STAFF POSITIONS ON SEP TOPIC III-5.B
PIPE BREAKS OUTSIDE CONTAINMENT
GINNA NUCLEAR PLANT

1. Because high and moderate energy line breaks in the Screen House could damage the power supplies to all service water pumps, the licensee must provide protection for these power supplies in accordance with Standard Review Plan 3.6.1 consistent with the service water system modifications which must be performed in connection with other ongoing SEP reviews and the fire protection review. Modifications to provide this protection can be acceptably delayed until the SEP integrated assessment of the plant provided that the diesel generator cooling method described, in the licensee's December 28, 1979 fire protection safe shutdown analysis, is tested to assure its timely availability and its capability to provide adequate cooling. The results of this testing should be submitted for NRC staff review.

2. The licensee must provide the means to warn the control room operator that flooding conditions exist in the Intermediate Building sub-basement. The licensee should provide the implementation schedule for this capability.

3. Based on our evaluation of Main Steam (MS) and Main Feed (MF) line breaks in the Turbine Building and Intermediate Building, the licensee should (1) proceed with the design and installation of jet impingement shielding in the Intermediate Building (as previously committed to by the licensee), (2) provide protection from the effects of the failure of the Turbine Building/Intermediate Building cinder block wall for the MS atmospheric dump valves and assess the need for and provide protection as necessary for the MS safety valves. The installation of additional jet impingement shielding for the MS bypass valves and associated piping is not necessary since the bypass valves are not required for safe shutdown or pipe break mitigation. A proposal to accomodate item (2) above should be submitted for staff review.

4. Since certain MELB's in the mechanical equipment room could result in flooding both battery rooms, the licensee must provide protection from the effects of these postulated MELB's in accordance with the acceptance criteria of Standard Review Plan 3.6.1. The licensee should provide a schedule for the implementation of this position.

5. To preclude adverse environmental conditions resulting from a heating steam or CVCS letdown break in the Auxiliary Building, the licensee must analyze the adequacy of once-per-shift inspections to prevent the formation of the adverse environment or to provide some other acceptable means of preventing the existence of the adverse environment. The results of this analysis (with a commitment to provide the required protection, if necessary) should be submitted for NRC staff review.

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SEP REVIEW

OF

PIPE BREAK OUTSIDE CONTAINMENT

TOPIC III-5.B

FOR THE

R. E. GINNA NUCLEAR POWER PLANT

INTRODUCTION

The safety objective of Systematic Evaluation Program (SEP) Topic III-5.B, "Pipe Break Outside Containment" is to assure that pipe breaks would not cause the loss of needed functions of safety-related systems, structures and components and to assure that the plant can be safely shut down in the event of such breaks. The needed functions of safety-related systems are those functions required to mitigate the effects of the pipe break and safely shutdown the reactor plant. The current criteria for review of pipe breaks outside containment are contained in Standard Review Plan 3.6.1 and 3.6.2 including their attached Branch Technical Positions.

BACKGROUND

In December 1972, the staff sent letters (Reference 1) to all power reactor licensees requesting an analysis of the effects of postulated failures of high energy lines outside of containment. A summary of the criteria and requirements in this letter is set forth below:

a. Protection of equipment and structures necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming a concurrent and unrelated single active failure of protected equipment, should be provided from all effects resulting from ruptures in pipes carrying high energy fluid, where the temperature and pressure conditions of the fluid exceed 200°F and 275 psig, respectively, up to and including a double-ended rupture of such pipes. Breaks should be assumed to occur in those locations specified in the "pipe whip criteria." The rupture effects to be considered include pipe whip, structural (including the effects of jet impingement), and environmental.

b. In addition, protection of equipment and structures necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming a concurrent and unrelated single active failure of protected equipment, should be provided from the environmental and structural effects (including the effects of jet impingement) resulting from a single open crack at the most adverse location in pipes carrying fluid routed in the vicinity of this equipment. The size of the cracks should be assumed to be 1/2 the pipe diameter in length and 1/2 the wall thickness in width.

In response to our letter and subsequent requests for additional information, Rochester Gas and Electric (RG&E, the licensee) submitted a report, "Effects of Postulated Pipe Breaks Outside the Containment Building," and several additional letters providing information and schedules for plant modifications. A complete bibliography of these letters is contained in the NRC Safety Evaluation Report (SER) for Amendment No. 29 for the Ginna plant (Ref. 2). The SER for Amendment No. 29 also provides the NRC staff evaluation of certain facility modifications proposed by the licensee to provide protection from the effects of a postulated pipe break outside containment. Reference 3 approved the licensee's augmented Inservice Inspection (ISI) Program which is intended to ensure a very low probability of pipe breaks at locations in the main steam and main feed systems where modifications to mitigate the effects of the breaks could not be installed. In addition, the licensee committed to make certain modifications in conjunction with the Systematic Evaluation Program (SEP) reevaluation of the effects of pipe breaks outside containment.

The NRC staff reevaluation of the effects of pipe breaks outside containment under SEP Topic III-5.B involves the comparison of the Ginna plant with current criteria for pipe breaks outside containment. The staff used an "effects oriented" approach to determine the acceptability of plant response to pipe breaks, i.e., each structure, system, component, and power supply which must function to mitigate the effects of the pipe break and to safely shutdown the plant was examined to determine its susceptibility to the effects of the postulated break. Break effects considered were compartment pressurization, pipe whip, jet impingement, spray, flooding, and environmental conditions of temperature, pressure, and humidity. This review complements that of SEP Topic III-12, "Environmental Qualification of Safety-Related Equipment."

(The effects of potential missiles generated by fluid system ruptures and rotating machinery were also considered and are evaluated under SEP Topic III-4C, "Internally Generated Missiles.")

The previous evaluation of pipe breaks outside containment for the Ginna Plant was performed using some methods and criteria which are no longer used by the staff in the review of current plants. For example, the current definition of a high energy fluid system as one that is maintained under conditions where either or both the maximum operating temperature and pressure exceeds 200°F and 275 psig is different from the definition applied in the previous review where a high energy fluid system was one in which <u>both</u> temperature and pressure exceed 200°F and 275 psig. The SEP reevaluation of this topic was performed using the current criteria in Standard Review Plan 3.6.1 and 3.6.2 and their attached Branch Technical Positions.

Data for this assessment was gathered during a visit to the Ginna plant on September 25-27, 1979.

EVALUATION

The results of the SEP reevaluation of pipe breaks outside containment for the Ginna plant are provided in Table 1. The table lists the zones within the plant which contain systems required for safe shutdown and/or systems required to mitigate the effects of postulated pipe breaks. These zones are the screen house, diesel generator rooms, intermediate building (elev. 293', 278' and 253'), turbine building (elev. 289', 271', and 253'), control room, relay room, battery rooms, mechanical equipment room, and auxiliary building (elev. 271', 253', and 235').

The safe shutdown systems which were examined from the standpoint of protection from pipe break effects are identified in the SEP Safe Shutdown Review for Ginna (Ref. 9). These systems are:

(a) Reactor Protection System

(b) Auxiliary Feed System

(c) Main steam safety, isolation, and atmospheric dump valves

(d) Service Water System

(e) Chemical and Volume Control System

(f) Component Cooling Water System

(g) Residual Heat Removal System

(h) Instrumentation for Shutdown and Cooldown

(i) Emergency Power (AC and DC) and control power for the above systems and components.

This section provides additional information used to evaluate certain pipe breaks listed in Table 1.

Screen House

Service Water System (SWS) or fire system MELB's and heating steam line breaks could result in the loss of the SWS by damaging 480V electrical buses 17 and 18 or their associated electrical cabling. Loss of the SWS would result in a plant trip because of the loss of several components cooled by the SWS such as the reactor feed pump lube oil systems, circulating water pumps, and the CCW system. In accordance with current criteria, a pipe break which results in a reactor or turbine trip results, in turn, in a loss of offsite power. To supply AC power following a loss of offsite power, redundant emergency diesel generators are available; however, the diesel generators are supplied cooling water by the SWS. Therefore, the postulated pipe break could cause the total loss of AC power at the plant, and reactor core decay heat removal would be dependent on the turbine driven auxiliary feed pump which is susceptible to a postulated single active failure.

The licensee has been evaluating the SWS in connection with the ongoing NRC fire protection review and the SEP reviews of flooding and tornado missiles. To conduct a plant cooldown following a fire which causes a loss of all SWS with no offsite power available, the licensee has developed a procedure which is described in Ref. 4. The procedure requires the installation of fire hoses from the city hydrant system to provide the diesel generators cooling water and to provide additional water to the auxiliary feed pumps for steam generator makeup water. While the fire hoses are being installed, the turbine driven auxiliary feed pump is used to add water from the Condensate Storage Tank to the steam generators for decay heat removal. After a diesel generator is operable, additional auxiliary feed pumps and the reactor coolant system charging pumps can be operated as required. According to the procedure, fire hoses and portable pumps would have to be connected to one CCW heat exchanger if a plant cooldown to cold shutdown conditions were required with no SWS flow available.

The proposed procedure could be used for the pipe break case even if the turbine driven auxiliary feed pump is assumed to fail. Without feedwater addition, the steam generators can remove decay heat for approximately 50 minutes before they are boiled dry. This time could be used to makeup the temporary diesel generator cooling connections to start a diesel generator and a motor driven auxiliary feed pump.

The staff's conclusion and position for resolution of these postulated pipe breaks in the Screen House and their associated equipment failures are contained in the CONCLUSIONS section of this report.

Intermediate Building Flooding

As noted in several places in Table 1, flooding from pipe breaks in the Intermediate Building (IB) would flow via open stairways and hatch gratings to the sub-basement of the IB. Sufficient drainage area is available so that no appreciable buildup of water would occur on any floor of the IB except for the sub-basement. No indications or alarms are available in the control room to warn of flooding conditions in the IB sub-basement. No equipment necessary for safe shutdown or flood mitigation is located on this level; but, if the flooding condition went unchecked, the IB 253' elevation could be affected to a depth of about 30 inches. Equipment on this elevation includes the auxiliary feed pumps and the reactor trip breakers. If this equipment were flooded, a reactor trip would occur and the auxiliary feed system would be inoperable. Although the standby auxiliary feed system, which is not located in the IB, would still be operable even if a loss of offsite power occurred, the staff believes it would be prudent to consider the installation of additional means to warn the plant operators of a flooding condition in the IB sub-basement. The staff position on this is included in the CONCLUSIONS section.

Intermediate Building Main Steam and Main Feed Breaks

Postulated Main Steam (MS) and Main Feed (MF) system HELB's in the IB could result in the following:

(a) The "A" MS line on the 293' elevation could damage cable trays 16, 72, and 122 by jet impingement. At this elevation, these trays contain control and power cables for the containment fan coolers and the containment purge exhaust fans. These systems are not required to function to mitigate a MS break outside containment or to shutdown the plant.

(b) The 30" dia. "A" MS line on the 293' elevation could damage the north IB cinder block wall (whip or impingement), an interior steel column supporting the IB floors above 293' (whip), or the cable trays discussed in (a) above (whip or impingement).

(c) On the 278' elevation of the IB, large MS line breaks could damage both the floor supporting the MS header and MF line "A"; and a break at the juncture of the 36" dia. and the 30" dia. steam lines could overstress the anchors which connect the lines to the IB structure.

(d) A "B" MF line break on the 278' elevation could damage one or more steam safety valves for the "A" steam generator.

(e) IB pressurization by a large HELB was predicted in Ref. 6, for the bounding case of the 36" dia. MS line break, to result in failure of the cinder block walls and roof beams and decking of the IB although the IB structure was not predicted to be damaged.

(f) In Reference 6, it is stated that a "B" 30" dia. MS line break outside the IB at the penetration to the containment building could damage the control building by means of pipe whip.

Because of the severe consequences of these postulated MS and MF line breaks in the IB and because plant modifications to prevent these consequences were not practical (Ref. 7), the licensee undertook a two-part program to reduce the vulnerability of the plant to a HELB in the IB. The first part of the program was an augmented radiographic inspection program, described in Ref. 8, to provide added assurance that postulated large MS and MF breaks would not occur. This program was reviewed and accepted by the NRC staff in 1975 (Ref. 3). The second part of the licensee's program was to move essential equipment from the IB into locations unaffected by an HELB in the IB. The intent of this program is to preclude the large (greater than the equivalent of six inch diameter) breaks and acceptably mitigate the small breaks. A summary of plant modifications installed and equipment relocated is provided in Ref. 2.

The licensee has committed to install additional modifications in conjunction with the SEP review of this issue. These modifications would include the installation in the IB of jet impingement shielding for one steam generator atmospheric dump valve and all MS safety valves. In the Turbine Building, the licensee committed to install jet impingement protection for the two main steam bypass valves and associated piping. Also, modifications to the IB cinder block wall resulting from the analysis of HELB's in the Turbine Building will be made as necessary upon completion of the SEP. The licensee's commitment is detailed in Ref. 10.

A comparison of the IB pressurization caused by a 6" dia. HELB provided in Ref. 6 with the design limits of the IB cinder block wall provided in Ref. 11 shows that even this small HELB could fail the cinder block wall. As a result of this failure, equipment in the Turbine Building could be damaged. The only equipment which may be of concern from the standpoint of plant shutdown are the MF regulating valves and bypass valves on the 270' elevation of the Turbine Building. However, even if these valves were damaged, the Standby Auxiliary Feed System (SAFS) would be available to feed the steam generators and effect a safe shutdown of the plant. The SAFS was installed to provide steam generator feed in case a pipe break in the IB damaged the Auxiliary Feed System.

Turbine Building Main Steam and Main Feed Breaks

Postulated MS and MF system HELB's in the Turbine Building (TB) could result in:

(a) The 24" MS lines could whip into the IB wall at the proper elevation to damage the "B" MS line safety valves, atmospheric dump valve, and steam supply line to the turbine driven auxiliary feed pump.

(b) MS and MF breaks could pressurize the TB itself. The following pressures have been calculated:

Location	Breaks 20" MF @ 270'	24" MS @ 298'	36" MS @ 270'	12" MF @ 270'
TB 298'	.456 psi	.589 psi	.742 psi	.233 psi
TB 270' and 243'	.848 psi	.507 psi	1.26 psi	.259 psi

These results are provided in Ref. 11 for the 20" MF break and in Ref. 12 for the other breaks. The pressurization of the TB could adversely affect those areas adjacent to the TB in which safe shutdown or pipe break mitigating equipment is located. These areas are the control room, diesel generator room, relay room, battery room and the IB.

Again, because of the consequences of these postulated MS and MF line breaks in the TB, the licensee utilized the two-part program to reduce the vulnerability of the plant to these HELB's. The licensee's previously approved augmented inspection program has been applied in the TB to MS lines larger than 12" dia. and several locations on the 20" dia. MF header. The inspection program limits the breaks which must be considered to a 12" MS or a 20" MF line break which are the largest potential double-ended breaks in locations which are not inspected. Of these, the 20" MF is more limiting. To protect the areas adjacent to the TB from the effects of HELB's, the licensee has installed pressure diaphragm walls between the TB and the control room, relay room, battery rooms, and diesel generator rooms. The design differential pressure for these walls is 0.7 psi for the control room and 1.14 psi for the other spaces. The NRC evaluation of these walls is in Reference 2. As noted previously, the licensee has committed to install jet impingement protection for the two MS bypass valves and associated piping in the TB and to modify the TB/IB wall as necessary upon completion of the SEP. The pressure resulting from a 20" MF or 12" MS line break in the TB is sufficient to cause failure of the TB/IB cinder block wall (design pressure .13 psid). If this wall failed, one containment purge exhaust fan on the IB 298' elev., the auxiliary feed system (AFS) steam supply valves, MS isolation valves, and MS safety and atmospheric dump valves on the IB 278' elev., and the AFS turbine driven pump, reactor trip breakers, and reactor rod control motor generator sets on the IB 253' elev. could be damaged by falling cinder blocks or adverse environmental conditions.

The purge exhaust fan is not required to function to mitigate a HELB outside containment. The rod control motor generators and reactor trip breakers fail safe if damaged and would not prevent a reactor trip (core shutdown). The AFS function is required for a safe shutdown; however, the SAFS has been installed by the licensee to accomplish this function if a HELB disables the AFS. The turbine driven AFS pump is not specifically required to operate following a postulated HELB since, even if offsite power were assumed to be lost, the redundant emergency diesel generators would be available to power the two SAFS pumps or the remaining two AFS pumps all of which are driven by electric motors. Only one of these four motor driven pumps is required for a plant shutdown and cooldown.

The discussion in the previous paragraph shows that most of the equipment which can be damaged by a failure of the TB/IB block wall is not necessary for

HELB mitigation or safe plant shutdown. However, the MS isolation valves and MS safety and atmospheric relief valves are necessary for HELB mitigation and safe shutdown. Although the safety valves would probably not be rendered inoperable by failure of the TB/IB wall, the licensee will be requested to assess this possibility and consider incorporating protection of the valves with the jet impingement shields to be installed. Both atmospheric dump valves would have to be protected from the effects of the wall failure. Our position on this is stated in the CONCLUSIONS section.

Battery Room/Mechanical Equipment Room Flooding

A SWS or fire system MELB in the mechanical equipment room could flood both battery rooms and result in a loss of all emergency DC power. A 20" diameter SWS line break in the mechanical equipment room would result in a calculated flooding rate of 585 gpm using the methods of Ref. 5. No sump level or flood alarms are installed in this space or in the battery rooms which are connected to the mechanical equipment room by normally closed non-watertight doors. The licensee will be required to provide adequate protection from the effects of this postulated MELB.

Auxiliary Feed System Breaks on the 253' Elevation of the IB

The AFS discharge lines from the pumps in the IB (253' elve.) to the "B" MF header run along the north wall of the IB at approximately the 270' elevation. A break in this line, which is a high energy line, could result in pipe whip or jet impingement on cable trays and containment electrical penetrations in that area. (The steam lines for the turbine driven AFS pump are also in this area but are not considered high energy lines since they are not pressurized during normal plant conditions.) Reference 4 presents an analysis of plant shutdown capability following an exposure fire in this area which destroys all electrical cables and equipment in the area. This condition envelopes the damage which could be done by the AFS HELB. To provide safe shutdown capability following the fire, the licensee has proposed methods and identified plant modifications to be installed (Ref. 4). Upon completion of these modifications and because of previously installed modifications, specifically the standby AFS and relocation of safe shutdown instruments from the IB, the plant will have an acceptable level of protection from the effects of AFS breaks on the 253' elevation of the IB.

CONCLUSIONS

Based on the information submitted by the licensee and obtained during the site visit to the Ginna plant, we have determined that the following review areas have not been adequately addressed in previous staff safety evaluations and should be resolved with the SEP:

1. SWS and fire system MELB's and heating steam line breaks in the screen house could result in the loss of all SWS flow, by damaging Buses 17 and 18, and the loss of all AC power. The licensee is implementing a method to provide cooling to the onsite emergency diesel generators which is not dependent on the SWS. The staff position regarding these pipe breaks is that the licensee must

provide protection for Buses 17 and 18 and their associated cables from the effects of the breaks in accordance with Standard Review Plan 3.6.1 consistent with the modifications which must be performed on the SWS to accomodate other ongoing SEP reviews, e.g., the tornado missile review. Installation of the required protection can be acceptably delayed to the SEP integrated assessment of the plant because the licensee has developed, in conjunction with the fire protection program, the previously described method to provide diesel generator cooling without the SWS; however, this method of cooling the diesels must be tested to assure its timely availability and its ability to provide adequate cooling.

2. Based on our discussion of MELB's in the IB in the EVALUATION section of this report, the licensee will be required to install some means to warn the control room operator that flooding conditions exist in the IB sub-basement. This need not be deferred until the SEP integrated assessment.

3. Based on our evaluation of MS and MF line breaks in the TB and IB, the licensee will be required to (1) proceed with the design and installation of jet impingement shielding in the IB (as previously committed to by the licensee), (2) provide protection from the effects of the failure of the TB/IB cinder block wall for the MS atmospheric dump valves and assess the need for and provide protection as necessary for the MS safety valves. The staff also supports the previous review and approval of the licensee's augmented inservice inspection program for large MS and MF lines in the TB and IB. In

addition, the installation of additional jet impingement shielding for the MS bypass valves and associated piping is not necessary since the bypass valves are not required for safe shutdown or pipe break mitigation.

4. Since certain MELB's in the mechanical equipment room could result in flooding both battery rooms, the licensee will be required to provide protection from the effects of these postulated MELB's in accordance with the acceptance criteria of Standard Review Plan 3.6.1.

5. To preclude adverse environmental conditions resulting from a heating steam or CVCS letdown break in the Auxiliary Building, the licensee will be required to analyze the adequacy of once-per-shift inspections to prevent the formation of the adverse environment or to provide some other acceptable means of preventing the existence of the adverse environment.

The staff is continuing this SEP reevaluation of pipe breaks outside containment and will update this report as additional information is provided and conclusions are reached.

TABLE 1. EFFECTS OF PIPE BREAK OUTSIDE CONTAINMENT

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Screen House	SWS (MELB)* or Fire System (MELB)	None	SWS Power Supply Bus 17 & 18	Potentially inadequate. Spray from a SWS or fire system leak can affect both and cause loss of all SWS pumps. See discussion in EVALUATION section.
	CW (MELB)	None	SWS, Bus 17 & 18	Adequate. Previously analyzed in CW flooding evaluation (Ref. 13).
	Heating steam (HELB)	None	SWS Power Supply Bus 17 & 18	Potentially inadequate. High temperature environment effects on cables to Buses 17 and 18 could cause loss of SWS. See remarks above.
Diesel Generator Room 1A (253')	SWS (MELB) or Fire System (MELB)	None	Diesel generator 1A	Adequate. Spray from MELB may affect generator or associated electrical panels, but redundant diesel generator and offsite power are available as backup. Flooding in room is detected by sump pump alarm in control room. Cable vault below diesel generator room is protected from flooding by watertight manhole cover.
	Heating steam (HELB)	None	Diesel generator 1A	Adequate. Fire protection temperature detector warn control room of high temperature conditions. No LOP; other diesel available.
Diesel Generator Room 1B (253')	SWS (MELB) or Fire System (MELB)	None	Diesel generator 1B	Adequate. See comments above for MELB in 1A diesel room. SWS supply line to diesel 1A passes through 1B diesel room but leakage from a crack break in this SWS line would not be enough to render the 1A diesel inoperable through loss of cooling water.

*A list of abbreviations is provided at the end of this table.

TABLE 1. (Continued)

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Diesel Generator Room 1B (253') (continued)	Heating Steam (HELB)	None	Diesel generator 1B	Adequate. See remarks above for heating steam leak in diesel room 1A.
Intermediate Building (293')	Fire system (MELB)	None	None	Potentially inadequate. Flooding by postulated MELB's on all elevations of the intermediate building is drained by means of open stairways and gratings to the sub-basement. No appreciable buildup of flood water will occur on any level except the sub-basement. See evaluation section of this report.
	MS and MF (HELB) [crack breaks]	Various; see evaluation section of this report.	Various; see evaluation section of this report.	Adequate. Jet impingement from a crack in "A" MS line could impact cable trays 16, 72, 122. Although these trays are safety related, at the 293' elevation they contain no cables needed to mitigate the effects of the break or to safely shutdown. Environmental effects of MS and MF crack breaks would be experienced throughout the intermediate building. Licensee has modified the plant to withstand these conditions in the intermediate building and to prevent these conditions from spreading to the auxiliary building. (Refs. 2 and 10)
	MS, "A" and "B" headers, MF, "B" header (HELB) [large break]	Various, see evaluation section of this report.	Various; see evaluation section of this report.	Adequate. Although a large MS or MF line rupture in the intermediate building has the potential to structurally damage the building, these ruptures are effectively precluded by the licensee's ongoing inservice inspection of these lines.

TABLE 1. (Continued)

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Intermediate Building (278') (continued)	AFS (HELB)	None	MSIVs, Atmospheric MS dump valves, MS safety valves, AFS turbine driven pump steam supply valve	Adequate. Jet impingement of AFS water (~80°F) on MSIVs, safety valves would not render these inoperable. Impingement on AFS turbine driven pump steam supply valve or either atmospheric dump air control system could render these inoperable; however, the turbine driven pump is not normally used for safe shutdown and the function of steam generator makeup can be performed by other AFS and SAFS pumps and the atmospheric dumps can be manually operated by handwheels.
Intermediate Building (278')	Fire system (MELB)	None	None	Adequate. See remarks above for MELB at 293' elevation.
	MS and MF (HELB) [crack break]	Various; see evaluation section of this report.	Various; see evaluation section of this report.	Adequate. Licensee has protected* or moved instrumentation required to mitigate the effects of the breaks or to safely shutdown. This is further discussed in the evaluation section of this report.
	MS and MF (HELB) [large break]	Various; see evaluation section.	Various; see evaluation section.	Adequate. See remarks for large MS or MF line break on 293' elevation of intermediate building.

*Some protection will be installed in conjunction with the SEP review of the facility.

TABLE 1. (Continued)

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Intermediate Building (253')	Fire system, SWS, chilled water system (MELB)	None	AFS pumps, reactor trip breakers	Adequate. Spray from MELB may impact AFS pumps or reactor trip breaker panels. Since the turbine driven AFS pump is located away from the 2 motor driven pumps and since there exists another system (SAFS) to supply auxiliary feed to the steam generators, spray from a MELB would not prevent steam generator makeup. The reactor trip breakers would fail safe (tripped) if damaged by spray from a MELB. Flooding protection from a MELB is adequate on this level; see remarks above for MELB at 293' elevation.
	AFS (HELB)	None	AFS, Safety related cable trays, containment electrical penetrations reactor trip breakers	Adequate. Licensee has analyzed loss of these shutdown systems in Ref. 4. This analysis applies to an AFS HELB in this zone.
Turbine Building (289')	MS (HELB)	Various; see evaluation section.	Various; see evaluation section.	Potentially inadequate. Effects of HELB's have been evaluated. See EVALUATION section.
	Fire system (MELB)	None	None	Adequate. Stairwells and large equipment hatch drain MELB water to turbine building basement. Effects of this flooding are enveloped by the CW system flooding review of Ginna (Ref. 13).
Turbine Building (271')	MS and MF (HELB)	Various; see evaluation section.	Various; see evaluation section.	Potentially inadequate. Effects of HELB's have been evaluated. See discussion in EVALUATION section.

TABLE 1. (Continued)

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Turbine Building (271') (continued)	Fire system (MELB)	None	None	See remarks for MELB's on 289' elevation of turbine building.
Turbine Building (253')	MS and MF (HELB)	Various; see evaluation section.	Various; see evaluation section.	Potentially inadequate. Effects of HELB's have been evaluated. See discussion in EVALUATION section.
	Condensate (HELB)	DC power	DC power	Adequate (after battery room diaphragm wall is complete). Spray from condensate booster pump discharge piping could enter battery rooms via ventilation exhaust openings. Batteries and DC distribution system could be damaged by flooding or spray. After diaphragm wall is complete, spray will be prevented from entering the battery room.
	SWS, Fire system, condensate system (MELB) CW	None	None	Adequate. See remarks for MELB's on 289' elevation of turbine building.
Control Room	None	-	-	-
Relay Room	Heating steam (HELB)	None	AC and DC electrical systems	Adequate. Fire protection temperature monitors in relay room would alert control room operators to adverse environment caused by steam leak.
Battery rooms and mechanical equipment room	Heating steam (HELB)	None	AC and DC electrical systems	Adequate. Fire protection system temperature monitors would alert operator to adverse environmental condition in any of these spaces.

TABLE 1. (Continued)

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Battery rooms and mechanical equipment (continued)	Fire system, SWS (HELB)	None	AC and DC electrical systems	Potentially inadequate. MELB in mechanical equipment room could flood this space and the battery rooms. The licensee will be required to demonstrate adequate protection from the effects of this break.
Auxiliary Building (271')	SWS, CCW Fire system (MELB)	None	480V Bus 14, MCC 1C & 1L, CCW pumps	Adequate. Flooding from MELB is prevented by sufficient drainage through building drains and open stairways. Leakage collects in the Auxiliary Building drain tank which has a high level alarm in the control room. Spray effects on electrical bus and MCCs will be mitigated by installation of modifications in conjunction with fire protection review. Spray on a CCW pump together with the postulated single failure of the other pumps results in loss of all CCW. This is acceptable and is discussed further in the SEP review of Topic IX-3, "Station Service and Cooling Water Systems."
	Heating steam, CVCS letdown line (HELB)	None	Safe shutdown system in Auxiliary Building	Potentially inadequate. Steam line breaks at various locations and letdown line breaks could result in high temperature/humidity environment in Auxiliary Building. Once-per-shift operator inspections are performed (Ref. 10); but this may be insufficient frequency to prevent the occurrence of the adverse environment. See CONCLUSIONS section.
Auxiliary Building (253')	SWS, CCW, Fire protection (MELB)	None	480V Bus 16, MCC 1D & 1M	Adequate. See discussion above for MELB on 271' elevation of Auxiliary Building.

TABLE 1. (Continued)

Zone	Pipe Break	Affected Mitigating System	Affected Safe Shutdown System	Adequacy of Protection/Remarks
Auxiliary Building (235')	SWS, CCW, RHR Fire protection (MELB)	None	RHR pumps	Adequate. MELB spray from RHR system onto RHR pump(s) could render the system inoperable. Loss of RHR is discussed in the SEP review of safe shutdown systems for Ginna.
	CVCS (HELB)	None	CVCS, RWST	Adequate. If a break occurs in the single CVCS charging line, an alternate method of adding RCS makeup exists using the HPSI pumps. The RWST (and HPSI injection lines near the RWST) have been protected from a CVCS line whip by the addition of pipe whip restraints.
	RWST (MELB)	None	RHR, CVCS	Adequate. The flooding rate from a RWST MELB (calculated as a MELB in the 10" RHR suction line from the tank-112 gpm) is within the capability of floor drains and RHR pit sump pumps. Adequate warning time is provided by sump alarms for operators to stop the leak.

TABLE 1. (Continued)

List of Abbreviations

AFS	-	Auxiliary feed system
CCW	-	Component Cooling Water system
CVCS	-	Chemical and Volume Control System
CW	-	Circulating Water system
HELB	-	High Energy Line Break
HPSI	-	High Pressure Safety Injection system
LOP	-	Loss of Offsite Power
MCC	-	Motor Control Center
MELB	-	Moderate Energy Line Break
MF	-	Main Feedwater system
MS	-	Main Steam system
MSIV	-	Main Steam Isolation Valve
RHR	-	Residual Heat Removal
RWST	-	Refueling Water Storage Tank
SEP	-	Systematic Evaluation Program
SWS	-	Service Water System

REFERENCES

1. NRC letter, A. Giambusso to Rochester Gas and Electric, dated December 18, 1972.

2. Amendment No. 29 to Provisional Operating License No. DPR-18 for the Ginna Plant, August 24, 1979.

3. Amendment No. 7 to Provisional Operating License No. DPR-18 for the Ginna Plant, May 14, 1975.

4. RG&E letter, L. White to D. Ziemann, dated December 28, 1979, transmitting Fire Protection - Shutdown Analysis, R. E. Ginna Nuclear Power Plant.

5. Branch Technical Position MEB 3-1, appended to Standard Review Plan 3.6.2.

6. RG&E letter, K. Amish to A. Giambusso, dated November 1, 1973 transmitting Effects of Postulated Pipe Breaks Outside of Containment Building, R. E. Ginna Nuclear Power Plant Unit No. 1.

7. RG&E letter, R. Koprowski to E. Case, dated September 4, 1974.

8. RG&E letter, R. Koprowski to E. Case, dated October 31, 1974.

9. SEP Review of Safe Shutdown Systems for R. E. Ginna Nuclear Power Plant, Topics VII-3, V-10.B, V-11.A, V-11.B, X.

10. RG&E letter, L. White to D. Ziemann, dated June 27, 1979.

11. RG&E letter, L. White to D. Ziemann, dated May 17, 1979.

12. RG&E letter, L. White to D. Ziemann, dated July 6, 1979.

13. RG&E letter, K. Amish to D. Skovholt, dated May 31, 1973.