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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards responses to NRC Questions 010.067 through 010.074 re internally generated missiles,per 821209 commitment. Responses closeout Outstanding Issue 2 in SER,NUREG-0892.

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December 9, 1982
G02-82-976
SS-L-02-CDT-82-111

Docket No. 50-397

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
RESPONSES TO NRC QUESTIONS 010.067 THROUGH 010.074 - INTERNALLY GENERATED MISSILES

Reference: Letter G02-82-975, G.D. Bouchey (SS) to A. Schwencer (NRC), "Response to NRC Question 010.066, NUREG-0803", dated December 9, 1982

Enclosed are sixty (60) copies of the responses to NRC Questions 010.067 through 010.074 as committed in the reference letter.

These responses close-out Outstanding Issue No. 2 in NUREG-0892, WNP-2 SER.

Very truly yours,

J C Jensen

for G. D. Bouchey
Manager, Nuclear Safety and Regulatory Programs

CDT/jca
Enclosure

cc: R Auluck - NRC
WS Chin - BPA
R Feil - NRC Site

B001

1/60

Q. 010.067
(3.5.1)

The FSAR infers that compartment walls will stop internally generated missiles. Verify that all compartment walls will: (1) prevent missiles from penetrating the walls, and (2) not form any secondary missiles, either by spalling or scabbing.

Response:

Except for the RCIC turbine, all credible missile sources have been evaluated and it has been verified, using the analysis methods cited in Bechtel Topical Report BC-TOP-9A, that these missiles neither penetrate or contain sufficient energy to induce secondary missiles by spalling/scabbing on the barrier walls they impact. The RCIC turbine analysis will be completed upon receipt and review of the RCIC turbine vendor's missile analysis report. The results of this review will be provided to the staff in the near future.

Q. 010.068
(3.5.1)
(RSP)

The FSAR states that "secondary missiles are not considered credible due to their low probability of occurrence and their low kinetic energy levels. In addition, no reliable method to predict secondary missile characteristics is known." Regarding your statement that no reliable method to predict secondary missile characteristics, the staff requests you use the empirical formula generated by CEA-EDF and Bechtel Topical Report BC-TOP-9A as appropriate to calculate the spalling and scabbing with the missile striking perpendicular to the barrier surface. Provide example calculations using each method. For each occurrence of scabbing, verify that all redundant equipment is completely protected from debris of all sizes.

Response:

We have reviewed both papers referenced in your question. The paper you refer to as "CEA-EDF" is, to the best of our knowledge, available only in French. If it should be determined that this paper is available in English, we will review it after staff approval and determine if it has any applicability to our project.

Bechtel Topical Report BC-TOP-9A does not provide any information on secondary missile characteristics. Formulas are presented to determine if secondary missiles would occur due to primary missiles striking concrete walls. However, an evaluation of a secondary missile would require a method of determining the size, trajectory, and velocity of the secondary missile.

Example calculations of how to predict spalling and scabbing are contained in BC-TOP-9A, which has been approved by the staff. The method outlined in BC-TOP-9A was used to evaluate all credible missile impacts. Except for the RCIC turbine, there are no credible missiles with sufficient energy to cause spalling or scabbing, thereby negating the necessity of evaluating the characteristics of the secondary missiles. See response to NRC Question 010.067 for the status of the RCIC turbine missile analysis.

Q. 010.069
(3.5.1)

With respect to bolted valve bonnets, the FSAR does not address the simultaneous failure of the bolts due to chemical attack followed by a pressure transient. Verify that no valves with bolted bonnets are located under or near any pipe or vessel containing any chemically corrosive material. For any valve for which this cannot be shown, specify the valve and provide a description of the design provisions which will be provided to ensure that no chemicals will be able to come in contact with the bolts. As an alternative, consider the bonnet to be a missile and verify that redundant safety-related equipment needed for safe reactor shutdown will not be damaged, including damage due to secondary missiles.

Response:

There are no corrosive chemicals in the plant that can come in contact with valve bonnet bolts, or any safety-related components in the plant.

Q. 010.070
(3.5.1)

The FSAR states that thermowells and detectors "are evaluated as potential missiles if a single circumferential weld would cause their ejection." Within the same paragraph the FSAR states that "because of their highly conservative design thermowells and sample probes are not considered credible missiles." These two statements are contradictory. Verify: (1) that thermowells and sample probes were evaluated as missiles, and (2) that no safety-related equipment needed for safe reactor shutdown would be damaged by thermowell or sample probe missiles including damage by secondary missiles.

Response:

Thermowells and sample probes which are retained by a single circumferencial weld were evaluated as potential missiles. A detailed analysis was made to determine both the actual stresses and yield shear and tension stresses for each thermowell and sample probe utilized. Thermowells and sample probes are retained by full penetration welds and are radiographed to insure integrity. The yield stress values were found to range from 6.6 to 20 times the actual stress values. This is a very high margin of safety, and supports our conclusion that thermowells and sample probes are not credible missiles because of their highly conservative design and weld quality inspections.

Q. 010.071
(3.5.1)
(RSP)

Compressed gas bottles are potential missiles. Consider all compressed gas bottles and accumulators as potential missiles and verify that redundant safety-related equipment needed for safe reactor shutdown will not be damaged, including damage by secondary missiles. If damage will result, describe the design provisions which will be used to protect the redundant equipment.

Response:

Compressed gas bottles and accumulators were evaluated as potential missiles. A detailed analysis was made of the gas bottles and accumulators to determine a credible method of failure. The actual yield shear and tension stresses for the gas bottle and accumulator stem connections were calculated. The yield stress values were found to be 89 times the actual stress values. All bottles and accumulators are held in place by at least two seismically qualified methods of retention. This analysis is the basis of our conclusion that compressed gas bottles and accumulators are not credible sources of missiles because of their highly conservative design.

Q. 010.072
(3.5.1)

The FSAR states that "when the separation and redundancy of the essential systems is not adequate ... It is shown that the essential components will not be damaged by the credible missile." Provide a discussion of, and figures as appropriate to illustrate, how "it is shown" that no damage would be incurred. Provide sample calculations, if appropriate.

Response:

The FSAR paragraph addressing this question is 3.5.1.1.4b(3). This information was transmitted in letter GO2-82-492, from Mr. G. D. Bouchey to Mr. A. Schwencer, dated May 28, 1982.

The analytical methods used to show that essential components will not be damaged when struck by the credible missile are contained in 3.5.1.1.4c and Bechtel Topical Report BC-TOP-9A, "Design of Structures for Missile Impact", Revision 2, dated September 1974. Table 3.5-7 tabulates credible missiles and notes measures taken to ensure essential systems are not damaged.

Q. 010.073
(3.5.1)
(RSP)

Provide the results of an analysis which verifies for each rotating piece of machinery that no failures can occur due to metal fatigue or chemical attack (such as chloride stress corrosion) such that any piece can become separated and, therefore, a missile. As an alternative, verify for each piece of rotating machinery that the casing will contain any missile generated at its maximum kinetic energy or that no safety-related equipment will be damaged by the generation of the missile taking no credit for any casing or enclosure.

Response:

For each rotating piece of equipment, the rotating component was assumed to fail regardless of fatigue useage level. For each failure, an analysis was performed to determine if the casing or protective housing would contain the resulting missile, or an analysis was performed to determine that no equipment required to safely shutdown the plant could be damaged. Details of the method used and the results of the analysis of each piece of rotating equipment are listed in Table 3.5-7.

Q. 010.074
(3.5.1)

Provide sample calculations and reference any support documentation used to assure that HVAC fan casings will retain any and all internally generated missiles.

Response:

A detailed analysis was performed to determine if the HVAC fan blades could potentially penetrate the fan casing in the event of a fan blade failure or hub failure. The results of the analysis showed that fan casings retained all internal missiles, see Note B of Table 3.5-7. The calculation method used is described in detail in Bechtel Topical Report BC-TOP-9A, "Design of Structures for Missile Impact", Revision 2, dated September 1974, Section 2.2.