GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

April 28, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **DFSER Confirmatory Item 8.3.2.8-1 and Open Item 8.3.3.5-1**

Dear Chet:

Enclosed are replacement pages for Attachment 1 to my letter dated March 31, 1993 for DFSER Confirmatory Item 8.3.2.8-1 and Open Item 8.3.3.5-1. Also enclosed are the corresponding SSAR markups.

Please provide a copy of this transmittal to John Knox.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Norman Fletcher (DOE)
Bob Strong (GE)

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DFSER CHAPTER 8 ISSUES & GE RESPONSES
.DO FSERSTAT .REPORT FORM FSERMEMO

ITEM NUMBER	TYPE	REF	NRC SUMMARY REPORT	GE RESPONSE
8.3.2.8-1	CONF	62	8.3.2.8-1 Physical separation of equipment The staff indicated the need for a committment for a 3-hour fire barrier and missile barrier for everything up to the power distribution panels. The staff has reviewed the writeup in Appendix 9A and found the following inconsistencies. Section 9A.5 conflicts Chapter 8 statement that all Class 1E busses, distribution systems and power and control systems are located in seismic Category I buildings. GE agreed to list the exceptions listed in 9A.5.5 in Chapter in Section 8.1.3.1.1.1. GE committed to verifying if additional cross references to exceptions are needed in Chapter 7 and adding additional information to the SSAR, if required. This was acceptable to the staff. Section 9A.5.5.1 indicates that there are multiple divisions of scram solenoid fuse panels in the same fire areas. GE committed to clarifying the discussion in the section to add a statement that the panels are in separate fire areas. GE agreed to provide a statement in section 8.3.1.4.2.2.2 indicating that the 3-hour fire barrier will be maintained from the power source up through the distribution panels. Exceptions for the loads are provided in 9A.5 This was acceptable to the staff. The staff provided a markup of 9A.5 to GE indicating sections which are inconsistent with other sections of the SSAR.	2nd Paragraph: The second-to-last sentence in 8.1.3.1.1.1 (page 8.1-3) has been modified, per the February meeting agreements, as follows: "This equipment is housed in Seismic Category I structures except for some control sensors associated with the Reactor Protection System (see 9A.5.5.1), and the Leak Detection System (see 9A.5.5.7)." Cross references to these sections were also added to 7.2.2.2.4(4) and 7.3.2.2.2(1), respectively, as shown in attached markups. 3rd Paragraph: The following sentence was added in the second paragraph of 9A.5.5.1, page 9A.5-1, per attached markup: "The Div. I rooms are located in separate fire zones from the Div. II rooms, which zones are separated by 3-hour fire barriers." The following clarification was added in the end of the first paragraph of 8.3.3.6.2.2.2 [formerly 8.3.1.4.2.2.2, page 8.3-17]: "The electrical equipment from the Class 1E power suppies to the distribution centers are separated by 3-hour fire barriers. Beyond the distribution centers, the exceptional cases where it is not possible to install such barriers have been analyzed and justified in Appendix 9A.5." 4th Paragraph:

DFSER CHAPTER 8 ISSUES & GE RESPONSES
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ITEM NUMBER	TYPE	REF	NRC SUMMARY REPORT	GE RESPONSE
				(The response for consistency check is included with the response for Open Item 8.3.3.5-1.)
8.3.3.5-1	OPEN	68	8.3.3.5-1 Redundant class 1E systems (environments) The staff indicated that in Table 9A.5.2 there is a list of reactor building special cases with redundant equipment or circuits in the same fire area. Electrical codes are listed to provide separation guidance. Some circuits list N/A under applicable codes which do not indicate the basis for protection of the equipment or circuits. GE indicated that the scram solonoids are addressed in 9A.5. That was acceptable to the staff. For other examples, GE provided an explanation for clarification and no revision to the SSAR was required. The staff questioned the protection of the power supply to the remote shutdown panel from a fire in the main control room. GE indicated that in SSAR section 7.4.1.4.4, it states that all necessary power supply circuits are manually transferred to other sources after a control room short circuit. The discussion of the SLCS in 9A.5 indicates that the SLCS will be lost in one fire. There is not discussion on the protection of the Class 1E electrical systems. GE agreed to modify the writeup to address this issue and do similar for the flammability control system, SGTS, among others to discuss the required protection of Class 1E power supplies. This was acceptable to the staff. The staff indicated that SPLB and SICB should also review the section. This becomes an interim confirmatory item based on the above items.	1st Paragraph: The statement in 7.4.1.4.4 (page 7.4-7.1 attached) has been marked up as follows: "Control of all necessary power supply circuits is also transferred to the remote shutdown system." 2nd Paragraph: *** Discussions for the protection of Class 1E electrical systems upstream of postulated faults in these systems are provided in Table 9A.5.2, Amendment 23. For the SLCS, see Items 9-12 (C41), electrical codes "1B" and "1C", which are explained in Section 9A.5.7. A similar process may be followed for all other systems identified in the table, which includes FCS (T49) and the SGTS (T22). For consistency and clarification, the following modifications were performed as marked in the attached: 9A.5.5.9 Flammability Control System - Section 9A.5.5.18 was deleted and its contents were moved to the end of 9A.5.5.9. The reference to 9A.5.5.18 in Table 9A.5.2 was changed to 9A.5.5.9. 9A.5.5.10 Fuel Pool Cooling Cleanup System - This section was deleted because the system is not Class 1E and does not receive power from Class 1E sources. 9A.5.5.11 Standby Gas Treatment System - This section was completely revised as follows: "The standby gas treatment system

DFSER CHAPTER 8 ISSUES & GE RESPONSES
.DO FSERSTAT .REPORT FORM FSERMEMO

ITEM NUMBER	TYPE	REF	NRC SUMMARY REPORT	GE RESPONSE
				equipment is contained in two separate adjoining rooms located between 270 and 330 degrees azimuth near the standby liquid control system area at the 38-foot level. The system consists of two totally independent and redundant divisional trains (Div. II and Div. III). Each divisional train has a filter train (consisting of the demister, an electric process heater, prefilter, pre-HEPA filter, charcoal absorber, a post-HEPA filter and space heaters), an exhaust fan and a cooling fan. The two divisional trains occupy two separate rooms separated by a 3-hour fire barrier. Each divisional train exhaust is connected to the R/A exhaust duct and they are isolated by fire dampers."***

The transmitters are located in separate enclosures and their connecting cables are housed in separate metal conduit. Shorting and/or grounding of these cables due to postulated fire would not jeopardize the emergency power busses because the low-voltage power supplies which feed the transmitters are current-limiting devices.

In event of fire in the spaces protected by temperature detection, it is expected that a signal will be generated by the ambient sensors at compartment temperatures well below the threshold of damage to equipment of either division. This signal would appear to the leak detection temperature sensor as a leak in the process piping or equipment within the compartment.

9A.5.5.8 Standby Liquid Control

The following SLC equipment is located in the same general area of the reactor building at the 38-ft level, azimuth (approximately) 250° (Division 2 general area) on a concrete slab outside the drywell:

Divisional Equipment	Designated Division
Pump C41-C001A	1
Pump C41-C001B	2
Injection Valve (MO) C41-F006A	1
Injection Valve (MO) C41-F006B	2
Suction Valve (MO) C41-F001A	1
Suction Valve (MO) C41-F001B	2
Control and Power Cabling to "A" Equipment	1
Control and Power Cabling to "B" Equipment	2

Nondivisional Equipment

Boron Storage Tank

Storage Tank Heating elements

Power Cabling for Storage Tank Heaters

The cabling is routed in separate conduit or trays for each division, separated from each other, to meet IEEE 384. Conduit will be embedded in concrete where feasible.

The electric drive motor and cabling for the redundant pumps are located more than 5 ft apart. The injection valves and cabling are located more than 3 ft apart centerline to centerline.

The control cables for Division 1 and 2 equipment are in separate conduit and separate from the power cables. The Division 1 power and control cabling is routed out of the Division 2 area to the Division 1 area by conduit embedded in the floor and walls.

Postulated fire damage to the electrical equipment in the SLC area could not inadvertently result in injection of boron because this can only be done by activation of a switch on the control room panel. Fire could damage the power cabling to the pump suction valves or to the pump motors preventing opening of valves or start of pump motors on command from the control room. However, the SLC equipment is not required for safe shutdown of the reactor, since it is redundant to the RPS.

9A.5.5.9 Flammability Control System

The flammability control system equipment is located in a large enclosed area at grade level at approximately 180 degrees azimuth. The room has a fire barrier floor and is completely surrounded by fire barrier walls and doors. There are large access doors to the outside at the centerline of the room.

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The FCS is made up of two independent redundant divisions (div. 2 & 3), and each division is located in fire area division 2 & 3 respectively. Each division has two suction isolation valves (inboard and outboard) and two return isolation valves (inboard & outboard). The inboard isolation valves are motor operated (MO) valves, and the outboard isolation valves are fail close (FC) air operated (AO) solenoid valves (two solenoids per valve). They are powered from divisions 1 & 4. Fire in either divisions may cause the inboard valve (div. 2 or 3) to fail to operate, but the outboard isolation valves are still capable to isolate because they are powered from different divisions (div. 1 & 4). Loss of a complete division is acceptable because FCS is made up of two independent redundant divisions mounted in two separate fire areas.

9A.5.5.10 Fuel Pool Cooling Cleanup System

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~~The fuel pool cooling cleanup system equipment is located 20-foot above grade and at approximately 310 degrees azimuth.~~

~~The Division I equipment is spatially separated from the Division II equipment, though there is no~~

9 fire barrier between the two divisions. The main pumps are located slightly more than 5 feet apart.

9A.5.5.11 Standby Gas Treatment System

The standby gas treatment system equipment is contained in two separate adjoining rooms located between 270 and 330 degrees azimuth near the standby liquid control system area at the 38-foot level.

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The system consists of two totally independent and redundant divisional trains (div.II & div. III). Each divisional train has a filter train (consisting of the demister, an electric process heater, prefilter, pre-HEPA filter, charcoal adsorber, a post-HEPA filter and space heaters), an exhaust fan and a cooling fan. The two divisional trains occupy two separate rooms separted by a 3-hour ~~hr~~ fire barrier. Each divisional train exhaust is connected to the R/A exhaust duct dcut and they are isolated by fire dampers.

9A.5.5.12 Fine Motion Control Rod Drive Components

The fine motion control rod drive components which require multi-divisional power interfaces are contained in two large enclosed areas approximately 50 feet above grade level.

One of these areas is centered at 90 degrees azimuth, just inside of the reactor building wall, and contains Divisions I and III power interfaces for FMCRD driver cabinets. The room also contains non-1E equipment associated with the rod control and information system.

The other area is a "mirror image" centered at 270 degrees azimuth and contains Division II and III power interfaces for FMCRD driver cabinets. The room also contains non-1E equipment associated with the rod control and information system.

Exception is taken to the LOCA-trip requirements of isolation circuit breakers for the FMCRDs because of ATWS considerations. As explained in Subsection 7.4.2.1.2(3) of the SAR, the breaker time-overcurrent trip characteristic for all circuit faults shall cause the breaker to interrupt the fault current prior to initiation of any upstream breaker. The power source shall supply the necessary fault current for sufficient time to ensure the proper coordination without loss of function of Class 1E loads. In addition, each FMCRD inverter has current limiting features to limit the FMCRD motor fault current. Continuous operation of all the FMCRD motors at the limiting fault current of the inverter shall not degrade operation of any Class 1E loads (i.e., the diesel generators shall be of appropriate design capacity).

Each of the FMCRD panel rooms are enclosed by fire barrier walls and are on opposite sides of the reactor building. Shorts and/or grounds on the Class-1E divisional FMCRD power source cables caused by postulated fires in either of these areas would therefore not cause an unsafe condition nor jeopardize the integrity of the Class 1E power busses.

9A.5.5.13 Reactor Building Operating Deck Radiation Monitors

Radiation monitoring within this area is facilitated by two independent systems. The area radiation monitoring system and the process radiation monitoring system.

The area radiation monitoring (ARM) system is non-safety related and uses two radiation channels in the fuel storage and handling areas. It has no system actuation function, but is used for monitoring of background radiation and radiation resulting from accidental fuel drops. The sensors are mounted on the walls within the fire zone area. These detectors are designed to annunciate local and control room alarms for both high and low radiation conditions. The low condition is an indication of an inoperative radiation monitor. Loss of these detectors, due to fire, does not impact plant safety.

The process radiation monitoring (PRM) channels that are utilized in this area are safety related, and are used to perform isolation functions. The Gieger Mueller detectors are mounted in the reactor building ventilation system exhaust duct (Rm 643). They are safety related, and receive their power from a dual auctioneered class 1E divisional high voltage power supplies of the digital ARM (D11-Z602A-D Div, 1-4). Each divisional digital ARM output voltage is hard wired to its associated detector and it

9A.5.5.16 Containment Isolation Valves

The primary function of each isolation valve is to close to isolate primary containment when isolation is required. In general, outboard isolation valves are assigned to division 1 and inboard isolation valves to division 2. In some cases this results in division 1 outboard isolation valves being located in division 2 or 3 areas. This is acceptable from a functional standpoint because a fire in an area outside of containment and involving the penetration must be assumed to disable the system anyway, without regard to whether or not the outboard isolation valve is disabled. If the valve is open at the time of the fire it could fail in the open position and remain open but the inboard valve would not be involved in the fire and would close on demand. It is a requirement that cables for outboard valves located in fire areas of a division different than the division of the valve not be routed through fire areas containing any circuitry associated with the inboard valve of the isolation pair. See Table 9A.5-2 for identification of specific valves which fall in this category.

9A.5.5.17 Division 4 Sensors

There are a few cases of division 4 instruments being mounted in division 2 fire and HVAC area. It is possible that both the division 2 and 4 sensors could be lost due to a single fire. This would either cause the two channels to trip high or alarm down scale. A high trip would cause the protective action to be taken as a result of the two out of four logic. For a down scale trip, the operator would know that a failure had occurred and automatic action would still be initiated by divisions 1 or 3. For these reasons, simultaneous loss of both the divisions 2 and 4 instruments is acceptable.

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~~9A.5.5.18 Flammability Control System (FCS)~~

~~The FCS is made up of two independent redundant divisions (div. 2 & 3), and each division is located in fire area division 2 & 3 respectively. Each division has two suction isolation valves (inboard and outboard) and two return isolation valves (inboard & outboard). The inboard isolation valves are motor operated (MO) valves, and the outboard isolation valves are fail close (FC) air operated (AO) solenoid valves (two solenoids per valve). They are powered from divisions 1 & 4. Fire in either divisions may cause the inboard valve (div. 2 or 3) to fail to operate, but the outboard isolation valves are still capable to isolate because they are powered from different divisions (div. 1 & 4). Loss of a complete division is acceptable because FCS is made up of two independent redundant divisions mounted in two separate fire areas.~~

(content moved to 9.A.5.5.9)

9A.5.6 (Deleted)

9A.5.7 Typical Circuits Analysis Of Special Cases

This analysis is for those cases where a device from one division is located in an area of another division. Only typical cases are analyzed here. Each case type is assigned an electrical separation type code for unique identification. An analysis and a typical electrical connection block diagram (Figure 9A.5-2) are presented for each typical case. Table 9A.5-2 provides a summary of the special cases of the equipment in the reactor building discussed in Appendix 9A.5 of the SSAR special cases. It provides the justification and their acceptability from the standpoint of the consequences on the electrical circuits only. The table also references analyses to confirm the acceptability of the loss of function.

In all cases Regulatory Guide 1.75 and IEEE Standard 384 are met. The justification is for the acceptability of complete burnout of the fire area in which the device is located.

Cases with special situations which do not lend themselves to a typical analysis are discussed individually in Appendix 9A, Section 9A.5, of the SSAR.

Type 1A, Large 460V Motor

This type is for a 460V Class 1E motor which is fed from a 480V Class 1E power center and is located in a divisional area different than the division of the motor. A current limiting fuse is added downstream of the breaker in the power center to provide Class 1E redundant protection for the motor feed circuit to assure that a motor or cable fault does not propagate back to the bus and cause the bus supply breaker to open. A fault in the motor circuit will cause a momentary voltage drop on the bus but the 480V loads are required to be designed to accomodate momentary voltage dips while a load breaker is clearing a downstream fault. Tables referencing this typical circuit analysis should have a column which gives the justification for

Table 9A.5-2

SUMMARY OF THE REACTOR BUILDING SPECIAL CASES (Continued)

ITEM NO.	MPL NO.	DIV.	ELEV	HORIZ DIM.	VERT DIM.	DESCRIPTION	ROOM NO.	FIRE AREA DIV.	ELEC. SEP. TYPE CODE	JUSTIFICATION FOR ACCEPTABILITY OF LOSS OF FUNCTION
91	T31-F008	1	19000	2.6	E.6	AO VALVE	521	2	3C	Normally closed, fail closed vlv. Loss of path to SGTS is accept.
92	T31-F009	1	19000	2.6	E.6	AO VALVE	521	2	3C	Normally closed, fail vlv. Loss of contmt atmos. control is accept.
93	T31-F040	2	13700	5.8	C.2	AO VALVE	411	1	3C	Normally open, fail clsd vlv. Loss of nitro. supply is accept.
94	T31-F041	2	13700	5.8	C.2	AO VALVE	411	1	3C	Normally open, fail clsd vlv. Loss of nitro. supply is accept.
95	T31-F731	1	23500	5.8	C.8	SO VALVE	616	3	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
96	T31-F737B	1	6500	2.1	D.5	SO VALVE	323	2	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
97	T31-F739D	4	2800	2.2	C.1	SO VALVE	241	2	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
98	T31-F741D	4	-1700	2.2	C.1	SO VALVE	241	2	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
99	T31-F801A	1	18100	2.0	D.5	SO VALVE	528	2	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
100	T31-F801B	2	18100	5.7	B.8	SO VALVE	510	1	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
101	T31-F805A	1	6600	5.9	D.5	SO VALVE	332	3	3C	Normally open, fail open instru vlv. Backed by manual iso vlv is accept.
102	T31-LT05ED	4	-8200	2.2	C.1	LEVEL TRANSMITTER	140	2	2B	See Section 9A.5.5.17
103	T49-F002B-1	1	20100	2.7	E.4	SOLENOID VALVE	521	2	3C	See Section 9A.5.5.18
104	T49-F002B-2	4	20100	2.7	E.4	SOLENOID VALVE	521	2	3C	See Section 9A.5.5.18
105	T49-F002C-1	1	20100	5.7	D.8	SOLENOID VALVE	530	3	3C	See Section 9A.5.5.18 9
106	T49-F002C-2	4	20100	5.7	D.8	SOLENOID VALVE	530	3	3C	See Section 9A.5.5.18
107	T49-F007A-1	1	800	5.8	D.5	SOLENOID VALVE	230	3	3C	See Section 9A.5.5.18 (68)
108	T49-F007A-2	4	800	5.8	D.5	SOLENOID VALVE	230	3	3C	See Section 9A.5.5.18
109	T49-F007B-1	1	800	2.8	E.5	SOLENOID VALVE	221	2	3C	See Section 9A.5.5.18
110	T49-F007B-2	4	800	2.8	E.5	SOLENOID VALVE	221	2	3C	See Section 9A.5.5.18
111	U41-D109	1	18100	1.4	A.7	FPC PUMP (A) RM HVH	547	2	1B	Cooling for FPC pump. redundancy provided by RHR

Table 9A.5-2

SUMMARY OF THE REACTOR BUILDING SPECIAL CASES (Continued)

ITEM NO.	MPL NO.	DIV.	ELEV	HORIZ DIM.	VERT DIM.	DESCRIPTION	ROOM NO.	FIRE AREA DIV.	ELEC. SEP. TYPE CODE	JUSTIFICATION FOR ACCEPTABILITY OF LOSS OF FUNCTION
66	E51-PT014B	2	-1700	6.2	B.9	PRESS XMTR (TURB EXH)	210	1	2B	See Section 9A.5.5.15
67	E51-PT014F	2	-1700	6.2	B.9	PRESS XMTR (TURB EXH)	210	1	2B	See Section 9A.5.5.15
68	G31-F003	1	14480	2.4	B.6	MO GATE VALVE (ISOL)	443	2	1C	See Table 9A.5-1
69	G31-F072	1	13500	2.3	B.6	AO VALVE	443	2	3C	See Section (a.5.5.16
70	H22-P044A*	1	23500	6.3	F.1	CAMS GAS CYL RACK A	633	3	N/A	Redundant rack in diff fire area. See Section 9A.5.5.
71	H22-P055A*	23	-1700	5.2	A.3	SCRAM SOL FUSE PNL A	210	1	N/A	See Section 9A.5.5.1
72	H22-P055B*	23	-1700	4.6	E.8	SCRAM SOL FUSE PNL B	231	3	N/A	See Section 9A.5.5.1
73	H22-P055C*	23	-1700	4.9	E.7	SCRAM SOL FUSE PNL C	231	3	N/A	See Section 9A.5.5.1
74	H22-P055D*	23	-1700	5.0	A.3	SCRAM SOL FUSE PNL D	210	1	N/A	See Section 9A.5.5.1
75	H22-P055E*	23	-1700	5.1	A.3	SCRAM SOL FUSE PNL E	210	1	N/A	See Section 9A.5.5.1
76	H22-P055F*	23	-1700	4.8	E.7	SCRAM SOL FUSE PNL F	231	3	N/A	See Section 9A.5.5.1
77	H22-P055G*	23	-1700	5.0	E.6	SCRAM SOL FUSE PNL G	231	3	N/A	See Section 9A.5.5.1
78	H22-P055H*	23	-1700	4.8	A.3	SCRAM SOL FUSE PNL H	210	1	N/A	See Section 9A.5.5.1
79	P21-F075B	1	13550	2.5	E.3	MO GATE VALVE (ISO)	420	2	1C	Outbd iso vlv, see Section 9A.5.5.16
80	P21-F081B	1	13550	2.6	E.4	MO GATE VALVE (ISO)	420	2	1C	Outbd iso vlv, see Section 9A.5.5.16
81	P24-F053	1	13550	2.7	E.5	MO GATE VALVE (DW ISO)	420	2	1C	Outbd iso vlv, see Section 9A.5.5.16
82	P24-F142	1	13550	2.8	E.6	MO GATE VALVE (DW ISO)	420	2	1C	Outbd iso vlv, see Section 9A.5.5.16
83	P54-F007B	2	19000	2.2	B.9	MO GLOBE VALVE	543	4	1C	Outbd iso vlv, see Section 9A.5.5.16
84	P54-F200	1	19000	2.4	B.9	MO GLOBE VALVE	543	4	1C	Outbd iso vlv, see Section 9A.5.5.16
85	P54-PT002B	2	19000	2.3	B.9	PRESS TRANSMITTER	543	4	2B	Redundant "A" Xmtr located in diff fire area
86	T22-~~C004A~~ C002C	2	~~27200~~ 23500	~~2.4~~ 2.2	~~C.2~~ B.6	~~EXHAUST~~ COOLING FAN ~~A~~ C	~~682~~ 642	3	1B	Redundant "B" pump located in diff fire area
87	T22-~~C004B~~ C002B	3	23500	~~2.6~~ 2.2	~~C.8~~ C.7	~~EXHAUST~~ COOLING FAN B	~~642~~ 641	2	1B	Redundant "A" pump located in diff fire area
88	T22-F019	3	23500	1.8	C.8	AO VALVE	640	2	3C	Redundant vlv located in diff fire area
89	T31-F002	2	13700	5.8	C.2	AO VALVE	411	1	3C	Normally closed, fail closed vlv. Loss of contmt atmos control is accept.
90	T31-F003	2	8500	5.5	B.6	AO VALVE	318	1	3C	Normally closed, fail closed vlv. Loss of contmt atmos control is accept.

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