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.:	**357-8344**
SRP Section:	**06.02.04 – Containment Isolation System**
Application Section:	**6.2.4**
Date of RAI Issue:	**01/05/2016**

Question No. 06.02.04-6

Justify containment isolation valve fail-as-is (open position) upon loss of power

General Design Criteria (GDC) 56 requires in part that upon the loss of actuating power the automatic containment isolation valves (CIVs) should take the position of greater safety.

1. Item No. 35, CVCS IRWST boron recovery return isolation valve

As described in Table 6.2.4-1 Sheet 6, the motor operated CIV, CV-509 associated with CVCS IRWST boron recovery return fails-as-is (open position), upon loss of power, however, its post-accident position is closed. Pursuant to the requirement of GDC 56, explain how a failed-open position of MOV, as shown in Figure 6.2.4-1 Sheet 2, is the position of greater safety upon loss of power.

2. Item No. 68, PCW return from containment ventilation units isolation valve

As described in Table 6.2.4-1 Sheet 10, the motor operated CIV, WI-0015 associated with PCW return from containment ventilation units fails-as-is (open position), upon loss of power, however, its post-accident position is closed. Pursuant to the requirement of GDC 56, explain how a failed open position of MOV, as shown in Figure 6.2.4-1 Sheet 9, is the position of greater safety upon loss of power.

3. Item No. 77, Reactor drain tank gas space to GWMS isolation valve

As described in Table 6.2.4-1 Sheet 10, the motor operated CIV, GW-0001 associated with Reactor drain tank gas space to GWMS fails-as-is (open position), upon loss of power, however, its post-accident position is closed. Pursuant to the requirement of GDC 56, explain how a failed open position of MOV, as shown in Figure 6.2.4-1 Sheet 8, is the position of greater safety upon loss of power.

Response

1. The containment isolation valve (CIV) (CV-509) on the IRWST makeup line is normally closed and used infrequently during normal plant and shutdown operation to provide makeup to the IRWST when necessary. The containment isolation configuration for this penetration is shown in Figure 6.2.4-1 Valve Arrangement 4 with a closed motor operated valve outside containment and a check valve inside containment. Table 6.2.4-1 Item 35 correctly depicts that the normal position for this valve as O/C meaning that it is infrequently opened during normal power and shutdown operation, the fail safe position is as-is since it is a motor operated valve, and the accident position is closed for containment isolation. The valve does not have a safety function (e.g., there is no credit taken in the accident analysis) to open post-accident to fill the IRWST. If a LOCA occurs while CV-509 is in the open postion filling the IRWST, CV-509 will be closed on an CIAS. If a loss-of-motive power to the CV-509 valve in the open position (e.g., loss of normal and emergency power), the inboard check valve CV-189 would provide the containment isolation function required for this penetration. Therefore, the specified configuration is in accordance with GDC 56 requirements.

2. The motor operated CIV (WI-0015) is normally open to return PCW from containment ventilation units and it is automatically closed upon receipt of a containment isolation actuation signal (CIAS) when its power is available. The CIV (WI-0015) is designed to fail as-is (open position) upon loss of its power. It is noted that a pneumatically operated CIV (WI-0012), located downstream and outside the containment in the PCW return line from the containment ventilation units, is designed to fail in the closed position and is used as backup of the CIV (WI-0015). The CIV (WI-0012) is also automatically closed upon receipt of CIAS and it can provide containment isolation even if the CIV (WI-0015) fails-as-is (open) upon loss of its power. From the overall safety point of view, the use of different types of CIVs in the PCW return line, in which the motor operated CIV (WI-0015) is located inside the containment and the pneumatically operated CIV (WI-0012) is located outside the containment, provides greater safety in the event of an accident.

3. The motor operated CIV (GW-001) is normally open to recieve radioactive gas vented from the reactor drain tank (RDT) and is automatically closed upon the receipt of a CIAS when its power is available. The CIV (GW-001) is designed to fail-as-is (open position) during the loss of its power. It is noted that a solenoid operated CIV (GW-002), which has a fail closed position, is located downstream of the valve GW-001 and outside the containment. The CIV (GW-002) will be closed upon the receipt of CIAS in order to provide the containment isolation function even if the CIV GW-001 is in the open position due to a loss of its power. From the overall safety point of view, the use of different types of CIVs in the radioactive gas vented line, in which the motor operated CIV (GW-001) is located inside the containment and the pneumatically operated CIV (GW-002) is located outside the containment, provides greater safety in the event of an accident.

Based on the above discussion, a DCD change is not needed.

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 Environment 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.: **357-8344**

SRP Section: **06.02.04 – Containment Isolation system**

Application Section: **6.2.4**

Date of RAI Issue: **01/05/2016**

Question No. 06.02.04-8

Provide information on provisions to alert the operator to isolate remote manual containment isolation systems.

In order to evaluate if requirements of General Design Criteria (GDC) 54, as it relates to reliable isolation capability systems utilizing remote manual containment isolation valves (CIVs), have been met for the APR1400, more information is needed. For each containment penetration listed in DCD Tier 2, Table 6.2.4-1 that is equipped with remote manual CIVs, provide details in the DCD as to what provisions are provided to alert the operator of the need to isolate fluid systems equipped with remote manual isolation valves. Such provisions may include instruments to measure flow rate, sump water level, temperature, pressure, and radiation level. For each penetration and provision (instrument(s)) listed, provide a description of how an operator in the main control room would use the provision or instrument to identify the line and to determine when to isolate the fluid system.

Response

The remote manual CIVs in Table 6.2.4-1 are the following:

Valve No.	Type	Valve Position Status		
		Normal	Accident	Cue to Operator to isolate fluid system via CIV
MS-102	R,M	C	C	N/A
MS-101	R,M	C	C	N/A
MS-104	R,M	C	C	N/A
MS-103	R,M	C	C	N/A
SI-304	R, M	LO	LO	Close CIVs on CIAS and with decision that Safety Injection is not further required.
SI-305	R, M	LO	LO	
SI-308	R, M	LO	LO	
SI-309	R, M	LO	LO	
SI-302	R, M	LO	LO	
SI-303	R, M	LO	LO	

Valve No.	Type	Valve Position Status		
		Normal	Accident	Cue to Operator to isolate fluid system via CIV
SI-300	R, M	C	C	N/A
SI-301	R, M	C	C	N/A
SI-600	R, M	C	O/C	N/A
SI-601	R, M	C	O/C	N/A
SI-602	R, M	C	O	N/A
SI-603	R, M	C	O	N/A
SI-321	R, M	LC	O/C	N/A
SI-331	R, M	LC	O/C	N/A
SI-653	R, M	LC	O/C	N/A
SI-654	R, M	LC	O/C	N/A
SI-655	R, M	LC	O/C	N/A
SI-656	R, M	LC	O/C	N/A
CV-524	R, M	O	O	Charging flow instrument and charging line pressure instrument
CV-255	R, M	O	O	Seal injection flow instrument
CM-17	R,M	O	O	Close CIVs manually with decision that containment air pressure monitoring is not necessary.
CM-18	R,M	O	O	Close CIVs manually with decision that containment air pressure monitoring is not necessary.
CM-19	R,M	O	O	Close CIVs manually with decision that containment air pressure monitoring is not necessary.
CM-20	R,M	O	O	Close CIVs manually with decision that containment air pressure monitoring is not necessary.
CM-21	R,M	O	O	Close CIVs manually with decision that containment air pressure monitoring is not necessary.
CM-22	R,M	O	O	Close CIVs manually with decision that containment air pressure monitoring is not necessary.
IW-010	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-022	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-024	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-026	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-011	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-023	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-025	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-027	R,M	O	O	Close CIVs manually with decision that IRWST water level monitoring is not required.
IW-012	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-013	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-014	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-015	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.

Valve No.	Type	Valve Position Status		
		Normal	Accident	Cue to Operator to isolate fluid system via CIV
IW-016	R,M	O	O	Close CIVs manually with decision that containment leak monitoring is not required.
IW-017	R,M	O	O	Close CIVs manually with decision that containment leak monitoring is not required.
IW-028	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-029	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-030	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-031	R,M	O	O	Close CIVs manually with decision that HVT water level monitoring is not required.
IW-018	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-019	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-020	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-021	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-032	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-033	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-034	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.
IW-035	R,M	O	O	Close CIVs manually with decision that reactor cavity water level monitoring is not required.

C: Closed, LC: Locked Closed, O: Open, LO: Locked Open

Remote manual containment isolation valves (CIVs) are provided in the main steam system (MS). Those CIVs are located on the main steam line. The main steam atmospheric dump valves (MSADVs) (MS-101 through MS-104) are closed during normal operation. These valves are provided to allow cooldown of the steam generator (SG) by discharging steam to the atmosphere when the main steam isolation valves (MSIVs) are closed or when the main condenser is not available as a heat sink. Therefore, there are no remote manual CIVs in the MS that need to be manually closed during normal operation or accident condition.

Remote manual CIVs are provided in safety injection system (SIS), shutdown cooling system (SCS), and chemical and volume control system (CVCS). Those CIVs are located on the safety injection pump (SIP) suction lines, SIP discharge lines, safety injection (SI) hot leg lines, and SIP mini-flow lines of the SIS; shutdown cooling pump (SCP) suction lines of the SCS; and charging and reactor coolant pump (RCP) seal injection lines of the CVCS.

Some remote manual CIVs in the SIP miniflow lines (SI-300, SI-301, SI-302, SI-303) and the SIP suction lines (SI-304, SI-305) are maintained in the locked open (LO) position (SI-302, SI-303, SI-304, SI-305) and some in the closed position (SI-300, SI-301) during normal operation to be in standby for the SI injection, as well as during accident conditions, in order to inject coolant into the reactor coolant system (RCS). The operator may close these valves with the containment isolation actuation signal (CIAS) after deciding that safety injection is no longer required.

On the other hand, those lines in the SIS and SCS, except for the SIP miniflow and SIP suction lines, are normally isolated from the RCS by maintaining the remote manual CIVs closed during normal operation. However, those CIVs can be opened by the operator during an accident, if necessary. Therefore, there are no CIVs in the SIS and SCS that need to be closed by the operator during normal operation or accidents.

Valves CV-524 in the CVCS charging line and CV-255 in the RCP seal injection line are in the open position during normal operation. These valves are also maintained in the open position during an accident condition to help maintain RCS coolant inventory and RCP seal integrity by establishing flow through these valves with an available charging pump or auxiliary charging pump. However, the operator can manually close these valves (as needed) in the main control room (MCR) if the charging pump and auxiliary charging pump become unavailable by checking the indications for charging flow, charging line pressure, and seal injection flow.

Valves CM-017 through CM-022 are solenoid-operated instrument isolation valves located outside of the containment building. They isolate the instrument sensing lines that contain the containment air. The instruments monitor the containment air pressure to generate engineered safety features actuation signals (ESFAS) such as CIAS, containment spray actuation signal (CSAS), main steam isolation signal (MSIS), and safety injection actuation signal (SIAS) if the containment air pressure exceeds the ESFAS actuation setpoint. Therefore, these CIVs are open during normal operation and during design basis accident (DBA) conditions. These valves are designed to the fail-open position so that the instruments can continuously monitor the containment air pressure. These valves are closed during instrument maintenance. The CIVs are manually opened and closed only by the MCR operator. No field instruments are used to provide interlock signals to these CIVs.

Valves IW-010 through 035 are solenoid-operated instrument isolation valves located outside of the containment building. They isolate the instrument sensing lines that contain containment air or the IRWST borated water. The instruments connected to valves IW-010, 011, and 022 through 027 are to monitor the IRWST water level during normal operation and DBA conditions. The instruments connected to valves IW-016 and 017 are to monitor containment leakage during normal operation. The instruments connected to valves IW-012 through 015 and 028 through 031 are to monitor the HVT water level during DBAs. The instruments connected to valves IW-018 through 021 and IW-032 through 035 are to monitor the reactor cavity water level during DBAs. Therefore, these CIVs are in the open position during normal operation and under DBA conditions. These valves are designed to the fail-open position in order to continuously monitor the IRWST water level or containment leakage. These valves are closed during instrument maintenance. The CIVs are manually opened and closed only by the MCR operator. No field instruments are used to provide interlock signals to these CIVs.

In addition, valves MS-016 and 017 are not only remotely and manually operated, but they are also automatically actuated by the main steam isolation signal (MSIS). Table 6.2.4-1 will be revised to correct the actuation signal type for valves MS-016 and 017.

Impact on DCD

DCD Tier 2, subsection 6.2.4.2 will be revised to incorporate the above discussion, as indicated in the attachment associated with this response.

DCD Tier 2, Table 6.2.4-1 will be revised to correct the actuation signal type for valves MS-016 and 017, as indicated in the attachment associated with this response.

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.

electrical generators is designed to close all valves receiving an ESFAS within seconds of the time the shift to emergency onsite electrical power signal is accomplished.

The CIAS is provided to isolate the process lines penetrating the containment to mitigate the consequences of a release of radioactive material during a LOCA, FWLB, or MSLB. The CIAS is initiated by a high containment pressure signal or a low pressurizer pressure signal. Provisions for manual initiation from the MCR are also required.

The pressure setpoint of the automatic containment isolation activated by the containment pressure rising is established according to the requirement of 10 CFR 50.34(f)(2)(xiv)(D) (i.e., use a containment set point pressure for initiating containment isolation as low as is compatible with normal operation) (Reference 29).

The setpoint (134 cmH_2O (1.9 psig)) for containment isolation is selected as 3.5 percent of allowable containment pressure limit (3.79 kg/cm^2G (54 psig)), which is determined by subtracting pressure margin (10 percent) from the containment design pressure (4.218 kg/cm^2G (60 psig)). This setpoint value is also considering the normal performance tolerance of the pressure instrument channel (35 cmH_2O (0.5 psig)).

Insert A

As described below, adequate protection is provided for piping, valves, and vessels against dynamic effects and missiles, which could result from plant equipment failures, including a LOCA.

Isolation valves inside the containment are located between the secondary shield wall and the inside containment wall. The secondary shield wall serves as the missile barrier. Any necessary missile barriers for isolation valves and piping, or vessels that provide one of the isolation barriers outside the containment, consist of structural steel or concrete.

Most of the mechanical penetrations are located with the outside containment isolation valve as close as possible to the containment wall in the four mechanical penetration rooms, and the inside containment isolation valve located within containment between the secondary shield wall and inside containment wall. The following outside containment isolation valves are located in spaces other than the four mechanical penetration rooms:

A

Systems including remote manual valve for containment isolation are the main steam system (MSS), SIS, CVCS, containment monitoring system (CMS), and IWSS.

Remote manual containment isolation valves (CIVs) are provided in the MSS. Those CIVs are located on the main steam line. The main steam atmospheric dump valves (MSADVs) (MS-101 through MS-104) are closed during normal operation. These valves are provided to allow cooldown of the steam generator (SG) by discharging steam to the atmosphere when the main steam isolation valves (MSIVs) are closed or when the main condenser is not available as a heat sink. Therefore, there are no remote manual CIVs in the MS that need to be manually closed during normal operation or accident condition.

Remote manual CIVs are provided in SIS, SCS, and CVCS. Those CIVs are located on the safety injection pump (SIP) suction lines, SIP discharge lines, safety injection (SI) hot leg lines, and SIP mini-flow lines of the SIS; shutdown cooling pump (SCP) suction lines of the SCS; and charging and reactor coolant pump (RCP) seal injection lines of the CVCS.

The remote manual CIVs in the SIP miniflow lines (SI-300, SI-301, SI-302, SI-303) and the SIP suction lines (SI-304, SI-305) are maintained in the locked open (LO) (SI-302, SI-303, SI-304, SI-305) or closed position (SI-300, SI-301) during normal operation to be on standby for the SI injection, as well as during accident condition, in order to inject coolant into the RCS. The operator may close these valves with the CIAS after deciding that Safety Injection is no longer required. On the other hand, those lines in the SIS and SCS, except for the SIP miniflow and SIP suction lines, are normally isolated from the RCS by maintaining the remote manual CIVs closed during normal operation. However, those CIVs can be opened by the operator during an accident, if necessary. Therefore, there are no CIVs in the SIS and SCS that need to be closed by the operator during normal operation or accidents.

CV-524 in the CVCS charging line and CV-255 in the RCP seal injection line are in the open position during normal operation. These valves are also maintained in the open position during an accident condition to help maintaining the RCS coolant inventory and the RCP seal integrity. Flow through these valves are established by utilizing the available charging pump or auxiliary charging pump. However, the operator can manually close these valves (as needed) in the main control room (MCR) when the charging pump and auxiliary charging pump are unavailable to establish flow through these valves after checking the charging flow, charging line pressure, and seal injection flow.

Valves CM-017 through CM-022 are solenoid-operated instrument isolation valves located outside of the containment building. They isolate the instrument sensing lines that contain the containment air pressure. The instruments monitor the containment air pressure to generate engineered safety features actuation signals (ESFAS) such as CIAS, CSAS, MSIS, and SIAS if the containment air pressure exceeds the ESFAS actuation setpoint. Therefore, these CIVs are

open during normal operation and during the DBA condition. These valves are designed with fail-open position so that the instruments can continuously monitor the containment air pressure. These valves are closed during instrument maintenance. The CIVs are manually opened and closed only by the MCR operator. No field instruments are used to provide interlock signals to these CIVs.

Valves IW-010 through 035 are solenoid-operated instrument isolation valves located outside of the containment building. They isolate the instrument sensing lines that contain the containment air pressure or the IRWST borated water. The instruments connected to valves IW-010, 011, and 022 through 027 are to monitor the IRWST water level during normal operation and DBA condition. The instruments connected to valves IW-016 and 017 are to monitor containment leakage during normal operation. The instruments connected to valves IW-012 through 015 and 028 through 031 are to monitor the HVT water level during DBA. The instruments connected to valves IW-018 through 021 and IW-032 through 035 are to monitor the reactor cavity water level during DBA. Therefore, these CIVs are in the open position during normal operation and under DBA condition. These valves are designed with fail-open position in order to continuously monitor the IRWST water level or containment leakage. These valves are closed during instrument maintenance. The CIVs are manually opened and closed only by the MCR operator. No field instruments are used to provide interlock signals to these CIVs.

Table 6.2.4-1 (1 of 15)

List of Containment Penetrations and System Isolation Positions

Item No.	Service	Line Size (in)	Valve No.	Closure Time (sec)	Figure No.	Valve Type	Fluid	Length of Pipe(ft)[15]	Location Relative to Contain-ment	Flow Direction Relative to Contain-ment	Valve Arrange-ment (GDC)[2]	Valve Position[3]				Actuator Type[4]	Actuation Signal[5]	Type[6]	Type Test	Type-C Test	Justifi-cation for Not Testing	Essential/ Nonessential Line[7]
												Nor-mal	Fail Safe	Shut-down	Acci-dent							
1	Main steam line #1 from SG #1[8]	3 30.9 6 6 6 6 6 16 1 4	MS-091 MS-012 MS-1302 MS-1304 MS-1306 MS-1308 MS-1310 MS-102 MS-1257 MS-016	15 5 - - - - - - - 10	10.3.2-1	Globe Gate Safety Safety Safety Safety Safety Angle Globe Gate	Steam	- 75 - - - - - - - -	Outside Outside Outside Outside Outside Outside Outside Outside Outside Outside	Out	3 (57)	O O C C C C C C LC C	C C - - - - - C - C	C C C C C C C C LC C	C C C C C C C C - C	EH EH - - - - - EH HW EH	MSIS MSIS SV setpoint SV setpoint SV setpoint SV setpoint - - MSIS	A,R,M A,R,M - - - - - R,M M ~~R,M~~	A	No	[9]	Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential
2	Main steam line #2 from SG #1[8]	3 30.9 6 6 6 6 6 16 8 1 4 1	MS-090 MS-011 MS-1301 MS-1303 MS-1305 MS-1307 MS-1309 MS-101 MS-0110 MS-1030 MS-015 MS-0112	15 5 - - - - - - 5 - 10 15	10.3.2-1	Globe Gate Safety Safety Safety Safety Safety Angle Globe Globe Gate Globe	Steam	- 69 - - - - - - - - - -	Outside Outside Outside Outside Outside Outside Outside Outside Outside Outside Outside Outside	Out	1 (57)	O O C C C C C C C LC C O	C C - - - - - C O - C O	C C C C C C C C C LC C O	C C C C C C C C O LC C O	EH EH - - - - - EH P HW EH P	MSIS MSIS SV setpoint SV setpoint SV setpoint SV setpoint - AFAS - MSIS -	A,R,M A,R,M - - - - - R,M A,R,M M A,R,M A,R,M	A	No	[9]	Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Essential Nonessential Essential

Table 6.2.4-1 (3 of 15)

Item No.	Service	Line Size (in)	Valve No.	Closure Time (sec)	Figure No.	Valve Type	Fluid	Length of Pipe(ft)[15]	Location Relative to Contain-ment	Flow Direction Relative to Contain-ment	Valve Arrange-ment (GDC)[2]	Valve Position[3]				Actuator Type[4]	Actuation Signal[5]	Type[6]	Type Test	Type-C Test	Justifi-cation for Not Testing	Essential/ Nonessential Line[7]
												Nor-mal	Fail Safe	Shut-down	Acci-dent							
4	Main steam line #2 from SG #2 [8]	30.9 6 6 6 6 6 16 1 4 3	MS-013 MS-1311 MS-1313 MS-1315 MS-1317 MS-1319 MS-103 MS-1073 MS-017 MS-092	5 - - - - - - - 10 15	10.3.2-1	Gate Safety Safety Safety Safety Safety Angle Globe Gate Globe	Steam	75 - - - - - - - - -	Outside Outside Outside Outside Outside Outside Outside Outside Outside Outside	Out	3 (57)	O C C C C C C LC C O	C - - - - - C - C C	C C C C C C C LC C C	C C C C C C C LC C C	EH - - - - - EH HW EH EH	MSIS SV setpoint SV setpoint SV setpoint SV setpoint SV setpoint - - MSIS MSIS	A,R,M - - - - - R,M M ~~R,M~~ A,R,M A,R,M	A	No	[9]	Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential Nonessential
5	Main feedwater to downcomer nozzle SG #1	10 10	FW-131 FW-132	5 5	10.4.7-1	Gate Gate	Water	- 15	Outside Outside	In	10 (57)	O O	C C	C C	O/C O/C	EH EH	MSIS MSIS	A,R,M A,R,M	A	No	[9]	Nonessential Nonessential
6	Main feedwater to downcomer nozzle SG #2	10 10	FW-133 FW-134	5 5	10.4.7-1	Gate Gate	Water	- 15	Outside Outside	In	10 (57)	O O	C C	C C	O/C O/C	EH EH	MSIS MSIS	A,R,M A,R,M	A	No	[9]	Nonessential Nonessential
7	Main feedwater to economizer nozzles for SG #1	24 24	FW-121 FW-122	5 5	10.4.7-1	Gate Gate	Water	- 17	Outside Outside	In	34 (57)	O O	C C	C C	O/C O/C	EH EH	MSIS MSIS	A,R,M A,R,M	A	No	[9]	Nonessential Nonessential
8	Main feedwater to economizer nozzles for SG #2	24 24	FW-123 FW-124	5 5	10.4.7-1	Gate Gate	Water	- 17	Outside Outside	In	34 (57)	O O	C C	C C	O/C O/C	EH EH	MSIS MSIS	A,R,M A,R,M	A	No	[9]	Nonessential Nonessential
9	Chemical injection	1 1	FW-138 FW-139	15 15	10.4.7-1	Globe Globe	Mixed chemical (15 wt% ethanlo amine and 2 wt% hydrazine)	- -	Outside Outside	In	10 (57)	C C	C C	C C	C C	P P	MSIS MSIS	A,R,M A,R,M	A	No	-	Nonessential Nonessential