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.:	**113-8062**
SRP Section:	**03.05.01.02 – Internally Generated Missiles (Inside Containment)**
Application Section:	**3.5.1.2**
Date of RAI Issued:	**07/27/2015**

Question No. 03.05.01.02-1

GDC 4 requires SSCs to be protected from internally-generated missiles. Maintenance equipment that is not secured or removed from an area is a potential gravitational missile source. SRP 3.5.1.2 specifies that unsecured maintenance equipment should be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile.

DCD Tier 2, Section 3.5.1.2 doesn't seem to include an evaluation of internal missiles resulting from failures of unsecured maintenance equipment.

The applicant is requested to provide an assessment of potential gravitational missiles from unsecured maintenance equipment and discuss the measures provided to prevent the impact of it falling on safety-related SSCs. DCD Tier 2 Table 1.8.2, should be revised to include a COL information item to establish/provide procedures which ensure that equipment, such as a hoist that is required during maintenance, be either removed or seismically restrained following maintenance to prevent it from becoming a missile.

Response

During operation, there should not be any unsecured maintenance equipment in containment that could have the potential to impact safety related SSCs. The design of the APR1400 considers that all permanent equipment is adequately secured and will not pose a gravitational missile hazard. It is normal practice to include walkdown inspections of containment prior to startup to identify potential gravitational missiles and take appropriate actions to eliminate the hazard if discovered. To ensure that appropriate administrative means are in place, DCD Tier 2 Subsection 3.5.1.2 and Table 1.8-2 will be revised to include the COL item "The COL applicant is to provide the procedures which ensure that unsecured maintenance equipment be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSC important to safety, or seismically restrained to prevent it from becoming a missile."

Impact on DCD

DCD Tier 2, Subsection 3.5.1.2 and Table 1.8-2 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.

protective features protect the reactor coolant pressure boundary (RCPB), containment liner plate, containment penetration, main steam line, main feedwater line, direct vessel injection line, and steam generator, including the instrument connection of steam side, blowdown line, and drain line from the missile. Engineered safety features, except for some portions of piping for direct vessel injection following a LOCA, are located outside the secondary shield wall to minimize the effects from missiles generated by the RCPB.

The protective shield is installed above the control element drive mechanism to protect the control rod drive mechanism and reactor vessel and SSCs required for safe shutdown from internally generated missiles and a missile from the control element drive mechanism breakaway.

The protective features inside the containment are provided to protect the containment liner plate, isolation system, and the main steam system related to the steam generator from missiles caused by the main steam and main feedwater line breaks, and to prevent the malfunction of other systems or equipment.

The secondary shield wall between the containment wall and refueling pool wall serves as a shield to protect the reactor coolant system, including the steam generator, from missiles generated inside the containment annulus area. The secondary shield wall also serves as a shield to protect safe-shutdown equipment, such as the safety injection tank, from missiles generated by the RCPB.

Missiles falling from heavy load transfers by crane and missiles from dropped SSCs designed to non-seismic category inside the containment are considered gravity-caused missiles. Designs for other lifts comply only with SRP 9.1.5 and NUREG-0612 for falling heavy loads from equipment or component transfers, and the design provides reasonable assurance that the effect of heavy load drops during transfers by crane is eliminated by blocking the path above the systems and components that are necessary to achieve a safe shutdown or protect against an accident. The drop of nonseismically designed SSCs in the containment could affect safety-related systems. Therefore, they are designed to seismic Category II to protect the safety-related systems from the impact of dropped objects.

The COL applicant is to provide the procedure for heavy load transfer to strictly limit the transfer route during plant maintenance and repair period (COL 3.5(1)).

The COL applicant is to provide the procedures which ensure that equipment required during maintenance, should be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSC important to safety, or seismically restrained (COL 3.5(6)).

3.5.4 Combined License Information

COL 3.5(1) The COL applicant is to provide the procedure for heavy load transfer to strictly limit the transfer route inside and outside containment during plant maintenance and repair periods.

COL 3.5(2) The COL applicant is to perform an assessment of the orientation of the turbine generator of this and other unit(s) at multi-unit sites for the probability of missile generation using the evaluation of Subsection 3.5.1.3.2 to verify that essential SSCs are outside the low-trajectory turbine missile strike zone.

COL 3.5(3) The COL applicant is to evaluate site-specific hazards induced by external events that may produce more energetic missiles than tornado or hurricane missiles, and provide reasonable assurance that seismic Category I and II structures are designed to withstand these loads.

COL 3.5(4) The COL applicant is to evaluate the potential for site proximity explosions and missiles due to train explosions (including rocket effects), truck explosions, ship or barge explosions, industrial facilities, pipeline explosions, or military facilities.

COL 3.5(5) The COL applicant is to provide justification for the site-specific aircraft hazard and an aircraft hazard analysis in accordance with the requirements of NRC RG 1.206.

3.5.5 References

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," U.S. Nuclear Regulatory Commission.

2. NUREG-0800, Standard Review Plan, Section 3.5.1.1, "Internally Generated Missiles (Outside Containment)," Rev. 3, U.S. Nuclear Regulatory Commission, March 2007.

3. NUREG-0800, Standard Review Plan, Section 9.1.5, "Overhead Heavy Load Handling Systems," Rev. 1, U.S. Nuclear Regulatory Commission, March 2007.

COL 3.5(6) The COL applicant is to provide the procedures which ensure that equipment required during maintenance, should be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSC important to safety, or seismically restrained.

Table 1.8-2 (3 of 29)

Item No.	Description
COL 3.4(1)	The COL applicant is to provide site-specific information on protection measures for the design-basis flood, as required in Subsection 2.4.10.
COL 3.4(2)	The COL applicant is to provide flooding analysis with flood protection and mitigation features from internal flooding for the CCW Heat Exchanger Building and ESW Building.
COL 3.4(3)	The COL applicant is to confirm that the potential site-specific external flooding events are bounded by design-basis flood values or otherwise demonstrate that the design is acceptable.
COL 3.4(4)	The COL applicant is to identify any site-specific physical models that could be used to predict prototype performance of hydraulic structures and systems.
COL 3.5(1)	The COL applicant is to provide the procedure for heavy load transfer to strictly limit the transfer route inside and outside containment during plant maintenance and repair periods.
COL 3.5(2)	The COL applicant is to perform an assessment of the orientation of the turbine generator of this and other unit(s) at multi-unit sites for the probability of missile generation using the evaluation of Subsection 3.5.1.3.2 to verify that essential SSCs are outside the low-trajectory turbine missile strike zone.
COL 3.5(3)	The COL applicant is to evaluate site-specific hazards induced by external events that may produce more energetic missiles than tornado or hurricane missiles, and provide reasonable assurance that seismic Category I and II structures are designed to withstand these loads.
COL 3.5(4)	The COL applicant is to evaluate the potential for site proximity explosions and missiles due to train explosions (including rocket effects), truck explosions, ship or barge explosions, industrial facilities, pipeline explosions, or military facilities.
COL 3.5(5)	The COL applicant is to provide justification for the site-specific aircraft hazard and an aircraft hazard analysis in accordance with the requirements of NRC RG 1.206.
COL 3.6(1)	The COL applicant is to identify the site-specific SSCs that are safety related or required for safe shutdown that are located near high- and moderate-energy piping systems and that are susceptible to the consequences of piping failures.
COL 3.6(2)	The COL applicant is to provide a list of site-specific high- and moderate-energy piping systems including layout drawings and protection features and the failure modes and effects analysis for safe shutdown due to the postulated HELBs.
COL 3.6(3)	The COL applicant is to confirm that the bases for the LBB acceptance criteria are satisfied by the final as-built design and materials of the piping systems as site-specific evaluations, and is to provide the information including LBB evaluation report for the verification of LBB analyses.
COL 3.6(4)	The COL applicant is to provide the procedure for initial filling and venting to avoid the known causes for water hammer in DVI line.
COL 3.7(1)	The COL applicant is to determine the site-specific SSE and OBE that are applied to the seismic design of the site-specific seismic Category I and II SSCs and the basis for the plant shutdown. The COL applicant is also to verify the appropriateness of the site-specific SSE and OBE.
COL 3.7(2)	The COL applicant is to confirm that the horizontal components of the SSE site-specific ground motion in the free-field at the foundation level of the structure satisfy a peak ground acceleration of at least 0.1 g.

COL 3.5(6) The COL applicant is to provide the procedures which ensure that equipment required during maintenance, should be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSC important to safety, or seismically restrained.

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.:	**113-8062**
SRP Section:	**03.05.01.02 – Internally Generated Missiles (Inside Containment)**
Application Section:	**3.5.1.2**
Date of RAI Issued:	**07/27/2015**

Question No. 03.05.01.02-2

GDC 4 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 3.5.1.2 does not include an adequate assessment for certain internally-generated missiles. For example, the applicant has not adequately addressed why the RCP flywheel or pressure vessels are not considered postulated missiles. In addition, the design criteria of ANSI Class 900 alone is not sufficient justification of quality for excluding valves as a missile source.

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

Response

The rotating parts of the RCP and RCP motor assemblies, including the flywheel, preclude missiles from occurring through the quality controls applied during the manufacturing and installation, inservice inspections performed, and the continuous monitoring for shaft and bearing vibrations. The design overspeed is sufficiently higher than the maximum rotating speed of the motor postulated at the plant, and the flywheel integrity can be maintained to prevent the possibility of producing high-energy missiles as described in Subsection 5.4.1.1 and excessive vibration of the pump assembly under standstill, normal and anticipated operating conditions consistent with the intent of General Design Criteria 4 and Regulatory Guide 1.14.

The pressure vessels inside containment are not considered missile generation sources because they are designed and fabricated in accordance with ASME Section III.

Most valves installed in high-energy lines are designed, constructed, and tested in accordance with ASME B16.34, Class 900. ASME B16.34 is accepted worldwide in nuclear plant design, including the APR1400, and provides a valve standard for the design, testing, and performance to assure a high level of quality. This standard covers new construction including pressure-temperature ratings and dimensions for cast, forged, and fabricated flanged, threaded, and welding end, and wafer or flangeless valves. Compliance with this standard means that body and shell materials comply with ASME and ASTM material standards for chemistry and strength, and are heat treated to insure grain structure, corrosion resistance and hardness. The minimum wall thicknesses of body and other pressure retaining components for each pressure class are also specified. The valve stems are internally loaded and blowout proof to meet the standard.

Valves with bolted bonnets are the 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 to ASME Code Section III or ASME B16.34, are unlikely to become missile sources due to the stress limitations in the bonnet-to-body bolting material required by the rules set forth in the ASME Code. Even if a bonnet-to-body bolt failure were to occur, the likelihood of all bolts experiencing a complete and simultaneous failure is very remote. The widespread use of valves with bolted bonnets in the nuclear industry and the low historical incidence of complete valve bonnet failures demonstrate that bolted bonnet type valves do not need to be considered as credible missile sources.

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 the retaining ring were to fail in shear, then the yoke would capture the bonnet or significantly reduce its energy. Because of the combination of these design features, a bonnet ejection incident is highly improbable and hence valve bonnets are not considered missile sources.

The design feature of threaded valve stems with face hardened backseats prevents the ejection of stems. Stems having valve actuators attached are additionally restrained.

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

DCD Subsection 3.5.1.1 will be revised to include the additional information provided on internally generated missiles. DCD Tier 2, Subsection 3.5.1.2.2.2 will be revised to include the codes and standards of ANSI Class 900.

Impact on DCD

DCD Tier 2, Subsection 3.5.1.2.2.2 and Subsection 3.5.1.1 will be revised as indicated in the attached markup. Note that the additional information inserted into Subsection 3.5.1.1 was also included as part of the response to RAI 117-8061 Question 03.05.01.01-4 (ref. KHNP submittal MKD/NW-15-0268L dated December 22, 2015).

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.

mechanism missiles are included. Items that are excluded because of redundant retention features are valve stems, valve bonnets, and pressurized cover plates.

3.5.1.2.2.2 Balance of Plant Components

Credible missiles resulting from failures of pressurized components in the balance of plant components are selected based on the same conditions as listed in Subsection 3.5.1.1.

As mentioned above, potential missiles from balance of plant pressurized components inside the containment are in the high-energy system range. Most of the valves installed on a high-energy line ~~are designed according to ANSI Class 900 and~~ designed, constructed, and tested in accordance with ASME B16.34 with Class 900 are excluded as a missile source from pressurized components. Valves installed on auxiliary steam systems are also excluded as a missile source because the operating pressure is below 19.3 kg/cm^2 (275 psig). Therefore, there is no missile influence from missile generation of balance of plant pressurized components inside the containment.

3.5.1.3 Turbine Missiles

Although the auxiliary system associated with the turbine is non-safety-related, missiles generated by turbine failure can adversely affect the integrity of essential SSCs as defined in Regulatory Guide 1.115 (Reference 13) Appendix A. Table 3.5-4 lists the essential SSCs outside the reactor building that are evaluated to provide reasonable assurance that they are adequately protected from potential turbine missiles. None of the essential SSCs listed are within the low-trajectory missile strike zone.

3.5.1.3.1 Geometry

The turbine generator is composed of one high-pressure and three low-pressure turbines. As shown in Figure 3.5-1, the turbine shaft is placed in a line with the containment and auxiliary building. The figure shows that the turbine generator is placed with favorable orientation so that all essential the SSCs are excluded from the low-trajectory turbine missile strike zone, as defined by Regulatory Guide 1.115, and are concentrated in an area bounded by lines inclined at 25 degrees to the turbine wheel planes and passing through the end wheels of the low-pressure stages. The arrangement is selected to meet Regulatory Guide 1.115 approach C.2.a. An assessment of the orientation of the turbine generator of

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.

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.

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.:	**113-8062**
SRP Section:	**03.05.01.02 – Internally Generated Missiles (Inside Containment)**
Application Section:	**3.5.1.2**
Date of RAI Issued:	**07/27/2015**

Question No. 03.05.01.02-3

GDC 4 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 3.5.1.2 uses the phrases “additional protective features” and “protective features inside containment;” however, it is not clear to the staff what the protective features are referring to.

The applicant is requested to provide additional information in the DCD in order to clarify what is meant by “protective features” and “protective features inside containment.”

Response

“Additional protective features” was in reference to missile shields and will be deleted because they are not required to protect the essential components inside the containment building. “Protective features inside containment” is in reference to structural concrete walls, structural steel beams, or floor slabs which serve as missile shields. DCD Tier 2 Subsection 3.5.1.2 will be revised to clarify the protective features.

Impact on DCD

DCD Tier 2, Subsection 3.5.1.2 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.

is not considered statistically significant. If the probability of occurrence is greater than 10^{-7} per year, the probability of impact on a significant target is determined. If the product of these two probabilities is less than 10^{-7} per year, the missile is not considered statistically significant.

Safety-related NSSS pumps and associated motors are considered rotating missile generation source outside containment. However, no postulated missiles are generated by valves in the NSSS vendor scope, and P_1 is less than 10^{-7} per year for one or more of the following reasons:

a. All valve stems are provided with a backseat or shoulder larger than the valve bonnet opening.

b. Motor-operated and manual valve stems are restrained by stem threads.

c. Operators on motor, hydraulic, and pneumatic operated valves prevent stem ejection.

d. Pneumatic-operated diaphragms and safety valve stems are restrained by the actuator casing.

3.5.1.1.2.2 Balance-of-Plant Components

Missile protection analysis is performed to provide reasonable assurance that the SSCs required for safe shutdown are located outside the trajectory of postulated missiles, capable of withstanding the impact, or protected from impact by a barrier or wall.

3.5.1.2 Internally Generated Missiles (Inside Containment)

The criteria used for protection of internally generated missiles inside the containment are generally consistent with the guidelines in SRP 3.5.1.2 (Reference 5).

Structures inside the containment, including the secondary shield wall, refueling pool wall, structural beams, and floor slabs, serve as missile shields for equipment, including the reactor coolant loop, that must be protected from missiles. These structures ~~and additional~~

~~protective features~~ protect the reactor coolant pressure boundary (RCPB), containment liner plate, containment penetration, main steam line, main feedwater line, direct vessel injection line, and steam generator, including the instrument connection of steam side, blowdown line, and drain line from the missile. Engineered safety features, except for some portions of piping for direct vessel injection following a LOCA, are located outside the secondary shield wall to minimize the effects from missiles generated by the RCPB.

The protective shield is installed above the control element drive mechanism to protect the control rod drive mechanism and reactor vessel and SSCs required for safe shutdown from internally generated missiles and a missile from the control element drive mechanism breakaway.

(such as structural concrete walls, structural steel beams, or floor slabs)

The protective features inside the containment are provided to protect the containment liner plate, isolation system, and the main steam system related to the steam generator from missiles caused by the main steam and main feedwater line breaks, and to prevent the malfunction of other systems or equipment.

The secondary shield wall between the containment wall and refueling pool wall serves as a shield to protect the reactor coolant system, including the steam generator, from missiles generated inside the containment annulus area. The secondary shield wall also serves as a shield to protect safe-shutdown equipment, such as the safety injection tank, from missiles generated by the RCPB.

Missiles falling from heavy load transfers by crane and missiles from dropped SSCs designed to non-seismic category inside the containment are considered gravity-caused missiles. Designs for other lifts comply only with SRP 9.1.5 and NUREG-0612 for falling heavy loads from equipment or component transfers, and the design provides reasonable assurance that the effect of heavy load drops during transfers by crane is eliminated by blocking the path above the systems and components that are necessary to achieve a safe shutdown or protect against an accident. The drop of nonseismically designed SSCs in the containment could affect safety-related systems. Therefore, they are designed to seismic Category II to protect the safety-related systems from the impact of dropped objects.

The COL applicant is to provide the procedure for heavy load transfer to strictly limit the transfer route during plant maintenance and repair period (COL 3.5(1)).

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.:	**113-8062**
SRP Section:	**03.05.01.02 – Internally Generated Missiles (Inside Containment)**
Application Section:	**3.5.1.2**
Date of RAI Issued:	**07/27/2015**

Question No. 03.05.01.02-4

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 3.5.1.2 states “[e]ngineered safety features, except for some portions of piping for direct vessel injection following a LOCA, are located outside the secondary shield wall to minimize the effects from missiles generated by the RCPB.” However, the applicant has not specified how the piping portions for direct vessel injection will be protected from internally-generated missiles.

The applicant is requested to provide a discussion in the DCD detailing the method of missile protection for those portions of piping not protected from the secondary shield wall.

Response

The piping portions of direct vessel injection located inside secondary shield wall do not require dedicated missile protection barriers for protection. The integrity of the piping can be assured since the piping is thicker than the possible missiles identified and has been verified through detailed missile penetration calculations using the BRL formula delineated in DCD Tier 2 Subsection 3.5.3.1.2.

Impact on DCD

There is no impact on the DCD.

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.

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.:	**113-8062**
SRP Section:	**03.05.01.02 – Internally Generated Missiles (Inside Containment)**
Application Section:	**3.5.1.2**
Date of RAI Issued:	**07/27/2015**

Question No. 03.05.01.02-5

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."

During the review of DCD Tier 2, Section 3.5.1.2, the staff noted the following items that need to be clarified:

1. DCD Tier 2, Section 3.5.1.2.2.2 states "[m]ost of the valves installed on a high-energy line are designed according to ANSI Class 900 …" The applicant is request to identify the valves that are not designed to this criteria and explain why they are not considered credible missiles.

2. DCD Tier 2, Section 3.5.1.2.1.2 states "[t]he only safety-related BOP rotating components inside the containment are … pump impellers, and blades of turbine-driven components." It is unclear to the staff what equipment the applicant is referring to in the aforementioned statement. The applicant is requested to clarify what BOP pumps and turbine-driven components are located inside containment.

Response

1. Other ANSI class valves used in high energy lines are also constructed in accordance with ASME Code Section III or ASME B16.34. Thus, pressure retaining parts are not considered credible missile sources on the same bases as Class 900 valves.

2. There are no turbine-driven components inside the reactor containment building. However, BOP pumps and HVAC components are located inside the reactor containment building as shown in Table 1. Deletion of blades of turbine-driven

components has been incorporated into the markup of the response to RAI 117-8061 Question 03.05.01.01-5 (ref. MKD/NW-15-0268L dated December 22, 2015) as shown in the attached markup.

Table1. BOP components located inside the reactor containment building

Tag	Description	Room No
481-M-PP04	ICI cavity sump pump	069C01
481-M-PP01	Containment drain sump & pump	100C02B
611-M-AH07	S/G enclosure recirculation fan	114C01A
611-M-HV05	Reactor cavity AHU	114C01A
611-M-HV11	Annulus area recirculation fan	136C01A
611-M-HV01	Reactor containment fan cooler	156C01

Impact on DCD

DCD Tier 2, Subsection 3.5.1.2.1 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.

3.5.1.2.1 Potential Missiles from Rotating Components (Inside Containment)

~~3.5.1.2.1.1 NSSS Components~~

Rotating components inside the containment building are reactor coolant pumps, heating, ventilation and air conditioning (HVAC) equipment, and pump impellers.

If the probability of missile generation P_1 is maintained less than 10^{-7} per year, the missile is not considered statistically significant. If the probability of occurrence is greater than 10^{-7} per year, the probability of impact on a significant target is determined. If the product of these two probabilities is less than 10^{-7} per year, the missile is not considered statistically significant.

~~The only safety-related NSSS rotating components inside the containment are the reactor coolant pumps.~~ However, ~~there~~ they are ~~no~~ not postulated missiles generated, and P_1 is less than 10^{-7} per year for the reasons described in Subsection ~~3.5.1.1.1.1~~ 3.5.1.1.1.

~~3.5.1.2.1.2 Balance of Plant Components~~

~~If the probability of missile generation P_1 is maintained less than 10^{-7} per year, the missile is not considered statistically significant. If the probability of occurrence is greater than 10^{-7} per year, the probability of impact on a significant target is determined. If the product of these two probabilities is less than 10^{-7} per year, the missile is not considered statistically significant.~~

~~The only safety-related BOP rotating components inside the containment are heating, ventilation and air conditioning (HVAC) equipment, pump impellers, and blades of turbine-driven components. Since the casings of these components are designed to preclude missile ejection, no missiles for HVAC are postulated. Therefore, there is no missile generated and P_1 is less than 10^{-7} per year.~~

3.5.1.2.2 Potential Missiles from Pressurized Components (Inside Containment)

~~3.5.1.2.2.1 NSSS Components~~

Table 3.5-1 lists the postulated missiles and their weight, shape, dimensions, and impact energy. Major pretensioned studs and nuts, instruments, and the control rod drive