Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, MI 49201 • (517) 788-0550

February 15, 1983

Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 -
BIG ROCK POINT PLANT - SEP TOPIC III-5.A,
"EFFECTS OF PIPE BREAK ON STRUCTURES,
SYSTEMS AND COMPONENTS INSIDE CONTAINMENT" -
RESPONSE TO FIVE NRC QUESTIONS

By letter dated November 12, 1982, the NRC provided its evaluation of Consumers Power Company's September 30, 1982 safety assessment report (SAR) submitted in regard to SEP Topic III-5.A, "Effects of Pipe Break on Structures, Systems and Components Inside Containment" for the Big Rock Point Plant. In the above referenced letter, the NRC concluded that the methodology and acceptance criteria being used in our evaluations are appropriate. However, the NRC has requested additional information to complete the staff's evaluations of our SAR.

Consumers Power Company has reviewed the NRC's requests and provides the following response:

1. Provide information concerning the criteria used in identifying high energy piping systems considered for pipe break inside containment.

   Response

   The criteria used in identifying high energy piping systems is contained in Reference 11 to the NUTECH report "Evaluation of High Energy Pipe Break Inside Containment for the Big Rock Point Nuclear Plant". Reference 11 has incorporated the July 20, 1978 letter from the NRC SEP Branch to KMC, Inc which is referenced on page 2 of the November 12, 1982 SER.

A035

2. Assess the effects of large displacement pipe motion due to longitudinal breaks.

Response

The effects of pipe whip due to longitudinal breaks were considered. However, due to the magnitude of the circumferential breaks, both in number and effects on targets, it was considered that longitudinal breaks would not affect any targets to a degree greater than had already been evaluated. Therefore, in the interest of conserving analysis costs the effects of pipe whip due to longitudinal breaks were not analyzed in a rigorous manner.

3. Justify the use of Model 2 jet expansion and a jet thrust coefficient of 1.26 for feedwater line breaks.

Response

The use of Model 2, and the jet thrust coefficient of 1.26, which are applicable to steam or water-steam blowdown, are justified by the assumption that the 365°F feedwater will flash to steam at the break location.

4. Justify the functional capability of target piping under the jet impingement and pipe whip loadings.

Response

Target piping which is required to be functional following a high energy line break, is the core spray system piping. Other target piping that is not required to be functional is the main steam, feedwater, service water, cooling water and demineralized water system piping. For the core spray target piping, which was deemed acceptable by virtue of use of the ultimate strength of 60.0 ksi for the material acceptance criteria, only six (6) jet impingement and one (1) pipe whip interactions are in question. The acceptance criteria of 60 ksi provided allowable margins when compared to the calculated stresses for the jet impingement loads of 10, 27, 27, 36, 39 and 42 ksi. Acceptance criteria for carbon steel of $2.4S_h$ = 36 ksi (based on yield strength) shows four (4) of the six (6) interactions still acceptable and the remaining two marginally acceptable. The method to calculate the stresses is very conservative and, therefore, the two interactions with stresses of 39 and 42 ksi would likely be acceptable by a large margin utilizing a more rigorous calculational method. The pipe whip interaction was deemed acceptable based on acceptance criteria which allowed larger pipes to be impacted by smaller pipes with as small or smaller wall thickness. Even though the ultimate strength of 60 ksi is stated as the acceptance criteria, use of $2.4S_h$ based on yield strength is shown to be met or to be nearly met for all the cases where functional capabililty is required.

5. Justify the ductility ratios for impacted steel structures and concrete used in the evaluation.

Response

The ductility ratios used (20 for steel structures, 10 for concrete beams and 30 for concrete slabs), are referenced in design criteria for impulse and impact loads in "Structural Analysis and Design of Nuclear Plant Facilities", ASCE, and are commonly used. These ductility ratios are also presented in Bechtel Topical report BC-TOP-9-A. Of the evaluations performed (which considered these ratios) only two interactions passed the acceptance criteria and both passed by such a large margin that 25% of the ductility ratio could have been employed. One other interaction was stated to probably pass a 2-inch pipe impacting the emergency condenser shell. The acceptance criteria, based on a ductility ratio of 20 for the steel shell was not met. The steel shell, however, was considered acceptable because of the very conservative method and conservative assumptions used for the evaluation.

Kerry A Toner

Kerry A Toner
Senior Licensing Engineer

CC Administrator, Region III, USNRC
NRC Resident Inspector-Big Rock Point