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January 30, 1997

U.S. Nuclear Regulatory Commission
Document Control Desk
Attn: Guy S. Vissing
Project Directorate I-1
Washington, D.C. 20555

Subject: Response to Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," dated September 30, 1996
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Vissing:

Rochester Gas and Electric (RG&E) Corporation has completed its evaluation of the R.E. Ginna Nuclear Power Plant as requested by Generic Letter 96-06. The purpose of this letter is provide the subject evaluation within the requested 120 day response (the generic letter was received by RG&E on October 2, 1996).

The attached evaluation addresses the effects of potential water-hammer and two-phase flow with respect to the service water supply to the containment recirculation fan coolers (CRFCs). Also included is an assessment of the potential for thermally induced overpressurization of isolated piping sections. The results of these two evaluations are presented in the attached report (Sections 2.1 and 2.2 for the CRFCs and Section 2.3 for isolated piping sections).

Very truly yours,

Robert C. Mecredy
Vice President, Nuclear Operations

Subscribed and sworn/affirmed before me this 30th day of January, 1997

Notary Public

SHARON J. ECKERT
Notary Public in the State of New York
Monroe County
My Commission Expires March 29, 97

xc: Mr. Guy S. Vissing
Project Directorate I-1
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

Ginna Senior Resident Inspector

ATTACHMENT 4.6

GL 96-06 EVALUATION OF PENETRATION PIPING SYSTEMS FOR THERMALLY INDUCED OVERPRESSURIZATION

PENETRATION	CONTENTS OF PIPE AFTER ACCIDENT	SIZE	P&ID DWG.:33013-	COMMENTS
1	EMPTY	N/A	N/A	USED ONLY DURING SHUTDOWN; EMPTY OTHERWISE
2	AIR	N/A	1884-2	USED ONLY DURING SHUTDOWN; EMPTY OTHERWISE
29	L	20"	1248	EMPTY DURING OPERATION
100	L	2"	1265-1	NO ENTRAPMENT; V392A ACTS AS A RELIEF
101	L	4"	1262-2	NO ENTRAPMENT; OPEN FOR SI FLOW
102	L	2"	1265-1	NO ENTRAPMENT; V392B ACTS AS A RELIEF
103	L	2"	1991	PIPE IS DRAINED BEFORE CAPS INSTALLED
105	L	6"	1261	NO ENTRAPMENT; OPEN FOR CS FLOW
106	L	2"	1265-1	NO ENTRAPMENT; V304A RELIEF TO RCP SEAL WATER
107	L	1"	1279	NO ENTRAPMENT; 10021 RELIEF
108	L	3"	1265-1	NO ENTRAPMENT; V314 RELIEF
109	L	6"	1261	NO ENTRAPMENT; OPEN FOR CS FLOW
110a	L	2"	1265-1	NO ENTRAPMENT; V304B RELIEF TO RCP SEAL WATER
110b	L	3/4"	1262-2	NO ENTRAPMENT; V887 RELIEF
111	L	10"	1247	NO ENTRAPMENT; V203 RELIEF
112	L	2"	1264	NO ENTRAPMENT; V203 RELIEF
113	L	4"	1262-2	NO ENTRAPMENT; OPEN FOR SI FLOW
119	L	3"	1238	NO ENTRAPMENT; OPEN FOR SAFW FLOW
120a	N2	1"	1262-2	GAS CONTENTS
120b	GAS	3/4"	1258	GAS CONTENTS
121a	L	2"	1258	RELIEF NEEDED ←
121b	N2	3/4"	1258	N2 CONTENTS
121c	N2	2"	1258	CONTAINMENT AIR CONTENTS
123a	L	3/4"	1272-1	NO ENTRAPMENT; OPEN INSIDE CONT. TO RCDT
123b	L	3"	1238	NO ENTRAPMENT; OPEN FOR SAFW FLOW
124a	L	2"	1246-1	NO ENTRAPMENT; V744 RELIEF
124b	A	TUBE	1863	POST ACCIDENT AIR SAMPLE
124c	A	2"	1246-1	NO ENTRAPMENT; V744 RELIEF
124d	A	TUBE	1863	POST ACCIDENT AIR SAMPLE
125	L	3"	1246-1	NO ENTRAPMENT; OPEN FOR CCW FLOW TO RCP
126	L	3"	1246-1	NO ENTRAPMENT; OPEN FOR CCW FLOW TO RCP
127	L	3"	1246-1	NO ENTRAPMENT; OPEN FOR CCW FLOW TO RCP
128	L	3"	1246-1	NO ENTRAPMENT; OPEN FOR CCW FLOW TO RCP
129	GAS	2"	1272-1	RCDT GAS HEADER
130	L	6"	1246-1	NO ENTRAPMENT; V818 RELIEF
131	L	6"	1246-1	NO ENTRAPMENT; V818 RELIEF
132	A	6"	1870	MINI-PURGE EXHAUST
140	L	10"	1247	NO ENTRAPMENT; OPEN TO RHR PUMPS IN AB
141	L	8"	1247	NO ENTRAPMENT; OPEN TO SUMP IN CONTAINMENT
142	L	8"	1247	NO ENTRAPMENT; OPEN TO SUMP IN CONTAINMENT
143	L	4"	1272-1	NO ENTRAPMENT; OPEN TO RCDT
201a	L	<2.5"	1250-3	NO ENTRAPMENT; V4759 RELIEF
201b	L	<2.5"	1250-3	NO ENTRAPMENT; V4658 RELIEF
202a	H2	3/4"	1275-2	HYDROGEN RECOMBINER
202b	H2	2"	1275-2	HYDROGEN RECOMBINER
203a	A	TUBE	1261	CONTAINMENT PRESSURE TRANSMITTER
203b	A	TUBE	1863	POST ACCIDENT AIR SAMPLE
203c	A	TUBE	1863	POST ACCIDENT AIR SAMPLE
204	A	36"	1865	PURGE SUPPLY
205	L	3/8"	1278-1	RELIEF NEEDED ←

PENETRATION	CONTENTS OF PIPE AFTER ACCIDENT	SIZE	P&ID DWG.:33013-	COMMENTS
206a	L	3/8"	1278-1	RELIEF NEEDED ←
206b	L	3/4"	1277-1	NO ENTRAPMENT; OPEN TO STEAM GENERATOR
207a	L	3/8"	1278-1	RELIEF NEEDED ←
207b	L	3/8"	1277-1	NO ENTRAPMENT; OPEN TO STEAM GENERATOR
209a	L	<2.5"	1250-3	NO ENTRAPMENT; V4658 RELIEF
209b	L	<2.5"	1250-3	NO ENTRAPMENT; V4759 RELIEF
210	A	1"	1275-2	OXYGEN MAKEUP
300	A	36"	1866	PURGE EXHAUST
301	SEALED	3/4"	1915	SEALED, WELDED SHUT
303	SEALED	3/4"	1915	SEALED, WELDED SHUT
304a	A	2"	1275-2	HYDROGEN CONTENTS.
304b	A	3/4"	1275-2	HYDROGEN CONTENTS
305a	A	TUBE	1863	CONTAINMENT AIR SAMPLE
305b	A	TUBE	1866	CONTAINMENT AIR SAMPLE
305c	A	TUBE	1863	CONTAINMENT AIR SAMPLE
305d	A	TUBE	1863	CONTAINMENT AIR SAMPLE
305e	A	1"	1866	CONTAINMENT AIR SAMPLE
307	L	4"	1991	RELIEF NEEDED ←
308	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOWVALVE
309	A	6"	1865	MINI-PURGE SUPPLY
310a	A	2"	1887	INSTRUMENT AIR
310b	A	2"	1886-2	SERVICE AIR SUPPLY
311	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
312	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
313	A	6"	1882	LEAKAGE TEST PRESSURIZATION
315	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
316	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
317	A	6"	1882	LEAKAGE TEST SUPPLY
318	EMPTY	N/A		WELDED SHUT
319	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
320	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
321	L	3"	1277-1	NO ENTRAPMENT; OPEN TO A STEAM GENERATOR
322	L	2"	1277-1	NO ENTRAPMENT; OPEN TO B STEAM GENERATOR
323	L	6"	1250-3	NO ENTRAPMENT; OPEN FOR SW FLOW
324	L	3"	1908-3	RELIEF NEEDED ←
332a	H2	TUBE	1278-1	CONTAINMENT HYDROGEN MONITOR
332b	H2	TUBE	1278-1	CONTAINMENT HYDROGEN MONITOR
332c	A	TUBE	1261	CONTAINMENT AIR
332d	H2	TUBE	1278-1	CONTAINMENT HYDROGEN MONITOR
401	STEAM	30"	1231	NO ENTRAPMENT; MAIN STEAM
402	STEAM	30"	1231	NO ENTRAPMENT; MAIN STEAM
403	L	14"	1236-2	NO ENTRAPMENT; OPEN TO A STEAM GENERATOR
404	L	14"	1236-2	NO ENTRAPMENT; OPEN TO B STEAM GENERATOR
1000	A	8'	1884-1	PERSONNEL HATCH
2000	A	8'	1884-2	EQUIPMENT HATCH

9702070236-01

RESPONSE TO GENERIC LETTER 96-06

"Assurance Of Equipment Operability And Containment Integrity During Design-Basis Accident Conditions"

For

R. E. Ginna Nuclear Power Plant
Rochester Gas & Electric Corporation
Rochester, New York 14649

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RESPONSE TO GL 96-06
R. E. Ginna Nuclear Power Plant
Rochester Gas & Electric Corporation

1.0 Introduction

Through Generic Letter 96-06 (Ref. 3.1), the U.S. Nuclear Regulatory Commission (NRC) notified holders of operating licenses of nuclear power reactors of three issues of concern:

(1) Cooling water systems serving containment air coolers maybe exposed to the hydrodynamic effects of water hammer during a loss-of-coolant accident (LOCA) or a main steamline break (MSB). These cooling water systems may not have been designed to withstand hydrodynamic effects of water hammer and corrective actions maybe needed to satisfy system design and operability requirements.

(2) Cooling water systems serving the containment air coolers may experience two-phase flow conditions during postulated LOCA and MSLB scenarios. The heat removal assumptions for design-basis accident scenarios were based on single-phase flow conditions. Corrective actions may be needed to satisfy design and operability requirements.

(3) Thermally induced overpressurization of isolated water-filled piping sections penetrating containment could jeopardize the ability of accident-mitigating systems to perform their safety functions and could also lead to a breach of containment integrity via bypass leakage. Corrective actions maybe needed to satisfy system operability requirements.

The generic letter also explained specific scenarios and events that have been reported and evaluated to have generic implications that formed the basis of the three issues of concern listed above.

RG&E immediately formed a team to review specific configurations, piping drawings, operability data, design basis commitments and documentation, component and system characteristics, P&ID's, and other relevant information for its Ginna Station as related to the three issues of concern. Reported here are the findings and actions taken by RG&E to assure operability of affected systems and components as requested by GL 96-06 (Ref. 3.1).

2.0 Evaluation Of GL 96-06 Issues For Ginna Station

2.1 Susceptibility Of Ginna Containment Recirculating Fan Coolers (CRFC's) Water System To Water Hammer During Postulated Accident Conditions

Ginna is currently using enhanced design CRFC's that provide cooling of the containment under both normal operating and design-basis accident conditions. One of the design enhancements for the new coolers is the replacement of the original copper tubes with AL-6XN stainless steel tubes that are stronger and more resistant to erosion/corrosion .

2.1.1 Description Of Ginna CRFC's

The original CRFC's were replaced by RG&E during the 1993 refueling outage (Ref. 3.2), due to problems such as performance limitations, degrading material condition, and poor accessibility for inspection, cleaning and repair. The replacement CRFC's enhanced the structural integrity and cooling capacity of the coils and also involved substantial modifications to the support structure. Description of these enhancements are documented in a design report (Ref. 3.3) from which the design parameters for the coils that are shown below were taken.

Tube Material	AL-6XN (21% Cr, 26% Ni Austenitic Stainless Steel)
No. of Tube Rows (Depth)............	12
No. of Tube Rows (Height)............	20
Tube Outside Diameter	0.625"
Tube Thickness	0.035"
Finned Length	120 "
Water Flow Circuit	Triple Serpentine

Fin Material	Copper
Fin Spacing	8/inch
Fin Thickness	0.010"
Headers	Stainless Steel Water Box Type

There are four CRFC units. System arrangement of these units are depicted in RG&E P&ID Drawing 33013-1250 (Ref. 3.4).

2.1.2 Description Of Ginna CRFC's Cooling Water System

Cooling water for the "A", "B", "C", and "D" CRFC's is supplied by the service water system which utilizes four (4) pumps (Ref. 3.4). Each CRFC is supplied through a separate penetration assembly with its own service water cooling circuit. The heated cooling water is then piped out of another containment penetration where it passes through a discharge orifice and joins the others in the Intermediate Building to a 14" header. This header eventually empties into the discharge tunnel (Ref. 3.5) which is open to the atmosphere.

The inlet and outlet cooling water piping of each CRFC are shown in Attachments 4.1 to 4.4. A typical arrangement of this piping with respect to the penetrations, supply and discharge headers is shown in Attachment 4.5.

It is noted that unlike some other plant designs, the Ginna inlet and outlet piping to each CRFC forms a U shape at the penetrations due to the elevational differences (see sketch in Attachments 4.1 to 4.4). Considering elevations of this piping with respect to the location of the CRFC's, these loops assure that cooling water fills the inlet and outlet piping inside containment when the service water pumps stop for any reason.

2.1.3 Evaluation Of CRFC's During LOCA With Concurrent Loss of Of Offsite Power (LOOP)

This section evaluates the thermal and dynamic events during a scenario that is postulated in GL 96-06 (Ref. 3.1) which challenges the structural integrity of the CRFC's. The assessment considers plant specific configuration of the service water cooling system and guidelines of the NRC publication, NUREG/CR-5220 (Ref. 3.6) and EPRI reports (References 3.7 and 3.8).

2.1.3.1 Description Of Event Scenario

It is assumed that the CRFC's are functioning normally in steady state condition concurrent with a design-basis accident condition (LOCA or MSLB) when a sudden loss of offsite power (LOOP) occurs.

With a LOOP, the service water pumps on the cooling water side and the fans on the air side of CRFC's will experience a power loss and start to coast down. Since the pumps have little inertia, they will stop in a few seconds. The CRFC fans on the other hand, will coast down for a period of approximately 30 seconds (Ref. 3.1) until the diesel emergency power restarts the service water pumps. During this period, the conditions exist inside the CRFC's that could contribute to boiling due to heating effects of the high temperature air/steam mixture in the air side.

Based on computational results of References 3.7 and 3.8, the water inside the coils will indeed boil and generate two-phase steam/water volume inside the tubes. However, with the U bend configuration of both inlet and outlet piping of the service water system, and utilizing guidelines in the NRC publication (Ref. 3.6), it is highly improbable that waterhammer can occur. This is discussed in Section 2.1.3.3. However, the tubes were evaluated assuming that waterhammer does occur (see next section).

2.1.3.2 Evaluation Of Structural Integrity Of CRFC Tubes Due To Waterhammer

In the unlikely event that steam formed inside the tubes suddenly mixes with cold water supplied by the pumps during restart of the service water system flow, a deterministic evaluation of the peak pressures and the resulting hoop stress at the tubes was made by RG&E (Reference 3.9). The analysis concluded that the condensation-induced water hammer will not adversely affect the structural integrity of the austenitic stainless steel CRFC tubes. It is noted that the CRFC's were changed during the 1993 refueling outage with enhanced structural and heat transfer design capabilities (Ref. 3.2). The CRFC gaskets, cover plates, pass ribs and spacers are held together by multiple bolts that can absorb a substantial amount of strain energy. Consequently, other sections of the CRFC's will also resist the effects of waterhammer peak pressures (Ref. 3.26).

2.1.3.3 Evaluation Of Waterhammer Potential Considering Effects Of Inlet And Outlet Piping

As shown in Attachments 1 to 5, inlet and outlet piping for each CRFC form a U bend configuration that assures an ample supply of service water between the CRFC tubes and the inlet/outlet headers during the LOOP event scenario. Reference 3.8 has documented the fact that "water on either side of the CRFC's is significantly heated during the boiling phase in the tubes." The mode of heat transfer is predominantly convection as steam inside the tubes diffuses through the inlet and outlet sections.

The U bend configuration on both sides of the CRFC assures that heated water acts as a "buffer" or transition region between the cold service water from the pumps and the steam voids at the tubes and vicinity. Consequently, the possibility of condensation-induced water hammer is dramatically reduced according to guidelines in Ref. 3.6,

since the cold incoming water cannot trap and condense the steam voids.

2.1.3.4 Summary - Waterhammer Evaluation

During LOOP coincident with design-basis accident conditions (LOCA or MSLB), waterhammer is not a concern for Ginna because of the following reasons:

(1) In the event that condensation-induced waterhammer does occur inside the CRFC tubes, the enhanced structural capability of the tubes (austenitic stainless steel) will be able to withstand the impact of the peak pressures such that the structural integrity of the CRFC will not be affected.

(2) Presence of U bend configuration in the inlet and outlet piping of each CRFC at the penetrations assures a heated "buffer" or transition region preventing cold service water from trapping steam voids that formed inside the tubes and its vicinity. Consequently, condensation-induced waterhammer is avoided.

2.2 Two-Phase Flow In Safety-Related Piping And Components

This section will evaluate Ginna safety-related components, (particularly the CRFC's) and whether these are susceptible to two-phase flow at steady state conditions when operating during design-basis accident conditions. For this particular issue, GL 96-06 concerns are listed below.

(1) Two-phase flow in cooling water systems associated with CRFC's significantly interfere with the ability of the coolers to remove heat under design-basis accident conditions, and can interfere with the cooling of other safety-related components.

(2) Cooling water systems were designed assuming single-phase flow conditions and containment heat transfer analyses are based on this assumption. Two-phase flow is a much more complex situation to deal with analytically than single-phase flow and involves additional hydrodynamic loading considerations as well as flow, heat transfer, systems interaction and erosion considerations.

(3) Additionally, the steam that is formed during two-phase flow can accumulate in the cooling water system, restricting flow and potentially resulting in waterhammer.

2.2.1 Design Of Enhanced CRFC's

As was mentioned earlier, the Ginna CRFC's were replaced during the 1993 refueling outage with the design of the replacement CRFC's substantially enhanced, to take care of several problems that were encountered during operation. Among these were some performance limitations (Ref. 3.3). Concerns for performance limitations when the CRFC's are operating during design-basis accident conditions have been investigated and documented in Reference 3.10, particularly

the following topics that are closely related to GL 96-06 concerns for two-phase flow.

(1) Determine if flashing, steam binding and water hammer can occur in the CRFC coils and SWS discharge piping.

(2) Address the concerns associated with flashing in the CRFC coils and/or SWS discharge piping.

Resolution of these issues, as depicted in Ref. 3.10, were based on conservative thermal performance data and assumptions, which are:

(1) No fouling in CRFC tubes.

(2) 162% design margin for heat removal capacity of coils.

(3) SWS inlet water temperature maximum design temperature of 80 F.

The enhanced CRFC design objectives were set such that operation will not result in boiling at the upper bound heat removal rates (Ref. 3.3). Test data for the newly installed CRFC's were then utilized to show margins for avoidance of flashing at the CRFC tubes (Ref. 3.10).

2.2.2 Evaluation Of CRFC's For Two-Phase Flow Formation

Based on comparison of test data and results of calculation for CRFC operating requirements, the following conclusions are documented in an RG&E Design Analysis (Ref. 3.10):

(1) Steam binding of the CRFC's will not occur. Voiding will not occur during two pump SWS operation.

(2) For a one pump SWS operation, no voiding will occur at CRFC "A", "B", and "D". CRFC "C" could flash by a very small amount, i.e., marginal and within instrument uncertainty, only during very conservative operating conditions (0% fouling, 162% design margin heat rate, & 80 F inlet SWS water temperature). It is anticipated that this marginal situation will not compromise flow or heat removal. Note that CRFC "C" has already been operating for approximately three years. Consequently, some degree of fouling (i.e., about 1/2% to 1%) is already present such that it will eliminate the marginal condition of voiding at the outlet of CRFC "C".

(3) If flashing does occur at CRFC "C" discharge, Reference 3.10 has evaluated that this will result in increase of inlet pressure through the lower coils resulting in an offset, i.e., prevention of the flashing event. Even at the reduced flow rate during equilibrium conditions the CRFC's can still meet the minimum heat removal rates assumed in the accident analyses (Ref. 3.11).

2.2.3 Evaluation Of Service Water System (SWS) Piping To Two-Phase Flow Formation

Evaluation of test data and CRFC design requirements for the conservative conditions that were previously identified has documented the following findings per Reference 3.10.

(1) For a two pump SWS mode of operation, flow and pressure conditions are high enough such that flashing will not occur in any CRFC discharge piping.

(2) During a one pump SWS mode of operation, voiding may occur in the piping downstream of the CRFC's. When this happens, the system will be self regulating. Flashing will reduce the flow through the affected CRFC due to increased frictional loss. Consequently, CRFC inlet and discharge pressure will increase supressing void formation. Reduced flow rate has been evaluated in Ref. 3.10 and

found that it can still meet the minimum heat removal rates assumed in the accident analysis.

(3) Calculations in Reference 3.3 showed that containment temperature will decrease from 286 F to 250 F after the first 2.8 hours into the design basis accident. The exit temperature from the CRFC's for the limiting heat removal condition will decrease to less than 212 F when the containment temperature becomes 250 F. Consequently, two-phase flow will not be a concern after the first 2.8 hours into the design basis accident.

2.2.4 Evaluation Of Waterhammer in SWS Discharge Piping System

The possibility that two-phase flow can occur in the SWS discharge piping downstream of the CRFC's also creates a potential for waterhammer occurence for certain conditions of operation, i.e., one pump SWS mode of operation. This concern has also been evaluated in Reference 3.10. Results are summarized below.

(1) Flashing will most likely occur downstream of the flow orifices for the CRFC's (Ref. 3.5) due to higher elevation and lower system pressures at this location.

(2) Waterhammer can only occur when the two-phase fluid gets trapped by a cooler subcooled fluid (Ref. 3.6). This can potentially happen only at the 14" header where individual 8" CRFC discharge lines join the common line.

(3) Cooler subcooled fluids can come from an inactive coolers, i.e., coolers with the fans off, which may happen during certain accident scenarios. Hence, possibility of waterhammer is greatest during this scenario due to limited heat removal, i.e., less service water heatup, by the inactive coolers.

(4) Evaluation of these inactive coolers reveal that with the fan off, they will still remove heat during design-basis accident conditions, where the dominant mode is "condensation heat transfer". This mode is less reliant on forced air flow for heat removal from the air/steam mixture. Since steam binding at the coils will not occur, the SW exit temperature from these "inoperative coolers" will be greater than 80 F , thereby reducing the difference in exit temperatures among the CRFC's. Potential for waterhammer in this condition consequently becomes negligible.

(5) Since the flow orifices are located in the Intermediate Building, piping inside the Containment Building is not susceptible to water hammer for any mode of SWS operation.

2.2.5 Summary - Two Phase Flow Formation in Safety-Related Piping and Components

Evaluation of the susceptibility of the CRFC cooling water system to two-phase flow formation during design-basis accident conditions has revealed the following results:

(1)· For two pump SWS mode of operation, two-phase flow formation will not occur anywhere in the CRFC cooling water piping and tubes.

(2) For one pump SWS mode of operation, CRFC "C" has a marginal and a very low probability tendency to develop voiding at the cooler discharge based on very conservative conditions of operation, i.e., 0% fouling, maximum heat transfer loads, and 80 F cooling water inlet temperature. However, if this were to occur, flow readjustment is expected to increase back pressure at the CRFC's to protect the tubes from steam binding. The reduced flow rate has been found to still remove design-basis accident heat loads required by the Ginna

UFSAR (Ref. 3.10).

(3) For one pump SWS mode of operation, SWS piping downstream of the discharge orifice has a possibility to flash into steam. Due to increased friction, flow will consequently decrease. Analysis of this condition shows that required heat removal rates are still met. The reduced flow results in an increase of back pressure at the coils which assures that two-phase flow does not develop at the coils or tubes (Ref. 3.10).

(4) There is a slight possibility that waterhammer can occur at the 14" discharge header during a scenario where one or more CRFC's is out of operation (i.e., fan is off). However, the condensation mode of heat exchange at the tubes will still transfer heat to the SWS cooling liquid thereby raising its exit temperature as it arrives at the discharge header. This condition will not only mitigate the effects of water-hammer, but also decreases substantially its probability of occurence.

(5) Waterhammer will not occur in the SWS piping inside the Containment Building.

2.3 Overpressurization Of Isolated Piping

The third issue of concern in GL 96-06 arose out of several reported experiences by utilities and the fundamental concept that heated water while it is trapped is capable of producing extremely high pressure due to its thermal expansion (Ref. 3.1). The high pressure has a potential to fail the pipe and if the pipe is part of accident-mitigating systems, then the safety function of the system is jeopardized. The potential for thermally induced overpressurization is greatest during design-basis accident conditions inside containment since the inside temperature can rise up to 286 F for Ginna over a 10 second period.

Of particular interest and concern for this issue are safety-related systems inside containment such as containment spray, and piping that penetrate the containment. An RG&E team reviewed safety and nonsafety related piping systems inside containment that maybe exposed to this particular sequence of events, including all penetration assemblies (Ref. 3.12). The interest in nonsafety related systems is solely dictated by interaction potential with safety related ones. Results of the evaluation are documented in this section.

2.3.1 Piping Systems Inside Containment Susceptible To Thermal Overpressurization

P&ID's for systems inside containment were reviewed, particularly those that are required to operate during design-basis accident conditions. The review was extended to nonsafety related systems that may attached to safety related systems. Rupture of these systems may divert flow, thereby affecting the effectiveness of accident-mitigating systems. One system has been found at Ginna that meets this scenario.

2.3.1.1 Containment Spray (CS) Charcoal Filter Dousing Line

Review of P&ID Drawing 33013-1261 (Ref. 3.13) revealed that during the injection phase of the Containment Spray Piping System of a design-basis accident condition, cold water can get trapped in the CS Charcoal Filter Dousing Line. Subsequent thermal heatup to a maximum containment temperature of 286 F (Ref. 3.14) can generate high pressures that may potentially rupture the piping (Ref. 3.15) and subsequently divert some of the CS flow, reducing the amount of CS water delivered in the CS ring headers. It is noted that CS system has the primary function of reducing containment pressure during design-basis accident conditions using cold water sprays to condense the steam inside containment. An Action Report (Ref. 3.18) was written to formally track and assess the problem.

A. Operability Of Affected System

Upon preliminary identification of the potential problem, the CS Charcoal Filter Dousing Line was immediately isolated and vented to assure the operability of the CS Piping System, by eliminating the possibility of thermal overpressurization and potential rupture of the charcoal dousing line (Ref. 3.16). Isolation and venting of the Dousing Line was made at about 0017 EST on Dec. 21, 1996. At this time, preliminary evaluations revealed that overpressurization would not results in rupture of the piping. When formal calculations were completed on Dec. 23, 1996 and found that there would be potential rupture of this line, the NRC Operation Center was notified (Ref. 3.16).

B. Actions To Prevent Recurrence

On January 3, 1997 the CS Charcoal Dousing Line was modified by installation of a relief valve (Ref 3.17) and the line was returned to its normal alignment. An LER was written (Ref. 3.16) and submitted to the NRC on January 22, 1997.

Training on the thermal overpressurization issue will be initiated to make sure that this condition will be evaluated when doing modifications, testing, maintenance, and operation lineups at Ginna.

2.3.2 Containment Penetrations Susceptible To Thermal Overpressurization

The RG&E team has evaluated all penetration assemblies (Ref. 3.12) considering the possibility that cold water can get trapped during testing, normal operation, or maintenance and subsequently heated during design-basis accident conditions or even during seasonal change and exposed to thermal overpressurization of the assemblies. For completeness, P&ID's that depict the penetrations and piping systems inside containment were also reviewed. Summary of the evaluation is shown in Attachment 4.6, which depicts six (6) penetrations that needed further investigations. These evaluations are reported below.

2.3.2.1 Penetration 121a - Pressurizer Relief Tank Makeup Water

Review of the P&ID drawing (Ref. 3.19) and Figure 6.2-29 of Reference 3.12 revealed that makeup water, which is at relatively cold temperature may be trapped between Valves 548 and 508. A section of trapped fluid can get heated during design-basis accident conditions thereby subjecting piping and valves in the penetration assembly to thermal overpressurization that may lead to potential rupture of the pipe or damaging the inside CIV (Ref. 3.20).

A, Operability Of Affected Penetration Assembly

A more detailed evaluation of the Valve 548 internals showed that before the pipe ruptures, the thermally generated fluid pressure can

overcome the opening force required to lift the plug. This assures that thermal overpressurization will not degrade the mitigating capability of the penetration assembly because of the relief action of Valve 548.

B. Action Planned For Permanent Protection Of Penetration Assembly

A Plant Change Request (PCR) is currently being planned to install a relief valve on the PRT Makeup System to permanently protect the penetration assembly from thermal overpressurization.

2.3.2.2 Penetration 205 - Reactor Coolant System (RCS) Loop B Hot Leg Sample

Review of P&ID (Ref. 3.21) and Figure 6.2-52 of Reference 3.12 showed that hot leg sample can get trapped in the penetration assembly. An engineering analysis (Ref. 3.20) found that assuming Valve 955 (Ref. 3.21) does not leak, the trapped fluid will be at a higher temperature than the maximum containment temperature of 286 F. Consequently, fluid contraction from RCS temperature to containment ambient temperature will be greater than fluid expansion from ambient to 286 F so that no thermal overpressurization results.

However, the RG&E team raised the issue of a postulated small leak at Valve 955 which can fill up the line and may subject the assembly to thermal overpressurization. Consequently, precautions are taken to check for valve leakage.

A. Operability of Affected Penetration Assembly

An operational check found that a leak exists at Valve 955 which has been quantified to be 300 ml/min (Ref. 3.24). It has been

ascertained that if heatup occurs in 10 seconds from ambient to 286 F, a relief rate of 215 ml/min will avoid thermal overpressurization in the penetration assembly. Since the measured value of 300 ml/min is greater than the minimum required, the line will not overpressurize (Ref. 3.25).

B. Action Planned For Permanent Protection Of Penetration Assembly

A PCR is currently being prepared to install a relief valve on the Hot Leg Sample System. Installation is planned during the next refueling outage since the PCR will involve welding inside containment for supporting the relief valve.

2.3.2.3 Penetration 206a - Pressurizer Liquid Sample

Review of P&ID (Ref. 3.21) and Figure 6.2-53 of Reference 3.20 revealed that pressurizer liquid sample can get trapped in the penetration assembly. Reference 3.20 showed that assuming Valve 953 does not leak, the high temperature fluid (higher than 286 F) will contract when cooled to ambient temperature and when it gets reheated to 286 F will not fill the line completely, thereby avoiding thermal overpressurization.

However, with a postulated small leak at Valve 953, the assembly can subsequently get filled with fluid at ambient temperature which may overpressurize the assembly during design-basis accident conditions.

A. Operability of Affected Penetration Assembly

An operational check found that a leak exists at Valve 953 which has been quantified to be 1500 ml/min (Ref. 3.24). It has been

ascertained that if heatup occurs in 10 seconds from ambient to 286 F, a relief rate of 215 ml/min will avoid thermal overpressurization in the penetration assembly. Since the measured value of 1500 ml/min is greater than the minimum required, the line will not overpressurize (Ref. 3.25).

B. Action Planned For Permanent Protection Of Penetration Assembly

A PCR is being prepared to install a relief valve on the Pressurizer Liquid Sample System. Installation is planned during the next refueling outage since the PCR will involve welding inside containment for seismic support of the relief valve.

2.3.2.4 Penetration 207a - Pressurizer Steam Sample

Review of P&ID (Ref. 3.21) and Figure 6.2-55 of Reference 3.12 revealed that steam can get trapped between Valves 951 and 966A. If Valve 951 does not leak, there is no concern because the assembly will not become water solid since the fluid trapped is steam. However, if Valve 951 is leaking, the assembly can become full of ambient temperature liquid which may cause thermal overpressurization if the leak is small enough that it cannot relieve the pressure buildup.

A. Operability Of Affected Penetration Assembly

An operational check found that indeed valve 951 does not leak (Ref. 3.24), thereby confirming the original finding that the line will not overpressurize.

B. Action Planned For Permanent Protection Of Penetration Assembly

A PCR is being written to install a relief valve on the Pressurizer

Steam Sample System. Installation is planned during the next refueling outage since the PCR will involve welding inside containment for seismic supports of the relief valve. In the interim, the valve will be monitored to ensure that it remains leakproof.

2.3.2.5 Penetration 307 - Fire Service Water

Review of P&ID (Ref. 3.22) and Figure 6.2-64 of Reference 3.12 revealed that cold water can get trapped in the fire service water system and jeopardize the penetration assembly during design-basis accident conditions due to thermal overpressurization. Reference 3.20 showed that both the assembly and the process line may potenially rupture due to high fluid pressure.

A. Operability Of Affected Penetration Assembly

To assure operability of the Penetration 307, a temporary precaution was implemented to either drain the water out of the assembly or open a vent valve inside containment (i.e., Valve 9255). Either of these actions will not affect system performance when needed.

B. Action Planned For Permanent Protection Of Penetration Assembly

A PCR is being prepared to install a relief valve inside containment to relieve fluid pressure during design-basis accident conditions. Installation can be done during Ginna normal operation mode.

2.3.2.6 Penetration 324 - Demineralized Water

Review of P&ID (Ref. 3.23) and Figure 6.2-73 of Ref. 3.12 showed that cold water may get trapped between Valves 8422 and CIV

8418. Design Analysis (Ref. 3.20) showed that the demineralized water line will rupture at a lower pressure than the penetration assembly thereby eliminating the concern of thermal overpressurization for the assembly.

A. Operability Of Affected Penetration Assembly

The demineralized water pipe is made of seamless drawn copper, while the penetration assembly is carbon steel. As mentioned above, concern for thermal overpressurization of the penetration assembly is eliminated, assuring operability of the component.

B. Action Planned For Permanent Protection Of Penetration Assembly

A PCR is being prepared to install a relief valve in the system to relieve potential thermal overpressurization in both demineralized water line and the penetration assembly. Installation can be done during Ginna normal operation mode.

2.3.2.7 Summary - Overpressurization Of Isolated Piping

Review of P&ID's of all safety related systems inside containment that are needed to mitigate design-basis accident conditions showed several ones that may be subject to thermal overpressurization. Review included all containment penetrations and non-safety related systems that could interact with the safety related ones. These findings are summarized below.

System Affected	Corrective Action		Status
	Temporary	Permanent	
Containment Spray Filter Dousing Line	Isolate & Vent	Install Relief Valve	Relief Valve installed 1/3/97
Penetration 121a-Press. Relief Tank Makeup Water	Valve 548 Relief	Install Relief Valve	PCR is being prepared
Penetration 205-RCS Loop B Hot Leg Sample	Valve 955 Leakage	Install Relief Valve	RV to be installed next refueling outage
Penetration 206a-Press Liquid Sample	Valve 953 Leakage	Install Relief Valve	RV to be installed next refueling outage
Penetration 207a-Press	Not required	Install Relief Valve	RV to be installed next refueling outage
Penetration 307-Fire Service Water	Drain or open vent	Install Relief Valve	RV to be installed prior to outage
Penetration 324-Demineralized Water	Not required	Install Relief Valve	RV to be installed prior to outage

3.0 List Of References

3.1 Generic Letter 96-06, "Assurance Of Equipment Operability And Containment Integrity During Design-Basis Accident Conditions", received by RG&E on October 2, 1996.

3.2 EWR 5275, "Containment Fan Cooler Coil Replacement", 1991
- RG&E Dwg. No. 21489-0657, "Containment Recirc. Fan Cooler "A" Enclosure-EWR 5275, Rev. 3, 1/21/94
- RG&E Dwg. No. 21489-0658, 0659, & 0660, "Containment Recirc. Fan Cooler "B", "C", "D" Enclosure-EWR 5275, Rev. 1, 1/21/94

3.3 Dominion Engineering, Inc. (DEI) Design Report, DEI 356, Rev. 1, "EWR 5275 Containment Recirculating Fan Cooler Replacement".

3.4 RG&E P&ID Drawing 33013-1250, Shts 1,2 & 3, "Station Service Cooling Water (Safety Related)", Rev. 14, 7/19/96.

3.5 GAI Drawings C-381-358 Shts. 9 (Rev.1), 13 (Rev.3), 18 (Rev. 1), 19 (Rev. 2), 20 (Rev.1), 21 (Rev. 2), 22 (Rev. 2), 23 (Rev. 1), 24 (Rev. 1), 25 (Rev. 1).

3.6 NUREG/CR 5220, "Diagnosis Of Condensation-Induced Water-hammer", Vol. 1 & 2, dated October 1988.

3.7 EPRI Interim Report, "Containment Air Cooler Heat Transfer During Loss Of Coolant Accident With Loss Of Offsite Power Conditions", Nov. 1996, Prepared By Numerical Applications, Inc.

3.8 EPRI Draft Report, "GOTHIC Analysis Of A Containment Fan Cooler Unit And Piping Under LOCA And Loss Of Offsite Power

Conditions", May 1996, Prepared By Numerical Applications, Inc.

3.9 RG&E Design Analysis, DA-ME-96-073, "Containment Recirc Fan Cooler Water Hammer Evaluation", 8/14/96

3.10 RG&E Design Analysis, DA-ME-94-012, "Boiling In The SWS Discharge Piping Of The CRFC's", Rev. 0, January 22, 1994.

3.11 Sections 6.1, 6.2.2 And 9.4, R. E. Ginna Nuclear Power Plant UFSAR, Rev. 10

3.12 Ginna UFSAR, Sections 6.2.4, 6.6 Including Figures 6.2-13 to 6.2-78 Inclusive. Also Table 6.2-15.

3.13 RG&E P&ID Drawing No. 33013-1261, "Containment Spray", Rev. 25.

3.14 Ginna UFSAR, Figures 6.1-1 & 6.2-2

3.15 RG&E Design Analysis, DA-ME-96-117, "Thermal Pressurization Of Containment Charcoal Filter Dousing Header", Dec. 20, 1996.

3.16 RG&E LER 96-015, January 22, 1997.

3.17 RG&E PCR 96-128 & Safety Evaluation, SEV 1088, 12/29/96.

3.18 RG&E Action Report 96-1250

3.19 RG&E P&ID Drawing 33013-1258, Reactor Coolant Pressurizer", Rev. 17.

3.20 RG&E Design Analysis, DA-ME-96-119, "Thermal Pressurization Of Containment Penetrations 121a, 205, 206a, 207a, 307 & 324", 12/21/96.

3.21 RG&E P&ID Drawing 33013-1278, Sht. 1, Rev.13.

3.22 RG&E P&ID Drawing 33013-1991, Rev. 11.

3.23 RG&E P&ID Drawing 33013-1908, Sht. 3, Rev. 8.

3.24 Data From Gregg Joss (Performance Monitoring Section), January 22, 1997.

3.25 NRC Meeting Minutes, "Meeting With NEI and Licensees to Discuss GL 96-06", November 22, 1996.

3.26 Marlo Coil Drawing No. 17917C050, "Coil Assembly Details", Rev. D, 2/18/93.

4.0 LIST OF ATTACHMENTS

4.1 Service Water Inlet And Outlet Piping For CRFC "A" (Schematic)

4.2 Service Water Inlet And Outlet Piping For CRFC "B" (Schematic)

4.3 Service Water Inlet And Outlet Piping For CRFC "C" (Schematic)

4.4 Service Water Inlet And Outlet Piping For CRFC "D" (Schematic)

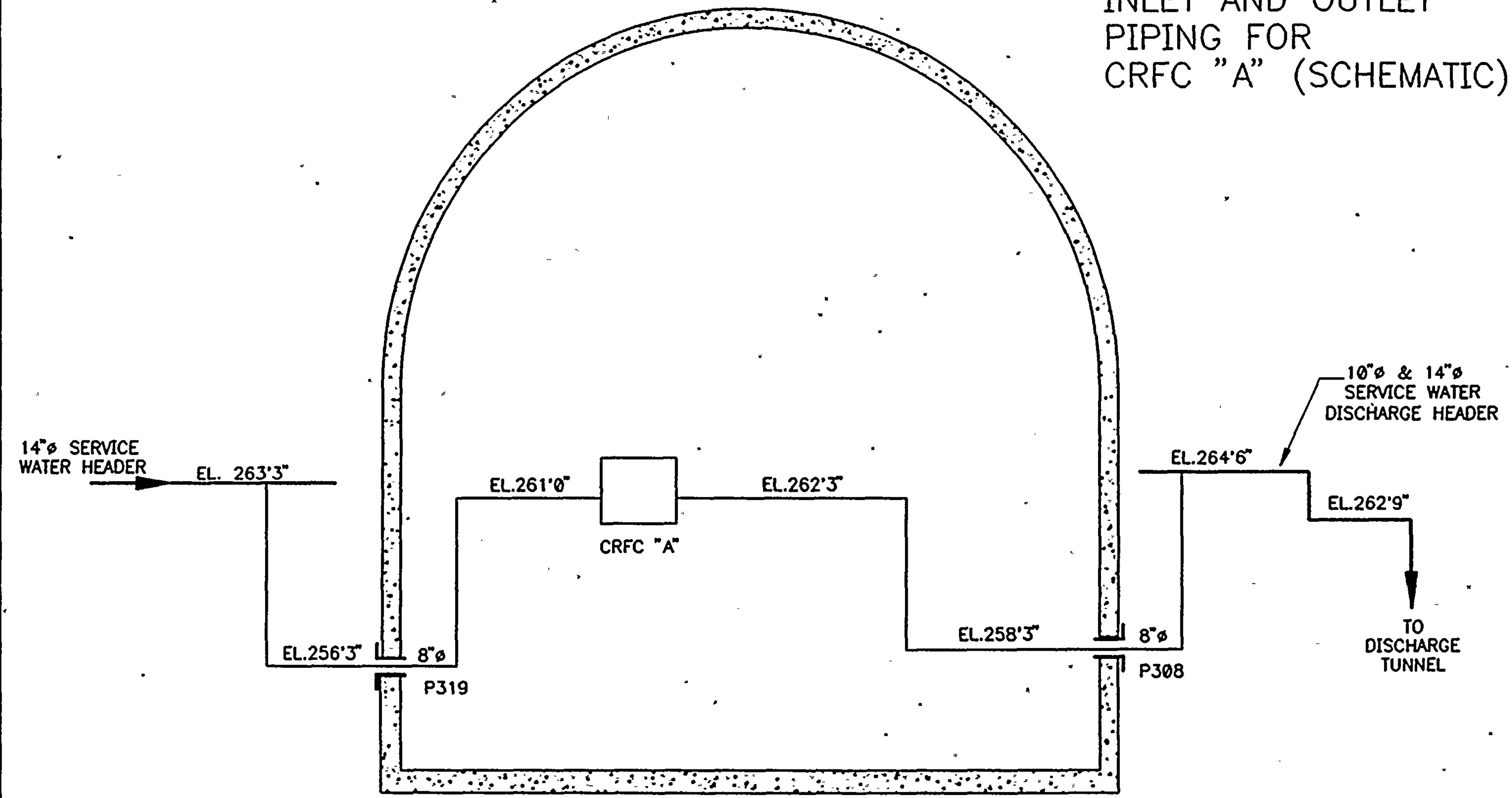
4.5 Schematic Showing Service Water Inlet And Outlet Piping For A Typical Containment Recirculation Fan Unit.

4.6 GL 96-06 Evaluation Of Penetration Piping Systems For Thermally Induced Overpressurization.

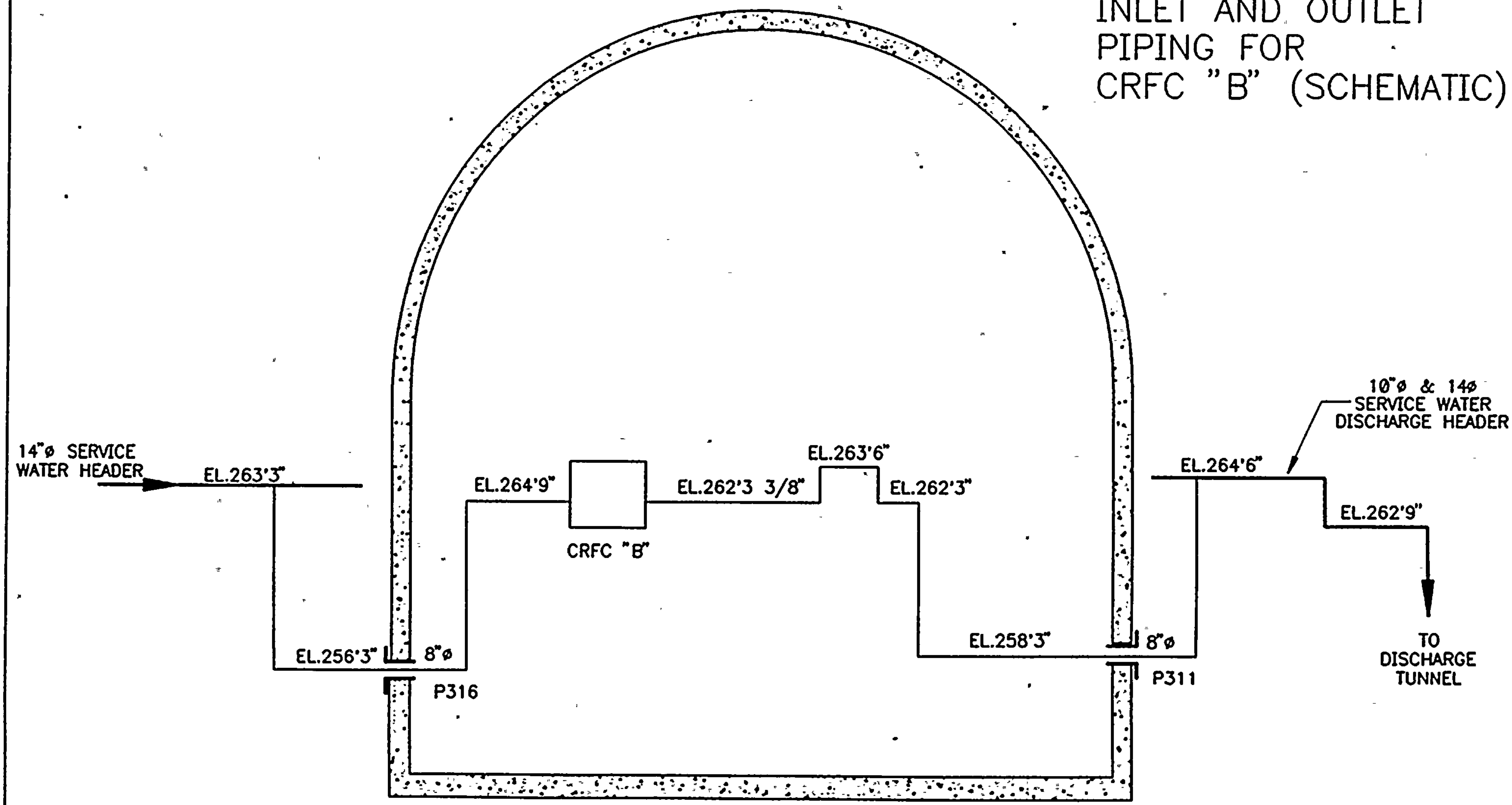
RESPONSE TO GENERIC LETTER 96-06

ATTACHMENTS

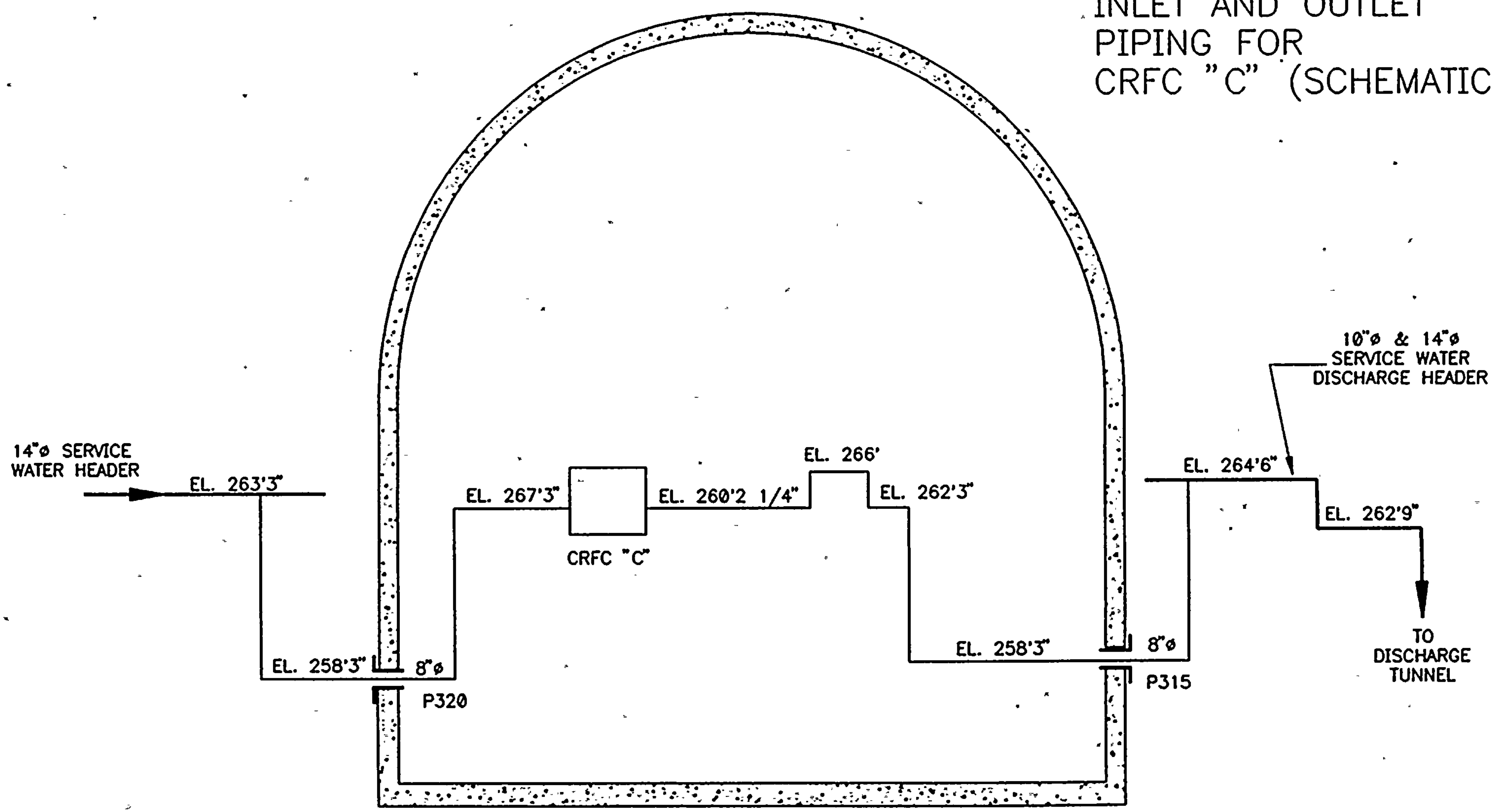
ATTACHMENT 4.1
SERVICE WATER INLET AND OUTLET PIPING FOR CRFC "A" (SCHEMATIC)



ATTACHMENT 4.2
SERVICE WATER
INLET AND OUTLET
PIPING FOR
CRFC "B" (SCHEMATIC)



ATTACHMENT 4.3
SERVICE WATER
INLET AND OUTLET
PIPING FOR
CRFC "C" (SCHEMATIC)



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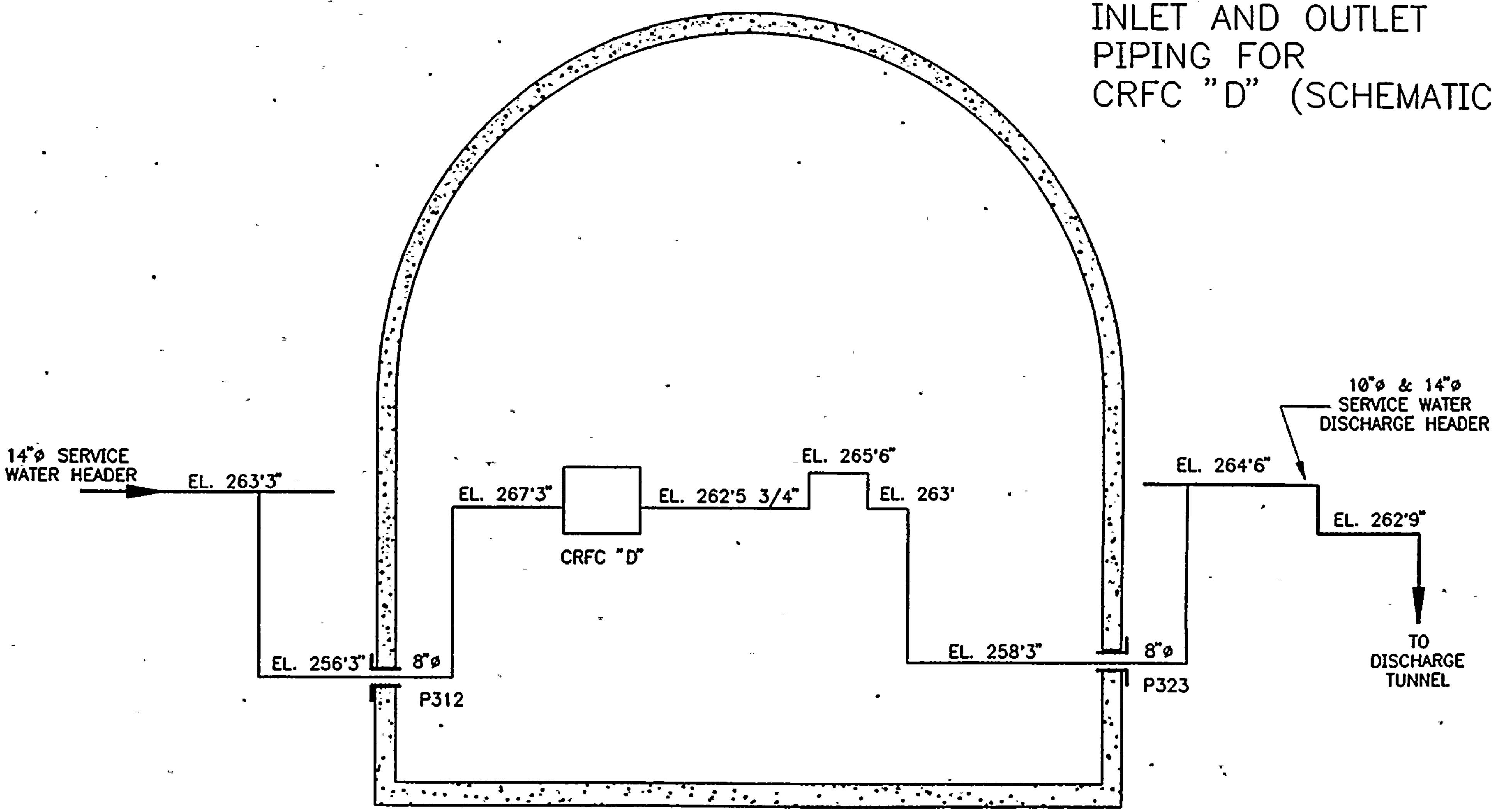
ATTACHMENT 4.4
SERVICE WATER
INLET AND OUTLET
PIPING FOR
CRFC "D" (SCHEMATIC)



ATTACHMENT 4.5

SCHEMATIC SHOWING SERVICE WATER INLET AND OUTLET PIPING FOR A TYPICAL CONTAINMENT RECIRCULATION FAN UNIT