REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**117-8061**
SRP Section:	**03.05.01.01 – Internally Generated Missiles (Outside Containment)**
Application Section:	**3.5.1.1**
Date of RAI Issue:	**07/27/2015**

Question No. 03.05.01.01-4

GDC 4, in part, requires SSCs to be protected from internally generated missiles. In addition, 52.47(a)(2) requires the applicant to provide “a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification … required to show that safety functions will be accomplished.”

DCD Tier 2, Section 3.5.1.1 provides a list of components that are not considered credible missile sources; however, the applicant has not provided an adequate explanation or technical justification as to why the components are not credible. For example, the applicant uses non-specific terms and phrases, such as, “valves constructed in accordance with regulation,” “ASME vessels,” and “industry pump,” without specifying the specific regulation or ASME section.

The applicant is requested to provide in DCD Tier 2, Section 3.5.1.1, the design criteria and applied codes and standards that demonstrate a high level of quality (e.g. material, design, fabrication, examination, testing, over pressure protection) thus assuring structural integrity of the components in order to conclude that the missile sources are not considered credible.

Response – (Rev. 1)

DCD Tier 2, Section 3.5.1.1 will be revised to specify the design criteria and applied codes and standards for rotating and pressurized components and to provide additional explanation of the basis for concluding that the missile sources are not considered credible. Additional details will be provided to state that the missile protection design of industry pumps is provided under overspeed conditions through vendor demonstration that the supplied pump casing is adequate to retain postulated fragments.

Impact on DCD

DCD Tier 2, Subsection 3.5.1.1 will be revised as indicated in the attached markup.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

c. Safety-related pumps have relatively low suction pressures and are not driven to overspeed due to a pipe break in their discharge lines. In addition, the induction motor would act as a brake to prevent pump overspeed.

d. Industry pumps are designed to prevent the penetration of pump casings from impeller pieces under overspeed condition through vendor demonstration that the supplied pump casing is adequate to retain postulated fragments.

3.5.1.1.1.2 Balance of Plant Components

All rotating components inside seismic Category I structures outside the containment are considered potential missile generation sources. Rotating parts in these components are therefore designed to be contained by a protective casing or structures.

The turbine building, which contacts with the seismic Category I auxiliary building, is designed as seismic Category II. The turbine building does not contain safety-related systems or components and does not require design for protection from rotating components that become missiles.

The turbine, the object with the largest kinetic energy in the turbine building, is considered a missile generation source. Turbine missiles are described in Subsection 3.5.1.3. The main feedwater pump, the object with the second largest kinetic energy outside containment, is considered to be a generation source for a missile that flies toward the auxiliary building, even though the main feedwater pump is designed such that the inside fragment cannot perforate the casing. By assuming penetration of its casing by a fragment, the results provide reasonable assurance that missiles from the main feedwater pump would not perforate the external wall of the auxiliary building. Considering that missiles that are generated from rotating components near the auxiliary building have rotors that are oriented toward the auxiliary building, reasonable assurance of the protection of safety-related systems and components inside the auxiliary building is provided.

3.5.1.1.2 Potential Missiles from Pressurized Components

3.5.1.1.2.1 NSSS Components

If the probability of missile generation P_1 is maintained less than 10^{-7} per year, the missile

c. The missile is postulated to occur only if the energy of the missile is sufficient to perforate the equipment's protective housing.

Missiles generated by postulated failures of pressurized components are selected and evaluated based on the following conditions:

a. Pressurized components in the systems whose maximum operating pressure exceeds 19.3 kg/cm^2 (275 psig) are assumed to be missile generation sources.

b. Connecting portions installed on piping or components are assumed to be missile generation sources. Connecting portions include thermowells, pressure gauges, and lines for vents, drains, and testing.

c. A connecting portion may be eliminated as a missile generation source if it is welded and its design strength is stronger than that of the basement.

Insert "A"

~~d. Valves constructed in accordance with regulation and valves designed to prevent ejection are not considered credible missile generation sources.~~

h. ~~e.~~ Non-ASME pressurized vessels with an operating pressure greater than 19.3 kg/cm^2 (275 psig) are considered missile generation sources. ASME vessels are not considered missile generation sources ~~because of their controlled design and fabrication.~~ because they are designed, fabricated, examined, and tested in accordance with ASME ~~codes~~ Section III.

i. ~~f.~~ Non-ASME valves in piping systems with an operating pressure greater than 19.3 kg/cm^2 (275 psig) are considered missile generation sources.

j. ~~g.~~ An industrial pressure bottle containing highly pressurized gas is considered a missile generation source except when the bottle is designed with overpressure protection and is located in a separate room to control the effect of an explosion.

Internally generated missiles (outside the containment) from rotating and pressurized components are not considered credible in accordance with the criteria described above.

"A"

d. Valves with bolted bonnets are most commonly used valve type such as gate, check or globe valves in high energy piping. The body and bolted bonnet of these valves constructed with ASME Code Section III or ASME B16.34 are unlikely to become missile sources due to the limitation of stresses in the bonnet-to-body bolting material by rules set forth in ASME Code. Even if a bonnet-to-body bolt failure were to occur, the likelihood of all bolts experiencing a simultaneous complete failure is very remote. The widespread use of valves with bolted bonnet in nuclear industry and the low historical incidence of complete valve bonnet failures demonstrate that the valves with bolted bonnets type need not be considered as credible missile sources.

e. Pressure seal bonnet type valves are also constructed in accordance with ASME Code Section III or ASME B16.34. The valve bonnets are prevented from becoming missiles by the retaining ring. If retaining ring were to fail in shear, then the yoke would capture the bonnet or at least significantly reduce its energy. Because of the combination of these design features bonnet ejection incident is highly improbable, and hence bonnets are not considered missile sources.

f. The design feature of threaded valve stem with face hardened backseats prevents the ejection of stems. The stems are prevented from becoming credible missiles. And the stems having valve actuators are additionally restrained by the valve actuators.

g. Nuts, bolts, nut-and-bolt combinations, and nut-and-stud combinations need not be considered as credible missile sources because it has not enough energy to eject a missile.