable loss of containment integrity. In order to reduce the probability of pipe break for superpipe so that a concurrent single active failure is not considered the staff requires that the superpipe meet the following design conditions:

1. The superpipe design maintains low stress and fatique usage factors which are attributable in part to the use of good geometry;

2. The superpipe design uses seamless pipe to minimize circumferential and longitudinal welds;

3. The superpipe design avoids all attachment welds to the superpipe surface; and

4. The superpipe is examined through 100% volumetric inspection of all welds through each inspection interval.

In order to maintain consistency, the pressurized water reactors (PWR) were also allowed to use the concept of superpipe in designing the MSLs. Subsequent to the derivation of the superpipe concept, it was found that plant designers assumed that the location of safety-related equipment in the vicinity of superpipe protected the equipment from high energy pipe breaks. This, of course, violates the major goal of the staff's pipe break criteria, which is to separate safety-related equipment from high energy lines whenever possible.

To enforce the staff separation criteria, where superpipe is a consideration, the staff defined the proper separation between the superpipe and safety-related equipment to be sufficient distance and/or barriers for the safety-related equipment to survive the environment and jet impingement effects resulting from a one square foot break in the superpipe. However, the staff did not postulate a single active failure coincident with the one square foot break. The one square foot break in the superpipe was postulated solely to define proper separation. When the SRP was revised in July 1981 this break defining proper separation was added (SRP Section 3.6.1). However, the staff's position concerning a single active failure was not stated.

Previously it was stated that the superpipe concept was devised to solve the problem of failing the section of MSL between the outer isolation valve and containment. The consequences in a BWR of failing this section of MSL concurrent with a single active failure of the inner isolation valve is a LOCA outside of containment. A LOCA outside containment is an unacceptable loss of containment integrity since the resulting dose at the site boundary would exceed the limits of 10 CFR Part 100. Given that BWRs were not required to consider a break in a MSL superpipe we believed that the PWRs should be treated similarly. However, due to separation problems, we required a one square foot break without a single active failure for BWRs and PWRs.

This is not the only situation wherein a single active failure is not assumed after a postulated piping failure. The staff's pipe break criteria also exempt "dual purpose" systems from single active failures after a postulated piping failure because of the remote probability of a "dual purpose" system failing during an accident.

We believe that for the Catawba plant the utility's analysis for the MSLB in the valve house is overly conservative. The arbitrary break in the superpipe should be analyzed without including a single active failure.

The Westinghouse Owners Group (WOG) presented the results of an analysis for a MSLB in the valve house of a typical Westinghouse plant which was comparable to the Catawba case. As with Catawba the WOG assumed that a failure in the superpipe with a single active failure results in the steam generator's tubes being uncovered and a resulting superheated steam environment. The WOG concluded that the safety-related equipment in the valve house performed its function before the environmental conditions exceeded the temperature and pressure for which the equipment was qualified.

Recommendation

1. As stated above we believe that postulating a MSLB in areas containing superpipe with a single active failure is too conservative. We propose that taking the single active failure be discontinued. This would be in concert with the SRP as discussed above.

2. We continue to concur with EQB that interim operation until March 31, 1985, of Catawba is acceptable. For the long term we believe that Duke should perform a sensitivity analysis for the spectrum of breaks in the superpipe one square foot or less without taking a single active failure to determine if superheated steam results from the break. If superheated steam is produced from the breaks we will require Catawba to verify that safety-related equipment is properly separated from the superpipe or that it is qualified to the superheat environment.