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Your ref: Project Number 740
Our ref: DCP/NRC2014

October 4, 2007

Subject: AP1000 COL Standard Technical Report Submittal of APP-GW-GLN-019, Revision 2 (TR 103)

In support of Combined License application pre-application activities, Westinghouse is submitting Revision 2 of AP1000 Standard Combined License Technical Report Number 103. This report identifies and justifies standard changes to the AP1000 Design Control Document (DCD). The changes to the DCD identified in Technical Report 103 are included in the proposed amendment to the AP1000 Design Certification Rule (DCD Revision 16). The purpose of this Revision to TR103 is to provide additional technical and regulatory justification for the changes proposed within as discussed and agreed upon in a teleconference between Andrea Sterdis and Chris Jackson on August 3, 2007 and a teleconference between Andrea Sterdis and John Segala on September 13, 2007. This report is submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in this report is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

The purpose for submittal of this report was explained in a March 8, 2006 letter from NuStart to the NRC.

Pursuant to 10 CFR 50.30(b), APP-GW-GLN-019, Revision 2, "Fluid System Changes," (Technical Report Number 103), is submitted as Enclosure 1 under the attached Oath of Affirmation. Revision 0 of this report was submitted on July 5, 2007 under Westinghouse letter DCP/NRC1944. Revision 1 of this report was submitted on July 27, 2007 under Westinghouse letter DCP/NRC1965.

It is expected that when the NRC review of Technical Report Number 103 is complete, the changes to the DCD identified in Technical Report 103 will be considered approved generically for COL applicants referencing the AP1000 Design Certification.

Questions or requests for additional information related to content and preparation of this report should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Westinghouse requests the NRC to provide a schedule for review of the technical report within two weeks of its submittal.

D063
D079

Very truly yours,

A. Sterdis, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Attachment

1. "Oath of Affirmation," dated October 4, 2007

/Enclosure

1. APP-GW-GLN-103, Revision 2, "Fluid System Changes," Technical Report Number 103

cc:	D. Jaffe	-	U.S. NRC	1E	1A
	E. McKenna	-	U.S. NRC	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Hastings	-	Duke Power	1E	1A
	C. Ionescu	-	Progress Energy	1E	1A
	A. Monroe	-	SCANA	1E	1A
	M. Moran	-	Florida Power & Light	1E	1A
	C. Pierce	-	Southern Company	1E	1A
	E. Schmiech	-	Westinghouse	1E	1A
	G. Zinke	-	NuStart/Entergy	1E	1A
	C. Steuck	-	Westinghouse	1E	1A

ATTACHMENT 1

"Oath of Affirmation"

ATTACHMENT 1

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:)

NuStart Bellefonte COL Project)

NRC Project Number 740)

APPLICATION FOR REVIEW OF
"AP1000 GENERAL COMBINED LICENSE INFORMATION"
FOR COL APPLICATION PRE-APPLICATION REVIEW

B. W. Bevilacqua, being duly sworn, states that he is Vice President, New Plants Engineering, for Westinghouse Electric Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this document; that all statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.

Bruce W. Bevilacqua

B. W. Bevilacqua
Vice President
New Plants Engineering

Subscribed and sworn to
before me this 4th day
of October 2007.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Patricia S. Aston, Notary Public
Murrysville Boro, Westmoreland County
My Commission Expires July 11, 2011
Member, Pennsylvania Association of Notaries

Patricia S. Aston
Notary

ENCLOSURE 1

APP-GW-GLN-103, Revision 2

"Fluid System Changes"

Technical Report Number 103

AP1000 DOCUMENT COVER SHEET

TDC: Permanent File: APY:

RFS#: RFS ITEM #:

AP1000 DOCUMENT NO.	REVISION NO.		ASSIGNED TO
APP-GW-GLN-019	2	Page 1 of 154	W-C.A. McGinnis

ALTERNATE DOCUMENT NUMBER: TR 103 WORK BREAKDOWN #:

ORIGINATING ORGANIZATION: Westinghouse Electric Company

TITLE: Fluid System Changes

ATTACHMENTS: N/A CALCULATION/ANALYSIS REFERENCE: N/A	DCP #/REV. INCORPORATED IN THIS DOCUMENT REVISION: APP-GW-GEE-043 R0, 044 R2, 053 R1, 054 R0, 065 R1, 068 R3, 076 R1, 078 R2, 093 R0, 098 R0, 122 R1, 124 R1, 126 R1, 145 R0, 151 R0, 157 R2, 165 R1, 172 R1, 189 R0, 191 R1, 193 R0, 196 R0, 199 R0, 209 R0, 212 R1, 214 R1, 218 R2, 231 R0, 242 R0, 247 R1 GW-GEE-228 R0, 315 R0,

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
APP-GW-GLN-019 R2	Word	

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Class 3 Documents being transmitted to the NRC require the following two review signatures in lieu of a Form 36.

LEGAL REVIEW T.J. WHITE	SIGNATURE/DATE T.J. White 9-28-07
PATENT REVIEW D. E. EKKROTH	SIGNATURE/DATE [signature] 9/28/07

☐ WESTINGHOUSE PROPRIETARY CLASS 2

ORIGINATOR	SIGNATURE/DATE	
N.M. Horne	Natalie M Horne 9/27/07	
C.M. Steuck	[signature] 9/27/07	
REVIEWERS	SIGNATURE/DATE	
VERIFIER	SIGNATURE/DATE	VERIFICATION METHOD
P.L. Greco	[signature] 9/27/07	Detailed Review
AP1000 RESPONSIBLE MANAGER	SIGNATURE	APPROVAL DATE
~~C.A. McGinnis~~ Mike Corletti	[signature] 10/2/07	

* Approval of the responsible manager signifies that document is complete, all required reviews are complete, electronic file is attached and document is released for use.

APP-GW-GLN-019
Revision 2

September 2007

AP1000 Standard Combined License Technical Report

Fluid System Changes

Westinghouse Electric Company LLC
P.O. Box 355
Pittsburgh, PA 15230-0355

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

Brief Description of the change (what is being changed and why):

The changes within this Technical Report are a compilation of approved design changes to AP1000 Fluid Systems that have not previously been submitted under individual header. This document is sectioned to identify Fluid System changes that have been approved by the Westinghouse Change Control Board, that have not been submitted in previous Technical Reports, and that have had a direct impact on the Design Control Document (DCD). These are predominantly minor changes in system designs that are due to the progression of the detailed design. Each change will be individually identified within this document. The description of these changes can be found within Section II of this document. Additionally, not all of the changes described within this document have been incorporated into Rev. 16 of the AP1000 Design Control Document. The changes to R16 are detailed on pages 144 to 149.

Section II below itemizes each Fluid System Design Change and provides a textural description of the changes. Section III identifies the DCD section(s) affected along with the section markup.

I. APPLICABILITY DETERMINATION

This evaluation is prepared to document that the change described above is a departure from Tier 2 information of the AP1000 Design Control Document (DCD) that may be included in plant specific FSARs without prior NRC approval.

A.	Does the proposed change include a change to:		
	1. Tier 1 of the AP1000 Design Control Document APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare a report for NRC review of the changes)
	2. Tier 2* of the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare a report for NRC review of the changes)
	3. Technical Specification in Chapter 16 of the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare a report for NRC review of the changes)
B.	Does the proposed change involve:		
	1. Closure of a Combined License Information Item identified in the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare a COL item closure report for NRC review.)
	2. Completion of an ITAAC item identified in Tier 1 of the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare an ITAAC completion report for NRC review.)

☒ The questions above are answered no, therefore the departure from the DCD in a COL application does not require prior NRC review unless review is required by the criteria of 10 CFR Part 52 Appendix D Section VIII B.5.b. or B.5c

II. TECHNICAL DESCRIPTION AND JUSTIFICATION

A. The following design changes have been incorporated to reflect design evolution, identifying adjustments required to maintain the existing design as more detailed information has become available. These design changes also reconcile discrepencies identified in the Design Control Document. These discrepencies are being resolved to create consistency throughout the document and create a consistent description of the AP1000 Standard Plant. These changes do not result in a change of the design; the purpose of these changes is to accurately represent the design.

1. RNS: Normal Residual Heat Removal System Figure Changes

An auto close, on high temperature, has been added to valve V029 in order to prevent high temperature fluid from passing through the demineralizers. Valve V029 is located downstream of the RNS heat exchangers (HX) in the connecting line between the CVS and RNS. This connection allows for shutdown purification. The resin in the CVS demineralizers can potentially be damaged if the temperature through the demineralizers exceeds 140°F for extended periods of time.

Flow through the RNS heat exchangers is now controlled via the HX discharge valves. This has been accomplished by switching the control signals on valves V008A/B with those on valves V006A/B. Valves V006A/B are the control valves at the outlet of the HXs. Valves V006A/B now automatically modulate to control RCS cooldown. Formerly, flow through the RNS HX was indirectly controlled by re-positioning the RNS HX bypass valve, V008A/B, and waiting for the HX outlet valve to re-position in the opposite direction. Controlling flow through the HX in this manner creates a potentially unsafe condition. It is counter intuitive for an operator to control flow through the HX via the RNS HX bypass valve, which could lead to an operator error during a cooldown situation.

The RNS relief valve size shown in Figure 5.4-7 of the DCD R15 has been modified from a 4" inlet and a 6" outlet to a 3" inlet and a 4" outlet. The RNS relief valve is sized for two conditions. The relief valve must be capable of mitigating primary overpressure events at low temperature conditions due to a heat injection, and it must also be able to mitigate a mass injection transient where the mismatch flow rate is no higher than 177 gpm. In order to use a 4" x 6" valve an orifice would be employed which has a relieving capacity that is more than twice the necessary capacity. This is not recommended due to valve instability caused by the valve being fluid starved, which would cause chattering. Employing a 3" x 4" valve would require an orifice which will properly relieve the required flow.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 41 and 42 for the impact of the change on Revision 15 of the DCD.

2. VES: Control Room Emergency Habitability System and Figures

AP1000 Control Room Emergency Habitability System (VES) DCD Figures have been updated to correct line and valve number duplications and inconsistencies present in the current version of the diagrams. The description of the AP1000 VES in the Tier 2 section of the AP1000 DCD includes Figure 6.4-2. The markup is shown in Section III of this document.

Changes to VES line numbering:

Line Function	Old Line Number	New Line Number
MT09 outlet	T036A	T045A
MT10 outlet	T037A	T046A
MT11 outlet	T038A	T047A
MT12 outlet	T039A	T048A
MT25 outlet	T036B	T045B
MT26 outlet	T037B	T046B
MT27 outlet	T038B	T047B
MT28 outlet	T039B	T048B

Changes to VES valve numbering:

Valve Function	Old Valve Number	New Valve Number
Air Bank 1 Relief Valve	V041A	V040A
Air Bank 2 Relief Valve	V040A	V041A
Air Bank 3 Relief Valve	V041B	V040B
Air Bank 4 Relief Valve	V040B	V041B

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 146 for the impact of the change on Revision 16 of the DCD.

3. VBS: Control Logic for VBS fans serving Class 1E Division B&D Electrical Rooms

The control logic depicted on the VBS Figure 9.4.1-1 (Sheet 4 of 7) of the DCD for the VBS fans serving the Class 1E Division B & D Electrical Rooms has been changed so that starting an air handling unit will start the chilled water system associated with that air handling unit. Previously, starting air handling unit MS03B sent a signal to the VWS to start chilled water pump MP02, which provides chilled water to air handling unit MS03D. In the same manner, starting air handling unit MS03D sent a signal to the VWS to start chilled water pump MP03, which provides chilled water to air handling unit MS03B. In both cases, starting the air handling unit fails to start the correct water chiller, and therefore the cooling system would not have operated correctly. The logic has been corrected so that starting air handling unit MS03B will start chilled water pump MP03 and starting air handling unit MS03D will start chilled water pump MP02; thus, starting each air handling unit will start the respective supporting pump.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 115 and 116 for the impact of the change on Revision 15 of the DCD.

4. WGS: Simplified Sketch Corrections

The previous version of the Gaseous Radwaste System (WGS) simplified sketch shown in the DCD did not accurately depict the current status of the WGS design. The sketch has been updated to reflect the current AP1000 WGS design by correcting the valve type for the discharge valve and the moisture separator drain valve, as well as moving the discharge radiation monitor upstream of the discharge valve. The change in valve type is for standardization and does not affect the system function. The relocation of the radiation monitor will allow for isolation of the system with minimal gaseous releases with above acceptable radiation levels.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 141 for the impact of the change on Revision 15 of the DCD.

5. PMS: QDPS Display Variable Modifications

Table 7.5-1 has been updated to reflect the current AP1000 design. The following modifications have been made to the variables that are displayed on the Quality Data Processing Subsystem (QDPS):

- Display of the status indications (open, closed) of the components actuated by the Reactor Trip System and the ESF System
- Display one WR RCS cold leg temperature per loop
- Display of 38 core exit thermocouples

Displaying these additional variables on the QDPS will result in significantly increasing operations support following a plant initiating event concurrent with a loss of the DCS, and automating several operation support tasks, thereby increasing the amount of information provided to the operator following a plant initiating event.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 57 through 65 for the impact of the change on Revision 15 of the DCD.

See page 147 for the impact of the change on Revision 16 of the DCD.

6. FWS: Startup Feedwater DCD Figure Changes

It was necessary to eliminate the control function shown on the Startup Feedwater DCD Figure 10.4.7-1 (Sheet 4 of 4), and in DCD section 7.7.1.8.2 for pressure transmitters PT 043-45 because the startup feedwater header pressure is no longer an input to the Startup Feedwater control System. Additionally, the Main Feedwater System also no longer utilizes the main feedwater header pressure or pressure drop across the main feedwater control valve as an input to its control system. Therefore, section 7.7.1.8.1 of the DCD has been revised.

All three pressure transmitters are no longer necessary since they do not have a control function. Pressure transmitters 044 and 045 have been deleted. Additionally, Note 4 has been revised to reflect the updated control logic diagram APP-PLS-J1-143, and the statement in the note that mentions startup feedwater header pressure as an input to the control system has been deleted. A change in has also been made in Note 3 to indicate that control logic diagram PLS-J1-114 has been updated and is now APP-PLS-J1-144.

The marked up DCD figure and updated DCD figure are shown in Section III.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 66 and 139 for the impact of the change on Revision 15 of the DCD.

7. SMS: Digital Metal Impact Monitoring System from AP600 to AP1000

The requirement for loose parts monitoring sensors was incorrectly interpreted as requiring 4 sensors per collection region rather than 2. The correction of this missinterpretation results in the following changes:

- Removed the term "redundancy" where inappropriately stated.
- Modified the second sentence in paragraph four to correct misinformation on performance test application.
- Deleted valve motion, pump start-ups, and others which are misinformation as only rod stepping is addressed.
- Deleted text from paragraph five, bullet three. Information was incorrect.
- Deleted last sentence of paragraph six, which was misinformation.

Attached in Section III are changes to DCD Chapter 4 for the accurate description of the Digital Metal Impact Monitoring System from AP600 to AP1000.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 30 for the impact of the change on Revision 15 of the DCD.

See page 145 for the impact of the change on Revision 16 of the DCD.

B. The following design changes have been incorporated in order to maintain functional requirements of the AP1000 Standard Plant. The changes are a result of design evolution, identifying adjustments required to maintain the existing design as more detailed information has become available. As stated, these changes do not change system functionality; the changes are being made to update features in order to maintain functional design.

1. PCS: Passive Containment Cooling System (PCS) DCD Figures

The previous Passive Containment Cooling System (PCS) DCD Figure 6.3-2 had the recirculation heaters positioned downstream of the chemical addition tank. However, the recirculation heater has been moved upstream of the chemical addition tank in the current plant model. This change was made to accommodate a horizontal heater as opposed to a vertical heater. In the new configuration chemical solution is no longer being added and immediately circulated through the heater. This will promote better mixing of the chemical additive since it is being added to water which is already hot. Also, the piping connection to the heater is now flanged; previously, the heater connections were welded.

The PCS DCD figure also needed to be modified to show the tank's chemical addition line as an independent connection. The Figure showed a single inlet into the tank; however, the tank actually has separate connections for the chemical additive and water. The independent connection ensures that any chemical addition flows into the tank and not into the downstream piping.

The previous DCD figure also showed a connection between lines L029 and L051 when no such connection existed in AP1000. Line L029 actually connects to line L048. Finally, the connecting tees between lines L080 and L064, L046 and L057, and L051 and L048 were misrepresented on the figure.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 50 for the impact of the change on Revision 15 of the DCD.

2. SGS: Changes in MSSV in SGS

Inlet Piping

The main steam safety valve's (MSSV) inlet piping has been replaced with a long welding neck, which has an 8 inch inner diameter, to conform with ASME code (Article 7141 section (e)). ASME code (Article 7141 section (e)) requires that a safety valve never be installed on a nozzle having an inside diameter smaller than the inlet connection to the valve. The AP1000 design specified an MSSV which had an 8 inch inlet and a 10 inch dual outlet. The inlet piping to the valve was 8 inch schedule 160, which has an inner diameter of 6.831 inches. Therefore, the configuration of the MSSVs did not meet the ASME code.

Changing the inlet piping requires recalculating the set pressures and relieving capacities of the valve. The valve set pressures are listed in Tech Specs (Chapter 16.1) in Table 3.7.1-2, and both the set pressures and relieving capacities are found in the DCD in Table 10.3.2-2. Changes to Tech Specs Table 3.7.1-2 are covered in technical report TR 74C. A markup of Table 10.3.2-2 can be found in Section III of this document. The first MSSV set pressure does not change since it is based on system design pressure. The set pressures of the remaining five MSSVs do change as a result of the change in geometry of the inlet piping. The set pressure of each increases due to decreased pressure losses in the valve inlet connections. The subsequent relieving capacity also increases since it is dependent on valve set pressure.

Valve Outlet

The drain connected to the discharge piping of the MSSVs between the valve outlet and the elbow has been moved to the discharge of the valve to avoid condensate accumulation. The MSSVs have dual 10 inch discharges which vent steam to the atmosphere. Each discharge pipe is equipped with two drains to ensure that condensate does not collect in the piping. One drain is located below the elbow of the piping which connects to the vent piping, and the second drain was previously connected to the discharge piping between the valve outlet and the elbow.

ASME code (Article NC-7143 Section III Division I, Subsection NC) specifies that drain lines on safety valves should be located at the low points in the discharge. Condensate accumulation in the discharge piping becomes potentially hazardous if the valve were to open with condensate in the line. Moving the second drain to the discharge of the valve will ensure that both drains are located in the low points of the discharge piping.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 122, 123, and 132 for the impact of the change on Revision 15 of the DCD.

3. VAS, VBS, VHS, VTS, VXS: Correction of HVAC Humidifier Reference

The DCD previously referenced standard ARI 620 "Self Contained Humidifiers for Residential Applications" in the design of the humidifiers. This was incorrect as the ARI 620 states that the intended application of these humidifiers is typically for non-ducted applications, and is independent of a central air system. The AP1000 uses humidifiers in ducted central air applications; therefore, ARI 640, "Commercial and Industrial Humidifiers" is the correct specification, and has replaced ARI 620.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 105 through 114 for the impact of the change on Revision 15 of the DCD.

4. SGS: Steam Generator Feedwater Piping Change

The 20" x 16" custom reducing elbow connecting the main feedwater piping to the steam generator has been replaced with a standard 16" DAB short radius elbow to meet ASME Section III stress limits. The AP1000 main feedwater piping was 20" DAB piping from the outlet of the main feedwater isolation valve to the 20" x 16" custom reducing elbow connecting the feedwater piping to the steam generator nozzle. This elbow cannot be qualified to meet ASME Section III stress limits.

The replacement standard 16" DAB short radius elbow connects to 16" DAB piping that will replace the current 20" DAB piping at the connection to the elbow. The 16" piping will run vertically down and reconnect to the specified 20" DAB piping via a 20" x 16" reducer. The proposed configuration meets the ASME Section III stress limits since the added flexibility of the 16" pipe reduces the loads at the connection to the Steam Generator nozzle.
The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 124 and 127 for the impact of the change on Revision 15 of the DCD.

5. PCS: PCS Changes

The lines APP-PCS-PL-L017 and APP-PCS-PL-L001A have been changed to a single 3 inch line; this change has been made to make it possible to achieve the flow rates required for adequate containment cooling. The reducer has been removed to allow for proper flow of PCS water to the containment shell once the flow measuring/limiting orifice has been tuned. This correction to the design allows the system to meet the requirements set forth in the DCD; this is not a functional change to the system.

Pressure indicators 005, 006, 007 and 008 were shown as pressure indicators with alarms. The instrument tags have been corrected to show that they also have a control that opens the containment cooling valves.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 47 for the impact of the change on Revision 15 of the DCD.

6. SFS: Spent Fuel Pool Cooling System Modifications

SFS Pump Common Suction Pipe Size

This change has increased the SFS common suction pipe from 6 inch, Sch 40 to 10 inch, Sch 40 from the SFP to the penetration at the SFS pump room. The line is then reduced from 10 inch, Sch 40 pipe to 8 inch, Sch 40 pipe from the pump room penetration to line L001A. The remainder of the SFS suction piping will remain 6 inch, Sch 40. The previously specified pipe diameter of 6 inches resulted in large pressure drops which would have caused cavitation in the SFS pump suction lines when the SFP temperature is elevated. This large suction line pressure drop created an unacceptable situation in which SFP cooling with the SFS pumps couldn't have been restored following a temporary loss of SFP cooling. The increase in line size will reduce the pressure drop in the suction line and increase the NPSHa to appropriate levels for proper pump operation.

SFS Pump Common Discharge Pipe Size

This change has increased the size of line the SFS pump common discharge line from 6-inch, Sch 40 to 8-inch, Sch 40. This change, combined with the reduced ΔP in the pump suction line, decreases the pump required head. This will lower the pump horsepower by approximately 35% at normal operating conditions.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 71 and 72 for the impact of the change on Revision 15 of the DCD.

See page 149 for the impact of the change on Revision 16 of the DCD.

7. CVS: Control Systems Corrections

The interlock between valves CVS-PL-V001, 002, 003 and temperature instrument TICA-002 has been revised because having three interlocks increases the potential for inadvertent actuation of system isolation which would result in thermal transient to the CVS heat exchangers, which should be avoided. The present DCD figure shows an interlock between TICA-002 and three purification isolation valves, CVS-PL-V001, V002 and V003 which is used to protect the demineralizer resin beds from excessive temperature. A single MOV closure is sufficient for automatic CVS isolation, and therefore, the interlocks between TICA-002 and CVS-PL-V001 and V002 are deleted as marked on the schematic drawing in Section III. A high alarm and signal to CCS-PL-V221 and a high interlock between CVS-PL-V003 and TICA-002 are sufficient to protect the demineralizer resin beds from overheating.

Correction of the boric acid tank heaters

A standard heating unit for the immersion heaters in tanks has been selected. Depending upon the connection of the heating element, the unit is able to produce either 13.3 kw or 4.43 kw. For extreme weather conditions it has been determined that the Boric Acid Tank will require 16.6 kw of heat to prevent freezing; therefore, two standard heating elements are required. Each heating element will have its own immersion well in the tank, and each will be configured differently. The CVS figure in Tier 2 has been updated to show two heating elements.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 95 and 96 for the impact of the change on Revision 15 of the DCD.

8. PXS: Differential Pressure Flowmeter for PRHR HX Flow

The method of flow measurement through the passive residual heat removal heat exchanger (PRHR HX) has been replaced with an averaging pitot primary element installed in the PRHR piping. PRHR HX flow measurements PXS-049A and -049B were previously identified as being implemented with ultrasonic flow meters. In the AP600 design, the measurements were specified as differential pressure measurements at a venturi primary element. Ultrasonic flow meters were introduced in the transition to AP1000 to eliminate the permanent pressure loss imposed by the primary element. The measurements are specified as electrical class "C," which requires that the sensors be qualified as IEEE Class 1E, for the harsh containment environment. Harsh environment qualification poses a problem both for the microprocessor-based circuitry of the transmitter electronics and for the coupling of the transducers to the process piping. Verification and validation of the third-party vendor software required for the ultrasonic sensors would also present obstacles to Class 1E qualification.

The principle objective of minimizing permanent pressure loss in the piping system can by satisfied by installing an Annubar™ averaging pitot primary element in the PRHR piping, and measuring the developed differential pressure. Preliminary information has been obtained from the manufacturer of the Annubar™ primary elements.

The Annubar™ primary elements can be supplied with an ASME "NPT" stamp, for installation in ASME Section III piping. Structurally, the primary element is like a small-diameter pipe extending across the diameter of the 14-inch Class BTA process piping. It would be inserted through a two-inch, socket weld nozzle and welded in place. The flow element would be supported on the opposite side of the process pipe with a 2-inch branch fitting. The primary element requires a minimum upstream straight pipe length of 10 diameters and a minimum downstream straight length of 4 diameters. The flow element could therefore be installed at the same location previously envisioned for the ultrasonic transducer. Manufacturer recommendation for installation in a horizontal pipe is to orient the flow element with the process connection in the bottom half of the pipe, to ensure the instrument tap and line remain water-filled.

Both flow measurements, PXS-049A and -049B, may be made using a single primary element. The cross-sectional area of the installed primary element would be a small fraction of the pipe cross-sectional area, and would produce a relatively small pressure drop. A fluid system evaluation has been performed to evaluate the acceptability of the additional pressure drop imposed by the Annubar™ element. The pressure drop can be accommodated by using some of the margin originally included in the piping system calculations to allow for pipe routing changes. Pipe routing is not expected to change significantly now, and it was not necessary to eliminate the margin entirely. The expected pressure drop is acceptable, and will not require a change to the safety analysis.

The changes are outlined in the Section III markup of Figure 6.3-2.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 52 for the impact of the change on Revision 15 of the DCD.

9. PCS: Ultrasonic Level Measurement for PCCWST Narrow-Range

The Passive Containment Cooling Water Storage Tank (PCCWST) level measurement was a single-leg pressure measurement that shared a common tap with the PCCWST wide-range level sensor. To make a level measurement of the top 20 percent of the tank span with the existing process connection, the sensor range would have to be increased to allow for the instrument location below the bottom of the tank. The combination of range extension and suppression ("turndown") would increase instrument uncertainty contributors to the point that the required accuracy enhancement, compared to the wide-range level measurement, could not be achieved. Therefore, the pressure-based narrow-range level measurement has been eliminated and replaced with an ultrasonic, non-contact level sensor. The ultrasonic level sensor will be wall-mounted inside the PCCWST, above the maximum water level.

Section III contains a markup of changes to DCD Figure 6.2.2-1.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 45 for the impact of the change on Revision 15 of the DCD.

10. CVS: Various CVS DCD Figure Changes

Batching Tank Heater Control

During the operation of the boric acid batching tank, there is no need for control room personnel to monitor or control any aspect of the tank operation. An operator locally controls all aspects; therefore, local indication and control of temperature and level is now specified with no remote operation or indication. DCD Figure 9.3.6 has been updated to show this change.

Letdown Isolation Valve Controls

The letdown isolation valves, V045, V047, and V059, open and close on a low level signal from RCS level instruments LIA 160 A and B during midloop operations. The instrument tags for LIA 160 A and B have been updated to LICA 160 A and B to indicated they have a control function. Note 15 has been changed to "Valves Close to Isolate Letdown on Low Hot Leg Level During Midloop on RCS LICA 160 A&B."

Valve V059 receives a PLS signal on low level during mid-loop operations via the PMS concurrent with valves V045 and V047. Therefore, a note has been added to the CIB, Note 23 "PLS – Closes CVS-V059 to Isolate Letdown on Low Hot Leg Level During Midloop." Updates are shown on DCD Figure 9.3.6.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 38, 99, 100, 102, and 103 for the impact of the change on Revision 15 of the DCD.

11. RCS: DCD Figure Changes for Tag Numbers RCS-TE125 A, B, C,D

In order to properly define the functional requirements for the dual temperature range channels RCS-TE125 A, B, C, D, the I&C systems require the establishment of separate I&C and P&ID database identifiers for each range of RCS-TE125 A, B, C, D this change is shown in the markup of Figure 5.1-5 (Sheet 1 of 3).

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 35 for the impact of the change on Revision 15 of the DCD.

12. RCS: Misc DCD Figure Changes

1. DCD Figure 5.1-1 (a simplified sketch of the RCS) incorrectly showed that the CVS purification system originates from cold leg 1A; it has been corrected to show that it originates from cold leg 1B.

2. RCS valve V241 was a normally open, fail closed, direct solenoid valve that closes on a high RCDT pressure signal from the PMS. This valve type will not operate in a continuously energized state per industry experience. The valve has been changed to a fail closed AOV.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 32 and 40 for the impact of the change on Revision 15 of the DCD.

13. PXS: In-service Testing of IRWST Injection Check Valves (V122A,B and V124A,B) Modification

To test full opening of the PXS Check Valves 122A/B and 124A/B, a test connection exists to run air through the line to allow the valves to fully open. To allow this test to occur without choking flow in the downstream test valve, the line resistance must be as low as possible. This is accomplished by the following two changes

1. The 2 inch pack-less globe valves, PXS-PL-V126A, V126B, V128A, V128B, V129A and V129B have been specified to be 2 inch y-body pack-less globe valves.

2. The lines PXS-PL-L122A, L122B, L126A, and L126B have been changed from BBB to BTA.

By making these changes the check valves are able to swing full open upon initiation of the test.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 53 and 55 for the impact of the change on Revision 15 of the DCD.

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14. CVS: DCD Figure DP Instrument Changes

Three pressure instrument channels (010, 020, and 110) in the CVS have been changed from DP switches to DP transmitters such that a continuous signal can be provided to the MCR. In the previous design these instruments were "local only"; that is, they provide remote alarms in the MCR but have local indication only. Thus, it is only known that an upset condition has been reached upon obtaining an alarm. This change does not affect the functional design of the system; this change allows the operators increased operational flexibility.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 98 and 101 for the impact of the change on Revision 15 of the DCD.

15. RCS: AP1000 Pressurizer Safety Valve Discharge Piping Pressure Rating System

The AP1000 Reactor Coolant System description in the DCD previously showed the 8-in pressurizer safety relief valve discharge piping as Class BBC. The DCD has been revised to show these piping lines to be class EBC, in order to be consistent with expected safety valve backpressure, as well as the required backpressure to discharge the safety valve's rated capacity, and the backpressure required to discharge the safety valve with choked flow at the 10-in rupture disk. Changing this piping to class EBC changes its pressure rating from 2485 psig @ 650F to 600 psig @ 500F, changes the piping schedule from 160 to S-40S, and changes the flange rating from CL 2500 to CL 600. This pressure rating is consistent with the valve vendor expected safety valve backpressure of 500 psig, and is consistent with the 300 psig expected backpressure required to discharge the safety valve's rated capacity of 750,000 lbs/hr with choked flow in the 8-in pipe section, and the 175 psig expected backpressure required to discharge the safety valve's rated capacity of 750,000 lbs/hr with choked flow at the 10-in piping rupture disk.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 39 for the impact of the change on Revision 15 of the DCD.

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16. SGS: Main Steam Line Condensate Drain Changes

A 1" bypass line, which includes a plug resistant orifice, has been placed around control valves V086 A/B which will allow condensate to be constantly drained to the Turbine Island Drain System (TDS) without need for continually opening / closing the control valve.

The 2" drain line connection (L020A/B) has been relocated as low as reasonable in the 12" pipe stub (L021A/B) to allow for a larger condensate volume collection pot, which will allow for better control of draining when valve V086 A/B must be opened. The level switch that controls this valve is replaced by a level transmitter to make the configuration consistent with the MSS. Using a level transmitter eliminates line L049A/B. The level transmitter also provides continuous indication of the level in the drain pot.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 28, 29, 125, and 126 for the impact of the change on Revision 15 of the DCD.

17. SFS: Spent Fuel Racks Designs

The updated storage capacity of the Spent Fuel Storage Racks, covered under TR 33, is 889 locations which is an increase from 619 locations. The Spent Fuel Pool Cooling System (SFS) has the capability to cool a fully loaded spent fuel pool under the design basis conditions. The maximum heat load during various offload conditions has increased as a result of the increased rack capacity. The updated decay heat levels and times to boil off are shown in the markup of DCD section 9.1.

The heat loading analyses have been compared with other TRs dealing with the increase in the Spent Fuel Pool storage capacity specifically TRs 105 and 108. These analyses took the proposed changes into account and therefore, the analyses are valid.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 67 through 70 for the impact of the change on Revision 15 of the DCD.

During the verification of the heat loading calculation, corrections were made to the document that resulted in the need to revise the times to boil off. See page 148 for the impact of the change on Revision 16 of the DCD.

18. VBS: Addition of VBS Heaters and Controls

The VBS HVAC system currently has one heater in each air handler and one pair of temperature sensors to control the temperature in the CSA and MCR areas. The airflow to each space is selected to properly cool each space at the summer design weather conditions. During winter conditions, cooling is required to maintain design conditions in some spaces, including the MCR, some electrical/electronic equipment spaces, and the CSA computer rooms. Since the VBS system, as previously configured, could not heat some spaces and cool others simultaneously, additional heaters and temperature sensors have been added in the return ducting from the computer room for temperature control.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 104, 118 for the impact of the change on Revision 15 of the DCD.

C. The following design change has been incorporated to further standardize and simplify the AP1000 Standard Plant.

1. Various Systems: AP Flow Orifice Flange Set Standardization

A standard has been selected for all flow orifice flange sets to simplify the I&C specification; previously, flow measurement using orifice flanges has specified different installation details. This change standardizes on a single orifice flange installation detail that utilizes raised face ASME B16.36 orifice flanges with the sensing lines attached via the flange taps. The sensing lines and first valves are 3/4" piping components, which is chosen for increased mechanical strength. The sensing line connection at the orifice flange is 3/4" NPT.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 26, 43, 46, 80 through 85, 97, 128, and 129 for the impact of the change on Revision 15 of the DCD.

D. Initial wording within the DCD described specific commodities that may change as design finalization progresses. The following changes are incorporated in the DCD to allow flexibility in design, as well as selection of final commodities. These changes do not effect system function.

1. Black Poly Piping

This change has added the option of black polyethylene plastic piping (High Density Polyethylene) to sections of Tier 2 in the DCD for nonsafety-related systems that contain or convey normally non-radioactive water or air.

As far as application to AP1000 systyems, HDPE may be used for systems and system areas of low pressure and low temperature. Based on manufacturer's recommendations, HDPE will be used in systems with pressures up to 150 psi (1,000 kPa) and temperatures up to 140F (60C) for water services. Pressure and temperature limits for other services shall be based on the hazards involved, but in no application shall they exceed 150 psi (1,000 kPa) and 140F (60C).

The reasons to consider HDPE as an alternative to carbon steel are:

a. HDPE installation is generally cheaper than carbon steel
b. 100% leak free in regards to both piping and joints
c. Very ductile and can be coiled around smaller areas while also being durable
d. Resistant to both slow crack growth (SCG) and rapid crack propagation (RCP)
e. Hydraulically efficient in that the inner portion of the HDPE is smoother than carbon steel and therefore can provide better flow whether it be water or gas
f. HDPE can be manufactured with UV protection
g. HDPE has been used in the gas and water industry for over 50 years

The changes to the DCD affect sections 9.2.1.2.2, 9.2.2.3.5, and 9.2.8.2.2. This change affects the write-up for Class D and Class E systems. Class D is constructed to the requirements of ASME B31.1. ASME B31.1 includes Appendix III that provides rules for nonmetallic piping. The impact on the DCD is shown in Section III.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 73 and 75 for the impact of the change on Revision 15 of the DCD.

2. **Removal of Smart Valves**

The inclusion of these valves in AP1000 diagrams and text in the DCD may be perceived as restricting the respective valve's design to a smart valve.

To provide the necessary design flexibility, the integral instrumentation has been replaced with standard in-line instrumention within the identified figures of the DCD or removed, and references to valves with internal instrumentation have been removed from the DCD text. This replacement does not change the function or design of any valves or instruments.

Figure 9.2.1-1 (Service Water System valves V011 and V009) and Figure 9.2.7-1 Sheet 2 of 3 (Central Chilled Water System valves V272A/B, and V261A/B/C/D) have been corrected in accordance with this change.

The affected text is located in Sections 9.2.1.5 and 9.2.7.2.2.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 75, 76 through 79, and 87 through 90 for the impact of the change on Revision 15 of the DCD.

3. **Spent Resin Transfer Pump Description in DCD**

The current AP1000 design identifies a "progressing cavity" positive displacement pump for resin transfer. This pump type was widely recommended and put into use approximately 15 years ago, with initially favorable results. However, as these installed pumps have worn, the increased clearances have started to entrap and grind resin beads. The crushed beads create an unfavorable waste form as they are difficult to dewater which creates a potential storage problem. Therefore, in order to provide the flexibility in the design to choose a more appropriate pump, the specificity of "progressive cavity" pump found in Table 11.4-10 has been removed from the DCD. The design of the system has not been changed with this modification, only the description.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See page 143 for the impact of the change on Revision 15 of the DCD.

4. Source of Cooling Water for TCS and CMS Heat Exchangers

In order to provide flexibility, the cooling water source for the TCS and CMS HX's has been changed from circulating water to a generic "cooling water" that can be provided by either circulating water and/or raw water make-up to the cooling tower basin.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 91 through 94 and 133 through 138 for the impact of the change on Revision 15 of the DCD.

E. OTHER

1. Spent Fuel Spray

The National Academy of Sciences (NAS) performed a study pertaining to the safety/security of the spent fuel storage in nuclear power plants. One of the areas they studied was the draining of the water from the Spent Fuel Pool (SFP). They determined that such an event could lead to the overheating of freshly discharged spent fuel sufficiently that the zirconium cladding could ignite. The resulting fire could release significant activity. It was suggested in this report that overheating of the spent fuel could be avoided by storing freshly discharged fuel with the old fuel and by providing spray to the spent fuel. In response to the NAS study, a spray system has been added to the spent fuel pool which is capable of providing emergency cooling to the pool in the unlikely event where the SFP drains. The cooling water will be delivered to the spray nozzles from either the Passive Core Cooling Water Storage Tank (PCCWST) or the Fire Protection System (FPS). Additionally, Valve 047 has been removed to eliminate the risk of inadverantly draining the Spent Fuel Pool.

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The addition of the Spent Fuel Pool Spray does not preclude the safety function of either the PCCWST or the FPS because the system was added based on the analysis of a beyond design basis accident.

The Regulatory Impact assessment contained in Section IV of this TR has been completed for this change.

See pages 48 and 120 for the impact of the change on Revision 15 of the DCD.

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III. DCD MARK-UP

The following pages describe the DCD changes defined in Section II.

DCD R16 mark-ups begin on page 145.

DCD R15 Markups:

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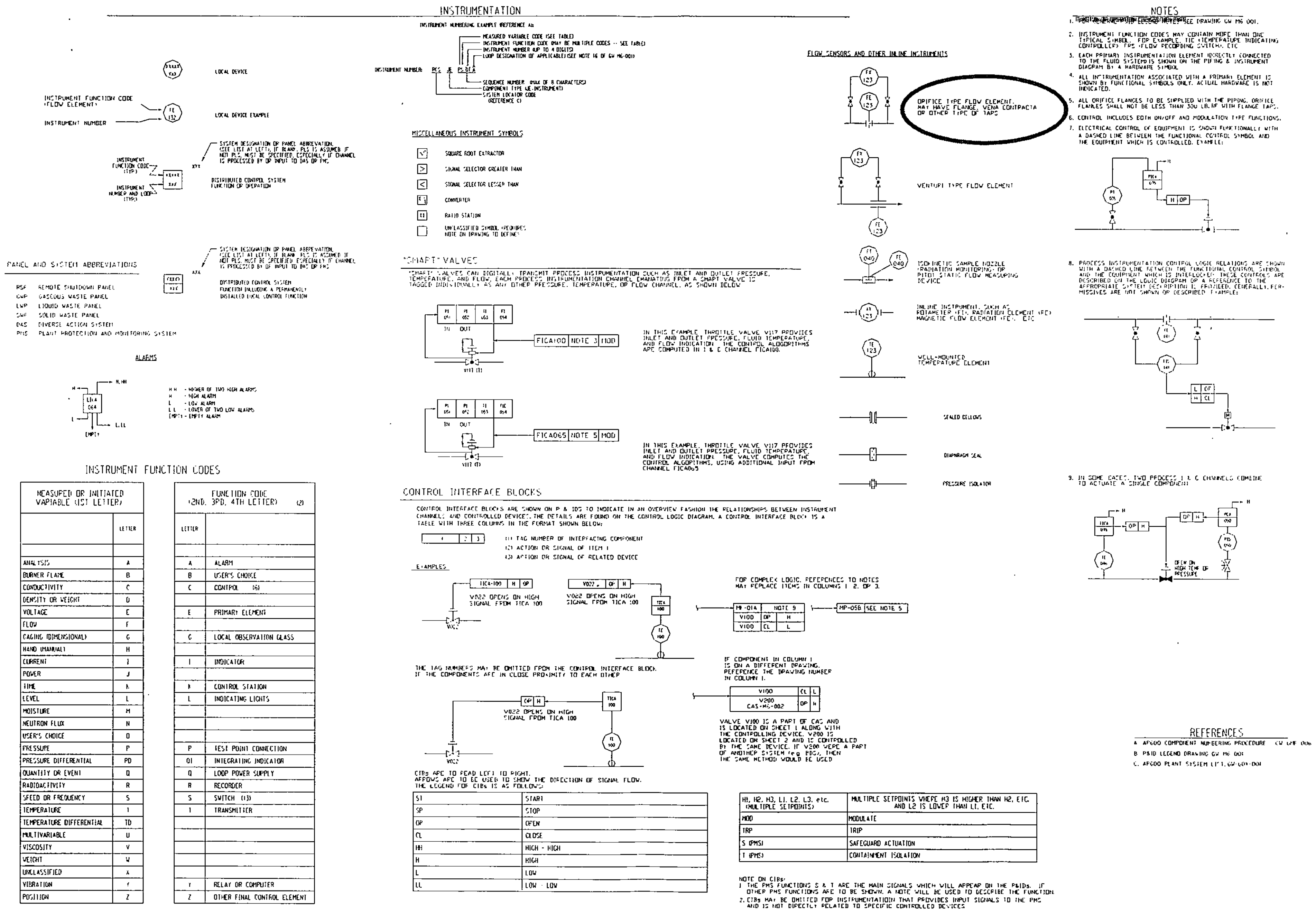

Figure 1.7-2 (Sheet 3 of 3)
Piping and Instrumentation Diagram Legend

R15 Figure Mark-up
See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

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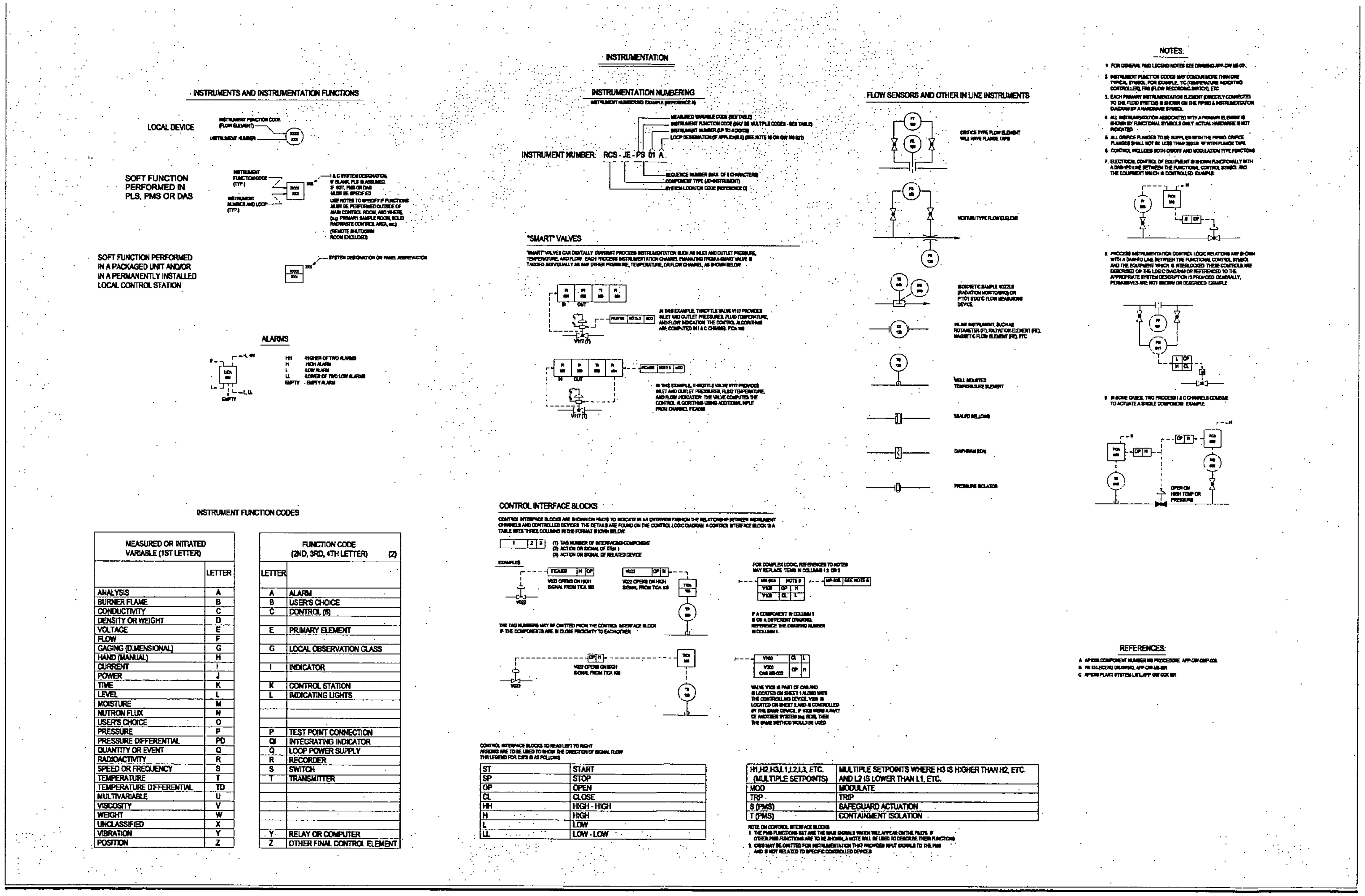

Figure 1.7-2 (Sheet 3 of 3)
Piping and Instrumentation Diagram Legend

R16 Figure with R15 changes incorporated

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See Section II.B.16 on page 19 of TR 103 for the description and justification of this change.

TABLE 3.2-3 (SHEET 50 OF 65) AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT					
Tag Number	**Description**	**AP1000 Class**	**Seismic Category**	**Principal Construction Code**	**Comments**
Steam Generator System (Continued)					
SGS-PL-V074B	SG Blowdown Isolation	B	I	ASME III-2	
SGS-PL-V075A	SG Series Blowdown Isolation	C	I	ASME III-3	
SGS-PL-V075B	SG Series Blowdown Isolation	C	I	ASME III-3	
SGS-PL-V084A	SG 1 Nitrogen Sparging Isolation	B	I	ASME III-2	
SGS-PL-V084B	SG 2 Nitrogen Sparging Isolation	B	I	ASME III-2	
SGS-PL-V086A	Steam Line Condensate Drain Control	C	I	ASME III-3	
SGS-PL-V086B	Steam Line Condensate Drain Control	C	I	ASME III-3	
SGS-PL-V093A	Orifice Isolation Valve	C	I	ASME III-3	
SGS-PL-V093B	Orifice Isolation Valve	C	I	ASME III-3	
SGS-PL-V094A	Orifice Cleanout Line Isolation Valve	C	I	ASME III-3	
SGS-PL-V094B	Orifice Cleanout Line Isolation Valve	C	I	ASME III-3	
SGS-PL-V095A	Orifice Isolation Valve	C	I	ASME III-3	
SGS-PL-V095B	Orifice Isolation Valve	C	I	ASME III-3	
SGS-PL-V096A	Steamline Condensate Drain Level Isolation Valve	B	I	ASME III-2	
SGS-PL-V096B	Steamline Condensate Drain Level Isolation Valve	B	I	ASME III-2	
SGS-PL-V097A	Steamline Condensate Drain Level Isolation Valve	B	I	ASME III-2	
SGS-PL-V097B	Steamline Condensate Drain Level Isolation Valve	B	I	ASME III-2	
SGS-PL-V233A	Power Operated Relief Valve	C	I	ASME III-3	
SGS-PL-V233B	Power Operated Relief Valve	C	I	ASME III-3	
SGS-PL-V240A	MSIV Bypass Isolation	B	I	ASME III-2	
SGS-PL-V240B	MSIV Bypass Isolation	B	I	ASME III-2	
SGS-PL-V250A	Main Feedwater Control	C	I	ASME III-3	
SGS-PL-V250B	Main Feedwater Control	C	I	ASME III-3	

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See Section II.B.16 on page 19 of TR 103 for the description and justification of this change.

Table 3.11-1 (Sheet 42 of 45)

ENVIRONMENTALLY QUALIFIED ELECTRICAL AND MECHANICAL EQUIPMENT

Description	AP1000 Tag No.	Envir. Zone (Note 2)	Function (Note 1)	Operating Time Required (Note 5)	Qualification Program (Note 6)
Orifice Isolation Valve	SGS-PL-V093A	5	PB	1 yr	M *
Orifice Isolation Valve	SGS-PL-V093B	5	PB	1 yr	M *
Orifice Cleanout Line Isolation Valve	SGS-PL-V094A	5	PB	1 yr	M *
Orifice Cleanout Line Isolation Valve	SGS-PL-V094B	5	PB	1 yr	M *
Orifice Isolation Valve	SGS-PL-V095A	5	PB	1 yr	M *
Orifice Isolation Valve	SGS-PL-V095B	5	PB	1 yr	M *
Steamline Condensate Drain Level Isolation Valve	SGS-PL-V096A	5	PB	1 yr	M *
Steamline Condensate Drain Level Isolation Valve	SGS-PL-V096B	5	PB	1 yr	M *
Steamline Condensate Drain Level Isolation Valve	SGS-PL-V097A	5	PB	1 yr	M *
Steamline Condensate Drain Level Isolation Valve	SGS-PL-V097B	5	PB	1 yr	M *
Startup Feedwater Check Valve	SGS-PL-V256A	5	PB	1 yr	M *
Startup Feedwater Check Valve	SGS-PL-V256B	5	PB	1 yr	M *
MCR Penetration Test Valve	VBS-PL-V160	3	PB	1 yr	M
MCR Penetration Test Valve	VBS-PL-V161	3	PB	1 yr	M
MCR Penetration Test Valve	VBS-PL-V162	3	PB	1 yr	M
Air Delivery Line Pressure Instrument Isolation Valve A	VES-PL-V006A	7	PB	1 yr	M
Air Delivery Line Pressure Instrument Isolation Valve B	VES-PL-V006B	7	PB	1 yr	M
Temporary Instrument Isolation Valve A	VES-PL-V016	7	PB	1 yr	M
Temporary Instrument Isolation Valve A	VES-PL-V018	7	PB	1 yr	M
Temporary Instrument Isolation Valve B	VES-PL-V019	7	PB	1 yr	M
Temporary Instrument Isolation Valve B	VES-PL-V020	7	PB	1 yr	M
Air Tank Isolation Valve A	VES-PL-V024A	7	PB	1 yr	M
Air Tank Isolation Valve B	VES-PL-V024B	7	PB	1 yr	M
Air Tank Isolation Valve A	VES-PL-V025A	7	PB	1 yr	M
Air Tank Isolation Valve B	VES-PL-V025B	7	PB	1 yr	M
Refill Line Isolation Valve	VES-PL-038	7	PB	1 yr	M
DP Instrument Line Isolation Valve A	VES-PL-V043A	3	PB	1 yr	M
DP Instrument Line Isolation Valve B	VES-PL-V043B	3	PB	1 yr	M
Containment Isolation Test Connection	VFS-PL-V001	7	PB	1 yr	M
Containment Isolation Test Connection	VFS-PL-V002	1	PB	1 yr	M *
Containment Isolation Test Connection	VFS-PL-V006	1	PB	1 yr	M *
Containment Isolation Test Connection	VFS-PL-V007	6	PB	1 yr	M
Containment Isolation Test Connection	VFS-PL-V008	6	PB	1 yr	M
Main Equipment Hatch Test					

See Section II.A.7 on page 8 of TR 103 for the description and justification of the following changes.

4.4.6.4 Digital Metal Impact Monitoring System

The digital metal impact monitoring system is a nonsafety-related system that monitors the reactor coolant system for metallic loose parts. It consists of several active instrumentation channels, each comprising a piezoelectric accelerometer (sensor), signal conditioning, and diagnostic equipment. The digital impact monitoring system conforms with Regulatory Guide 1.133.

The digital metal impact monitoring system is designed to detect loose parts that weigh from 0.25 to 30 pounds, and can also detect impact with a kinetic energy of 0.5 foot-pounds on the inside surface of the reactor coolant system pressure boundary within three feet of a sensor.

The digital impact monitoring system consists of several redundant instrumentation channels, each comprised of a piezoelectric accelerometer (sensor), preamplifier, and signal conditioning equipment. The output signal from each accelerometer is amplified by the preamplifier and signal conditioning equipment before it is processed by a discriminator to eliminate noise and signals which are not indicative of loose part impacts. The system starts up and operates automatically.

The system facilitates performance tests, hardware integrity tests, and the recognition, location, replacement, repair and adjustment of malfunctioning components. System performance tests are made using a hammer as a tool to simulate an impact. Additional system performance testing is performed using special test modules. These modules simulate impacts and test performance of the signal processing equipment. Hardware integrity tests are also performed to verify equipment operation.

The impact detect algorithm used by the signal processing equipment is designed to minimize the number of false alarms. False impact detection, attributable to normal hydraulic, mechanical and electrical noise, is minimized by a number of techniques including:

- Utilizing a floating level within the impact detection algorithm. The floating level is based on signal levels not characteristic of an impact, and is generally a function of the background noise level.
- Comparing the impact event with the times and type of normally occurring plant operation events received from plant control system, such as a control rod stepping~~, valve motion, pump start-ups, and others~~.

- Comparing the number of events detected within a given time interval. ~~For example, a impact occurring more than two times in one minute may be considered as valid, but random impact occurring at sporadic intervals longer than one minute may not be considered as a valid alarm.~~

The sensors of the impact monitoring system are fastened mechanically to the reactor coolant system at potential loose part collection regions including the upper and lower head region of the reactor pressure vessel, and the reactor coolant inlet region of each steam generator. ~~Sensors are mounted in a manner which protects the sensors from mechanical damage, compensates for thermal expansion and provides a constant holding force throughout the operating range, maintains the mounting resonance frequency greater than 17 kHz.~~

The equipment inside the containment is designed to remain functional through an earthquake of a magnitude equal to 50 percent of the calculated–Safe Shutdown Earthquake and normal environments (radiation, vibration, temperature, humidity) anticipated during the operating lifetime. The ~~two~~ instrument channels associated with the ~~redundant~~ sensors at each reactor coolant system location are physically separated from each other starting at the sensor locations to a point in the plant that is always accessible for maintenance during full-power operation.

The digital metal impact monitoring system is calibrated prior to plant startup. Capabilities exist for subsequent periodic online channel checks and channel functional tests and for offline channel calibrations at refueling outages.

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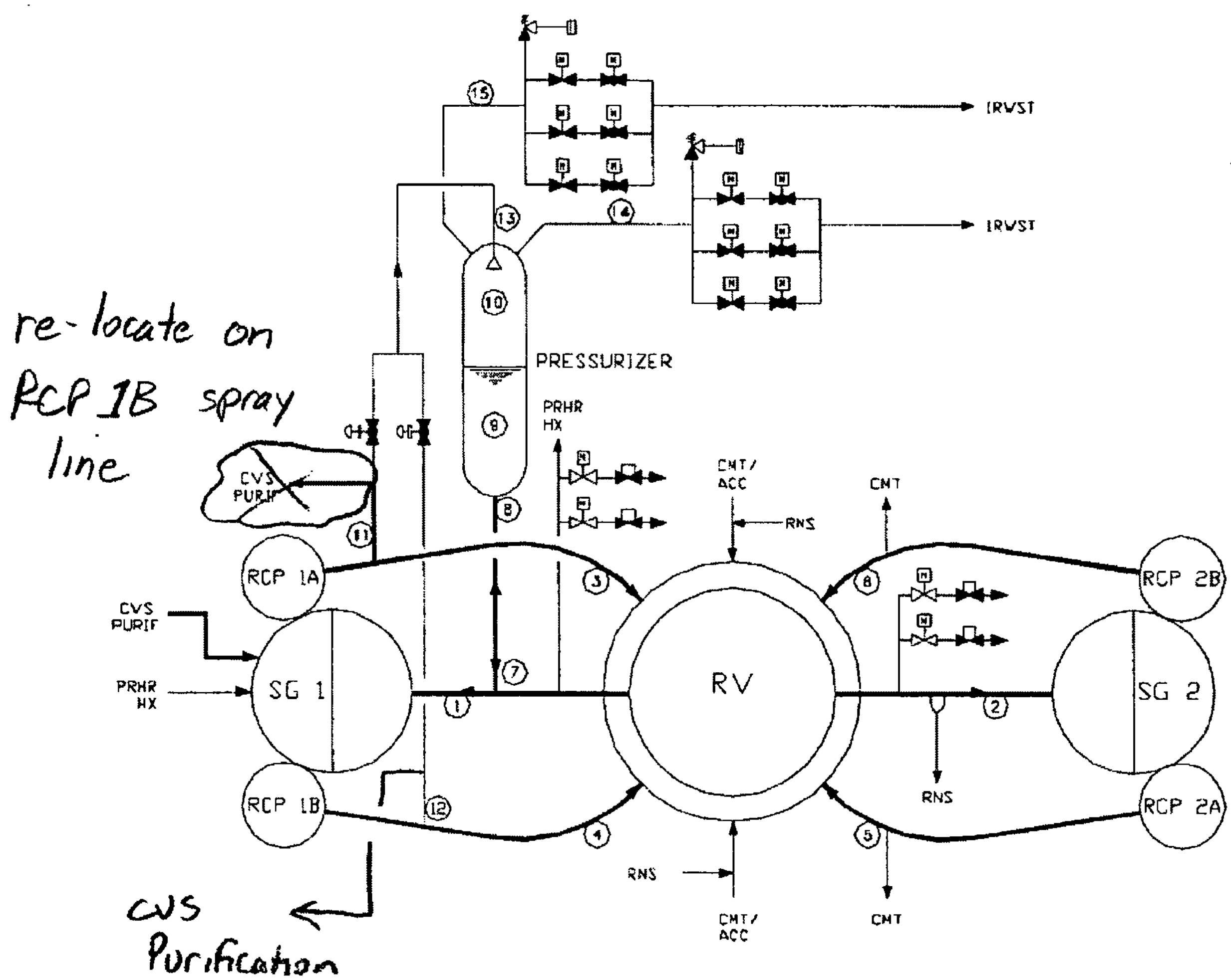

Figure 5.1-1

Reactor Coolant System Schematic Flow Diagram

R15 Figure Mark-up

See Section II.B.12 on page 17 of TR 103 for the description and justification of this change.

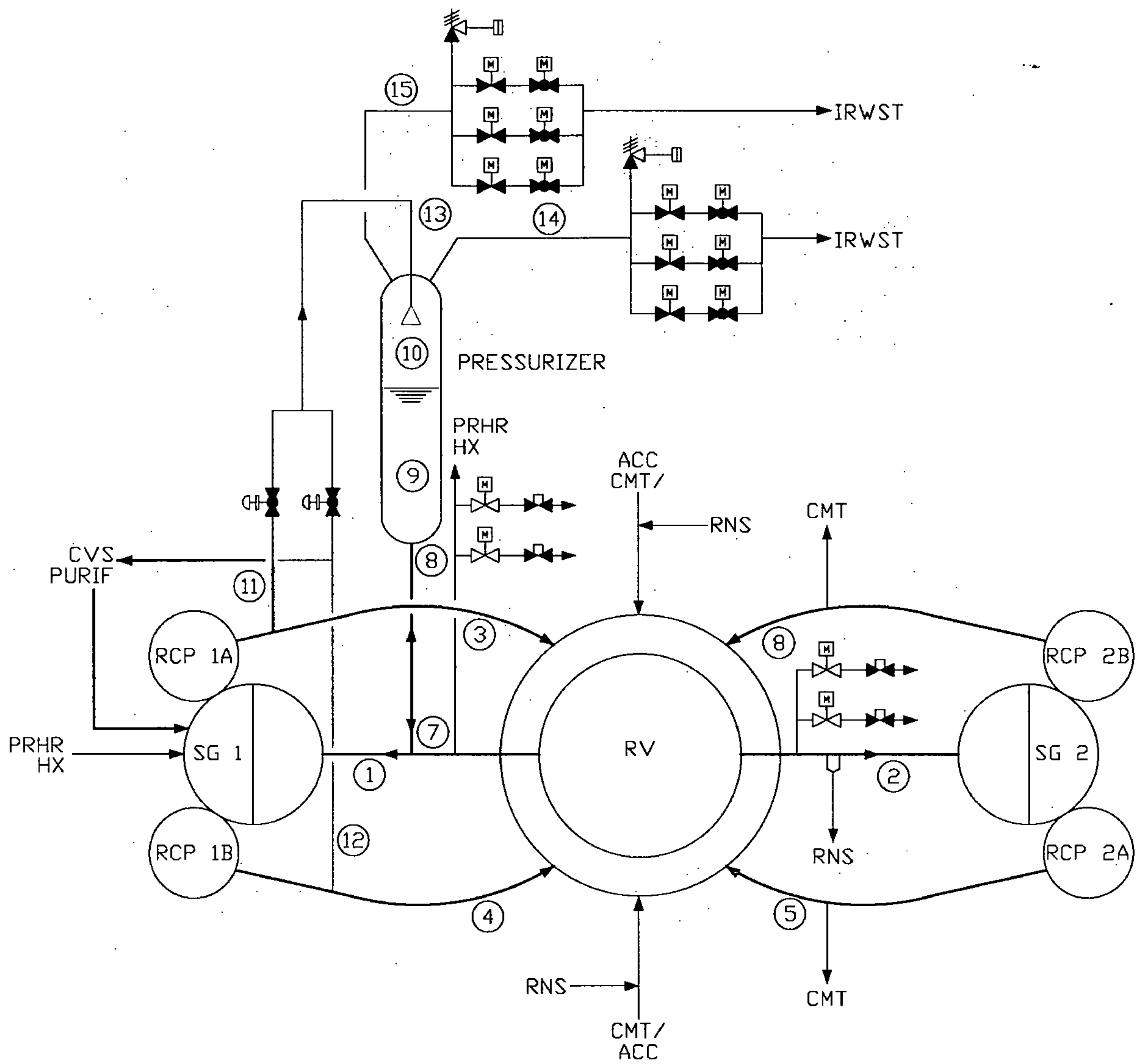

Figure 5.1-1

Reactor Coolant System Schematic Flow Diagram

R16 Figure with R15 changes incorporated

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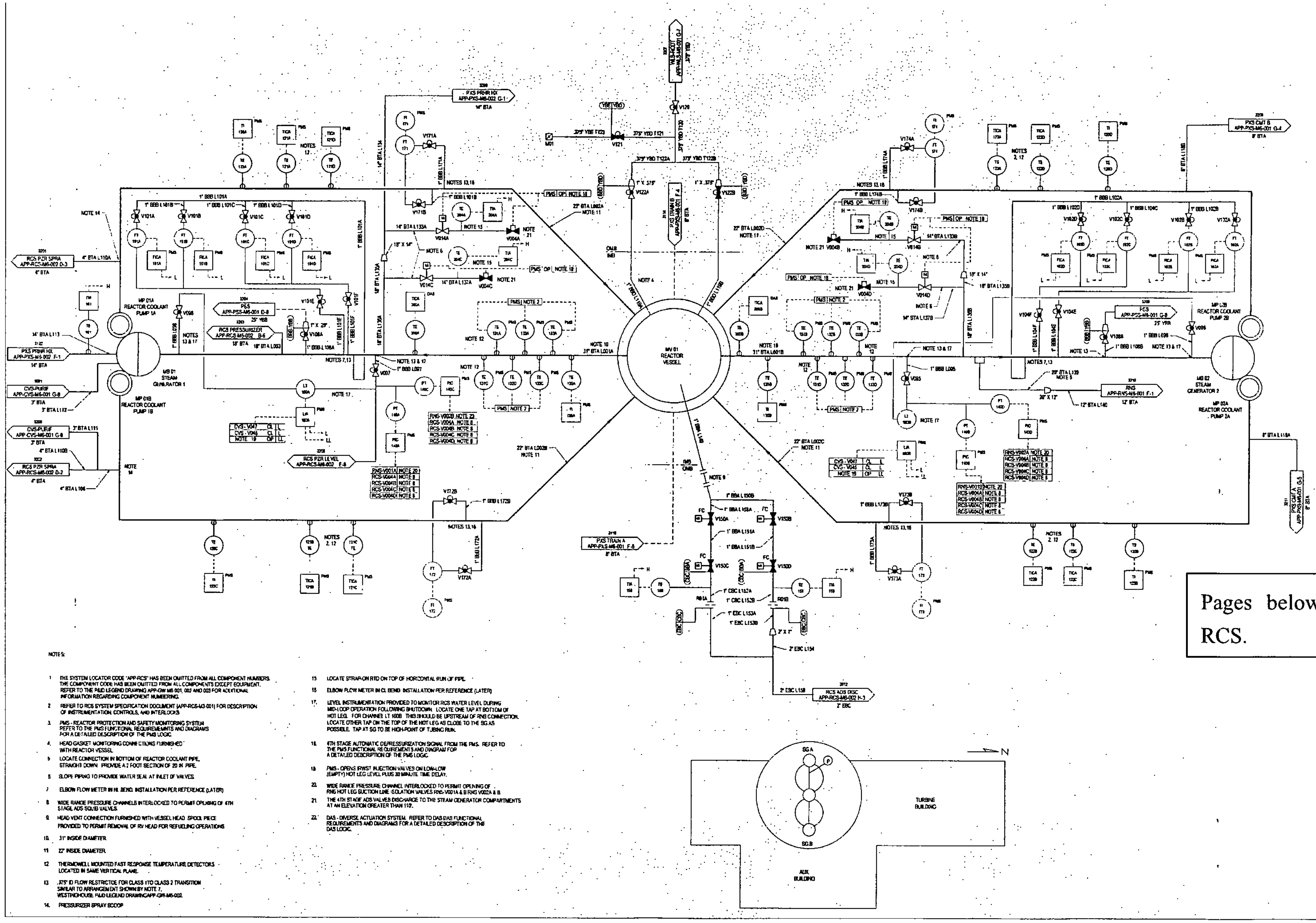
Title: Fluid System Changes



Pages below shows markup of RCS.

Figure 5.1-5 (Sheet 1 of 3)
Inside Reactor Containment

R15 Figure Mark-up
See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

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Title: Fluid System Changes

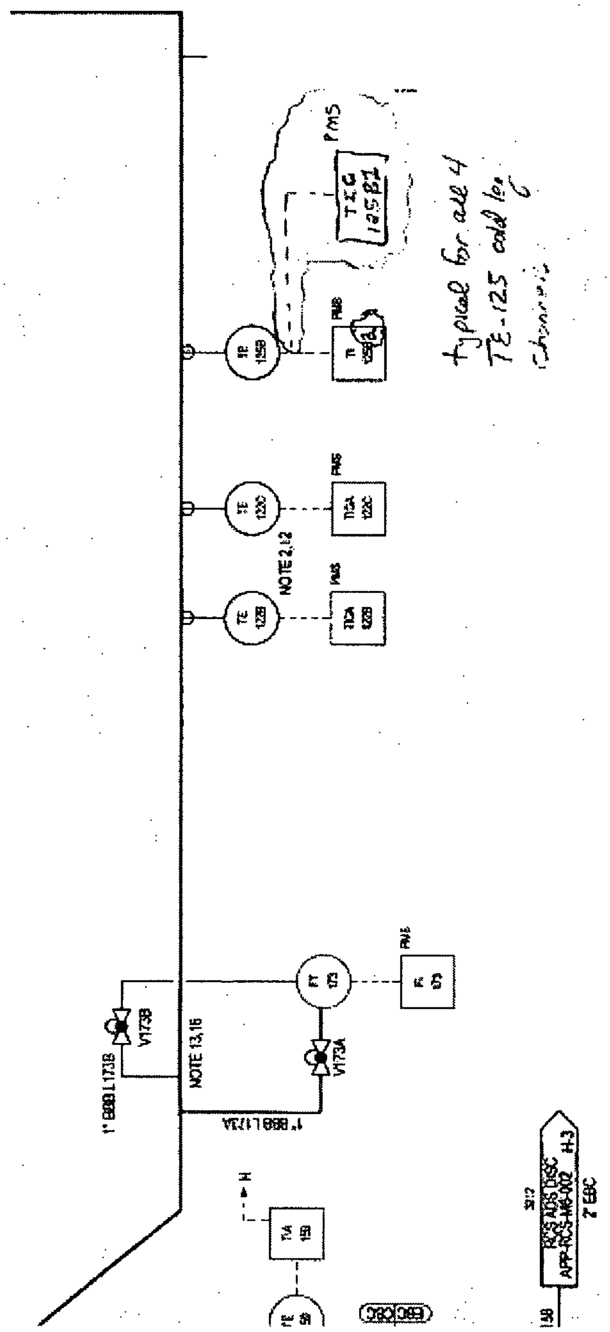

Figure 5.1-5 (Sheet 1 of 3)

R15 Figure Mark-up

See Section II.B.11 on page 16 of TR 103 for the description and justification of this change.

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Title: Fluid System Changes

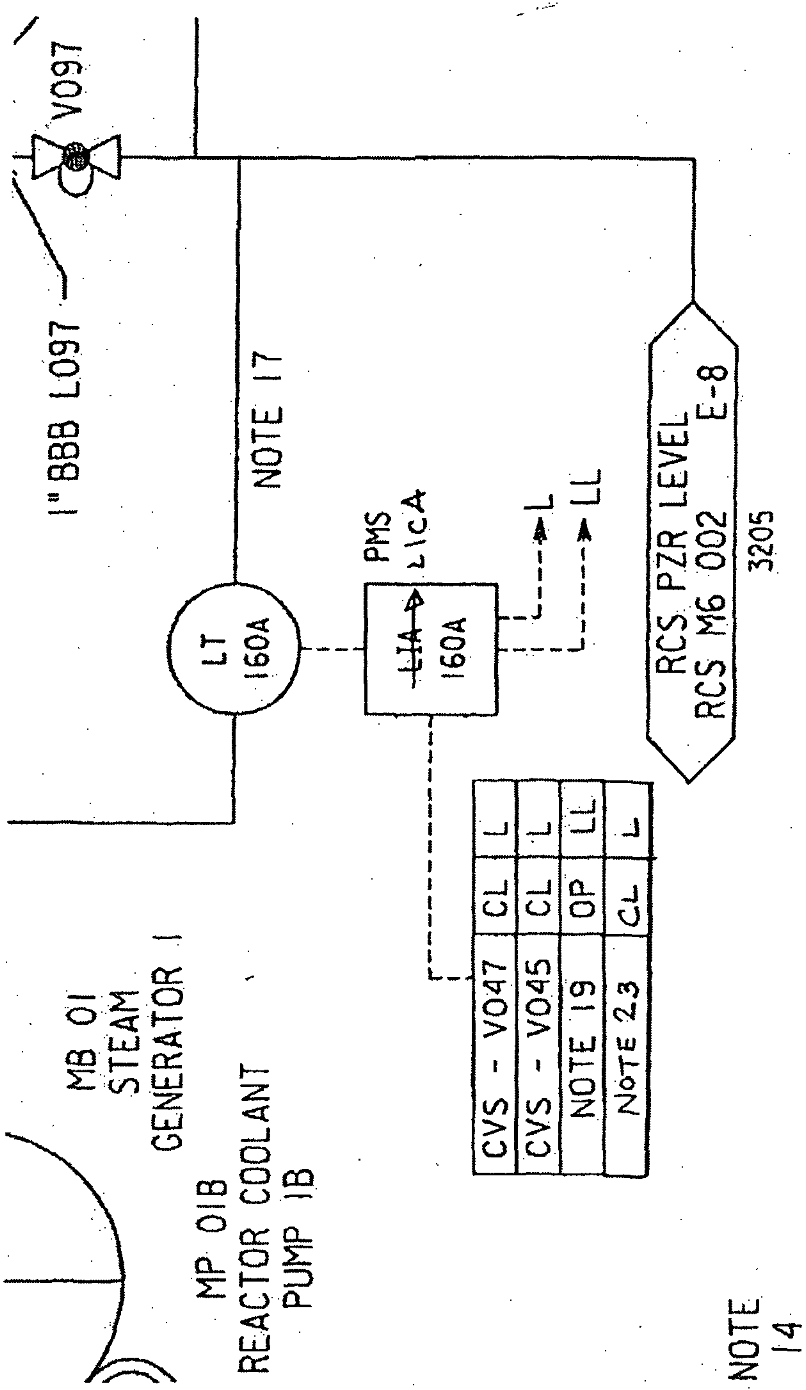

Figure 5.1-5 (Sheet 1 of 3)

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

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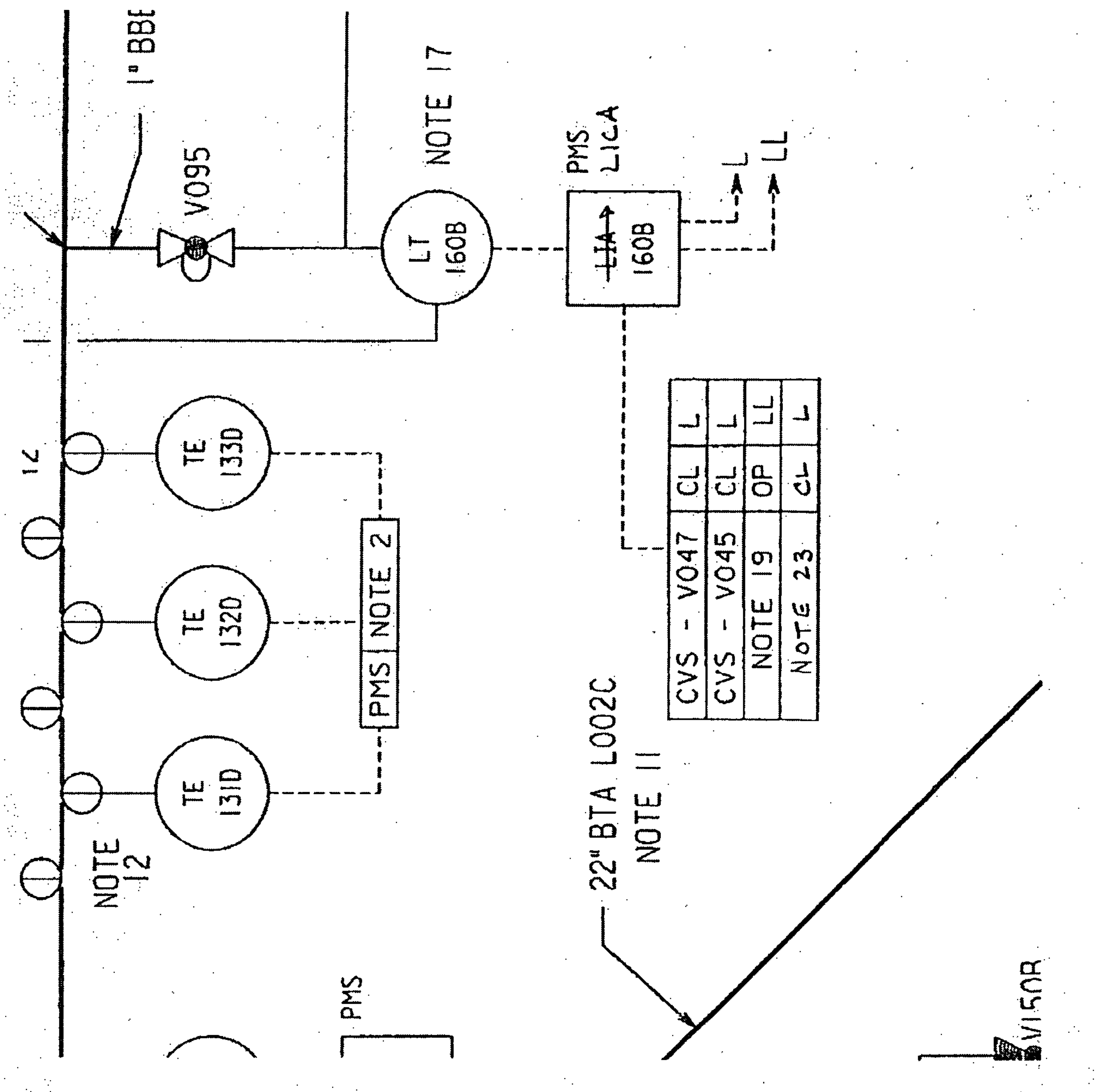


Figure 5.1-5 (Sheet 1 of 3)
Reactor Coolant System
Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

NOTES:

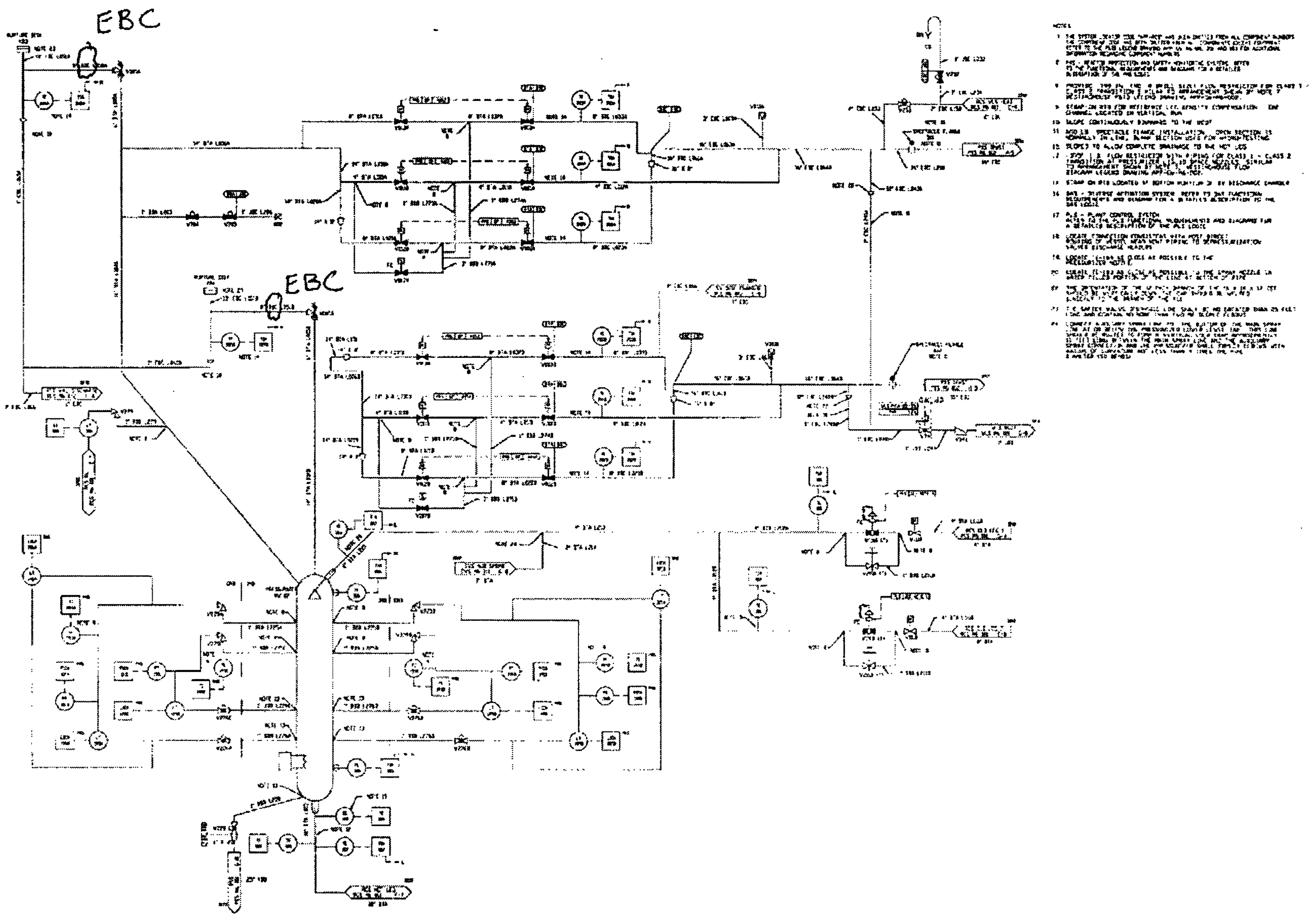
1. THE SYSTEM LOCATOR CODE "APP-RCS" HAS BEEN OMITTED FROM ALL COMPONENT NUMBERS. THE COMPONENT CODE HAS BEEN OMITTED FROM ALL COMPONENTS EXCEPT EQUIPMENT. REFER TO THE P&ID LEGEND DRAWING APP-GW M6 001, 002 AND 003 FOR ADDITIONAL INFORMATION REGARDING COMPONENT NUMBERING.
2. REFER TO RCS SYSTEM SPECIFICATION DOCUMENT (APP-RCS-M3-001) FOR DESCRIPTION OF INSTRUMENTATION, CONTROLS, AND INTERLOCKS.
3. PMS - REACTOR PROTECTION AND SAFETY MONITORING SYSTEM REFER TO THE PMS FUNCTIONAL REQUIREMEMNTS AND DIAGRAMS FOR A DETAILED DESCRIPTION OF THE PMS LOGIC.
4. HEAD GASKET MONITORING CONNECTIONS FURNISHED WITH REACTOR VESSEL.
5. LOCATE CONNECTION IN BOTTOM OF REACTOR COOLANT PIPE, STRAIGHT DOWN. PROVIDE A 2 FOOT SECTION OF 20 IN. PIPE.
6. SLOPE PIPING TO PROVIDE WATER SEAL AT INLET OF VALVES.
7. VELOCITY HEAD PROBE INSTALLATION PER REFERENCE (LATER). PROBE INCLUDES INTEGRAL .375" FLOW RESTRICTOR FOR CLASS 1 TO 2 TRANSITION.
8. WIDE RANGE PRESSURE CHANNELS INTERLOCKED TO PERMIT OPENING OF 4TH STAGE ADS SQUIB VALVES.
9. HEAD VENT CONNECTION FURNISHED WITH VESSEL HEAD. SPOOL PIECE PROVIDED TO PERMIT REMOVAL OF RV HEAD FOR REFUELING OPERATIONS.
10. 31" INSIDE DIAMETER.
11. 22" INSIDE DIAMETER.
12. THERMOWELL MOUNTED FAST RESPONSE TEMPERATURE DETECTORS LOCATED IN SAME VERTICAL PLANE.
13. .375" I.D. FLOW RESTRICTOR FOR CLASS 1 TO CLASS 2 TRANSITION SIMILAR TO ARRANGEMENT SHOWN BY NOTE 7, WESTINGHOUSE P&ID LEGEND DRAWING, APP-GW-M6-002.
14. PRESSURIZER SPRAY SCOOP.
15. LOCATE STRAP-ON RTD ON TOP OF HORIZONTAL RUN OF PIPE.
16. LOCATE VELOCITY HEAD PROBE AT LEAST 44 INCHES DOWNSTREAM OF THE PZR SPRAY SCOOP, ORIENTED ON THE OPPOSITE SIDE OF THE SCOOP.
17. LEVEL INSTRUMENTATION PROVIDED TO MONITOR RCS WATER LEVEL DURING MID-LOOP OPERATION FOLLOWING SHUTDOWN. LOCATE ONE TAP AT BOTTOM OF HOT LEG. FOR CHANNEL LT 160B, THIS SHOULD BE UPSTREAM OF RNS CONNECTION. LOCATE OTHER TAP ON THE TOP OF THE HOT LEG AS CLOSE TO THE SG AS POSSIBLE. TAP AT SG TO BE HIGH-POINT OF TUBING RUN.
18. 4th STAGE AUTOMATIC DEPRESSURIZATION SIGNAL FROM THE PMS. REFER TO THE PMS FUNCTIONAL REQUIREMENTS AND DIAGRAM FOR A DETAILED DESCRIPTION OF THE PMS LOGIC.
19. PMS - OPENS IRWST INJECTION VALVES ON LOW-LOW (EMPTY) HOT LEG LEVEL PLUS 30 MINUTE TIME DELAY.
20. WIDE RANGE PRESSURE CHANNEL INTERLOCKED TO PERMIT OPENING OF RNS HOT LEG SUCTION LINE ISOLATION VALVES RNS-V001A & B RNS V002A & B.
21. THE 4th STAGE ADS VALVES DISCHARGE TO THE STEAM GENERATOR COMPARTMENTS AT AN ELEVATION GREATER THAN 110'.
22. DAS - DIVERSE ACTUATION SYSTEM. REFER TO DAS DAS FUNCTIONAL REQUIREMENTS AND DIAGRAMS FOR A DETAILED DESCRIPTION OF THE DAS LOGIC.

23. PLS – Closes CVS-V059 to Isolate on Low Hot Leg Level During Midloop

Figure 5.1-5 (Sheet 1 of 3)
Reactor Coolant System
Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.



Inside Reactor Containment
Figure 5.1-5 (Sheet 2 of 3)

Reactor Coolant System
Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.B.15 on page 18 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

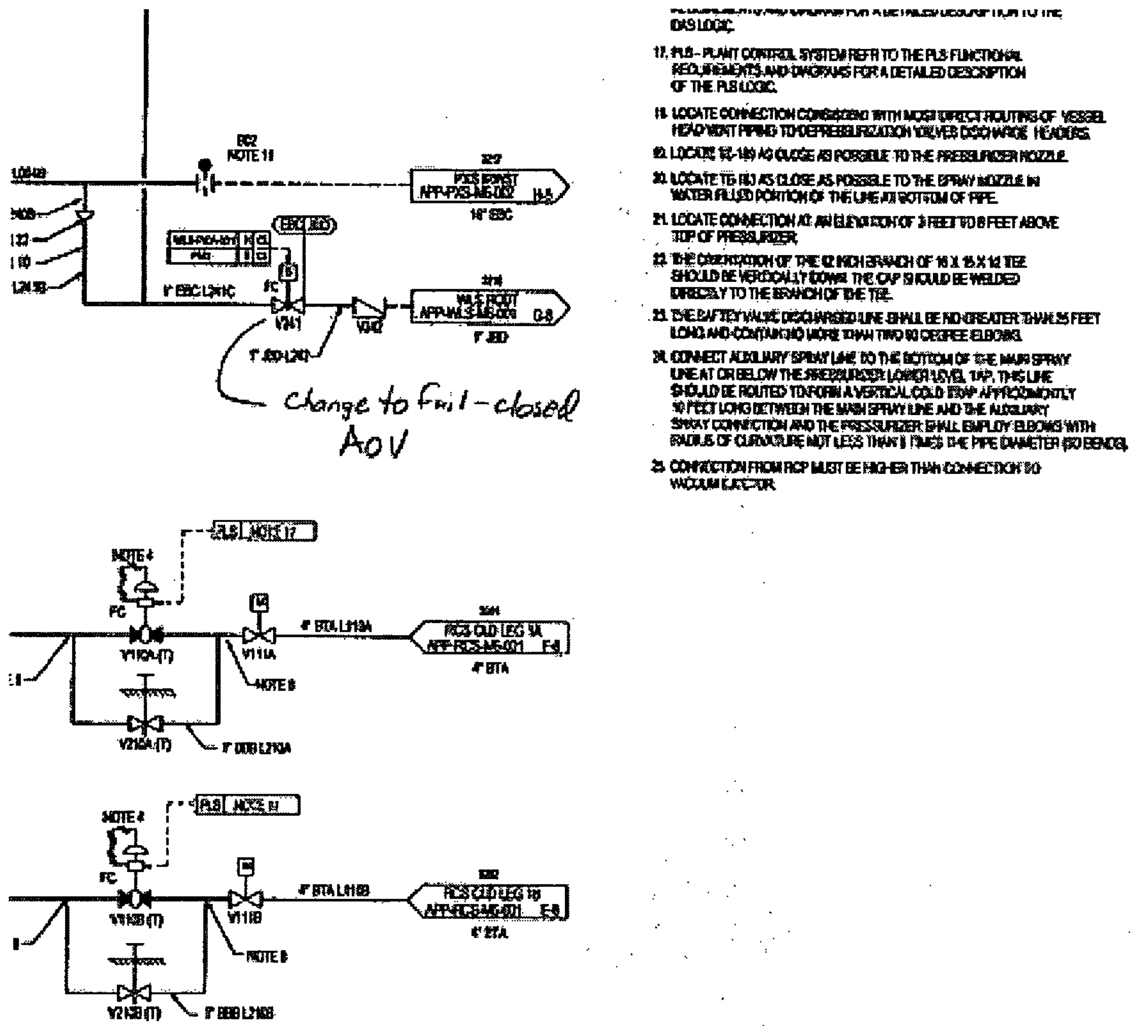


Figure 5.1-5 (Sheet 2 of 3)
Reactor Coolant System
Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.B.12 on page 17 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019   **Revision Number:** 2
Title: Fluid System Changes

See Section II.A.1 on page 4 of TR 103 for the description and justification of this change.

5.4.7.4.2 Plant Cooldown

Once the proper valve alignment has been performed and component cooling water flow has been initiated to both residual heat removal heat exchangers, normal residual heat removal system operation may begin. The pumps are started and the cooldown proceeds. The cooldown rate is controlled by throttling the flow through ~~the bypass around~~ the heat exchanger based on reactor coolant temperature.

Document Number:	APP-GW-GLN-019	**Revision Number:**	2
Title:	Fluid System Changes		

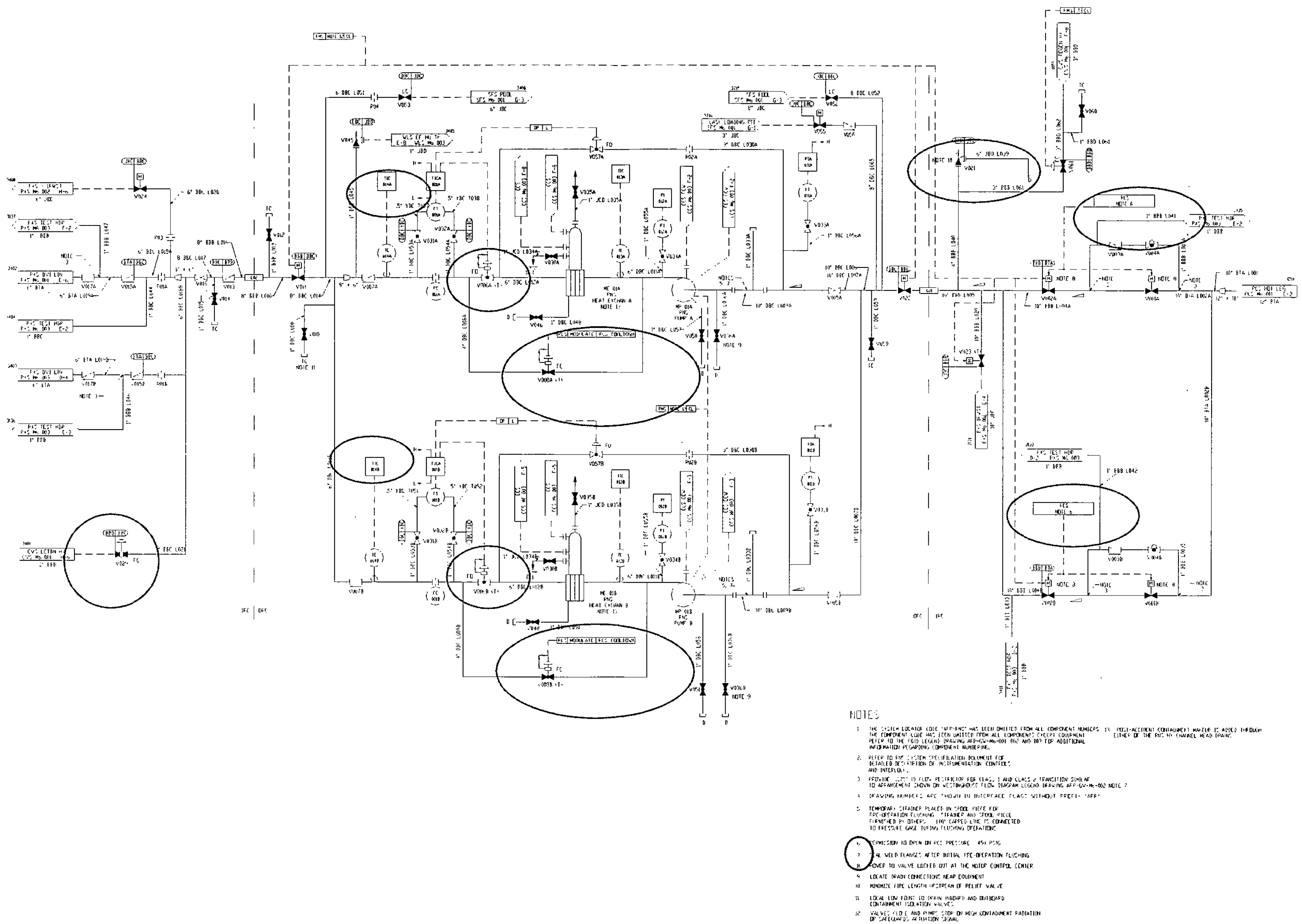


Figure 5.4-7
Normal Residual Heat Removal System
Piping and Instrument Diagram

R15 Figure Mark-up

See Section II.A.1 on page 4 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 Revision Number: 2

Title: Fluid System Changes

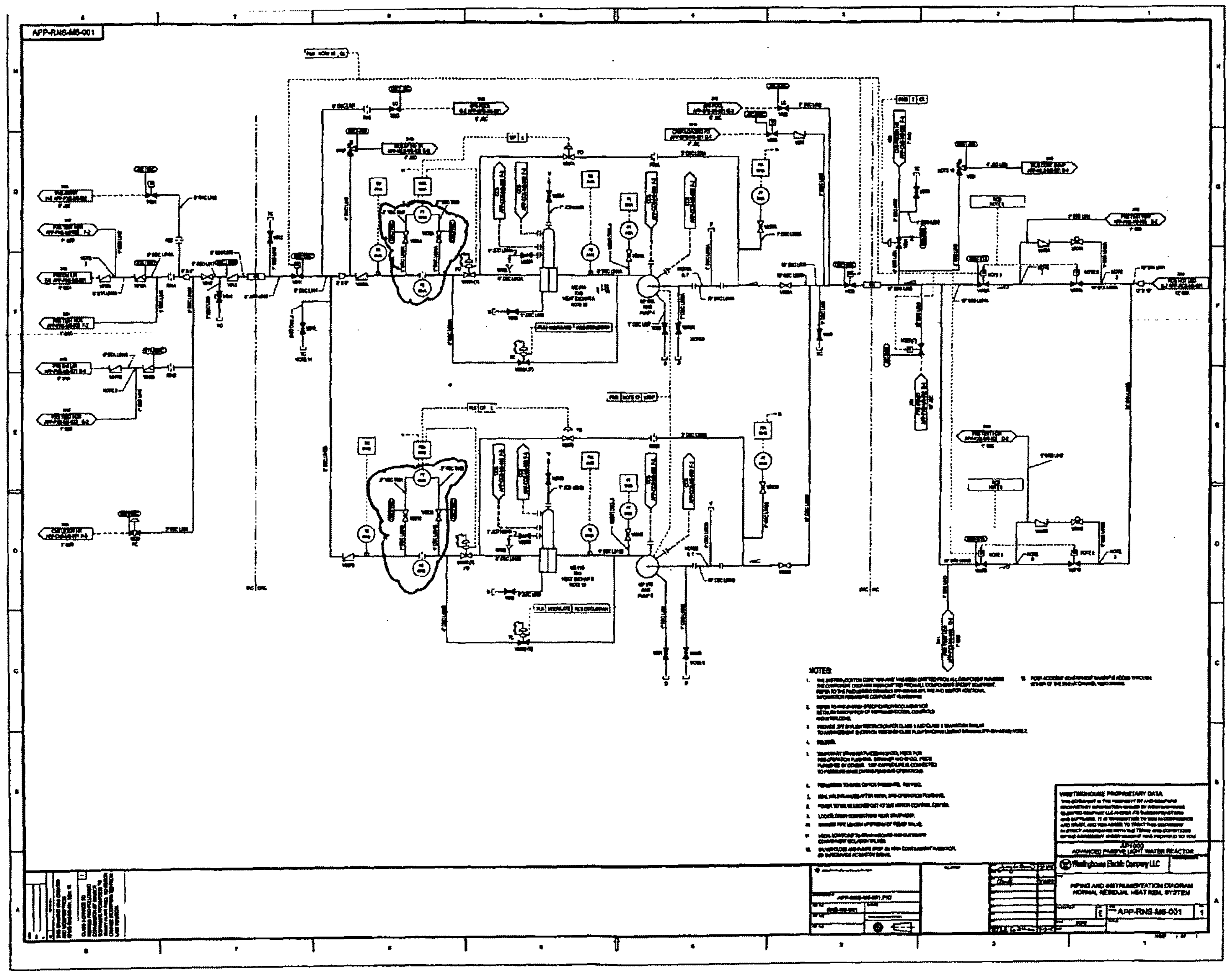


Figure 5.4-7
Normal Residual Heat Removal System
Piping and Instrument Diagram

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

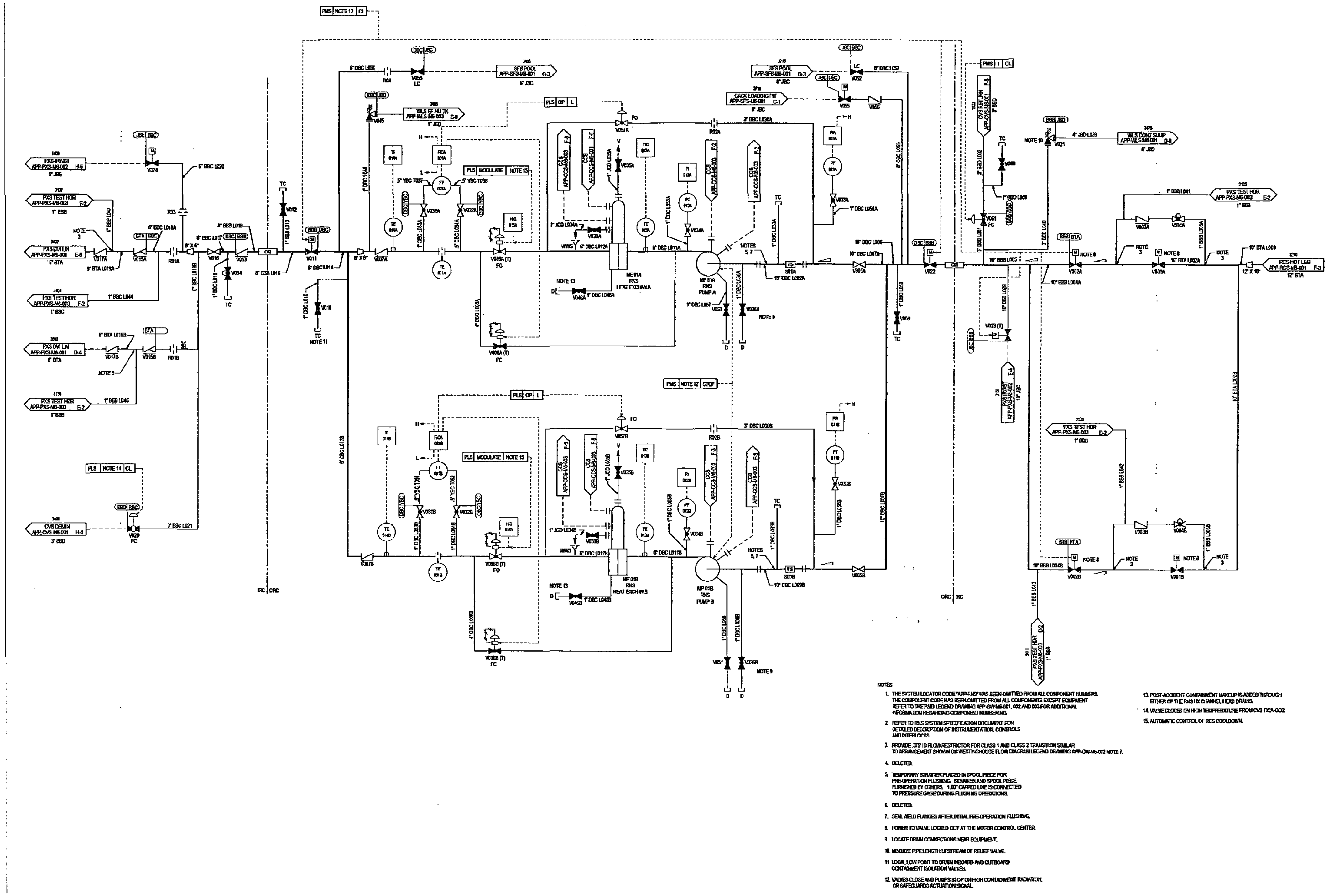
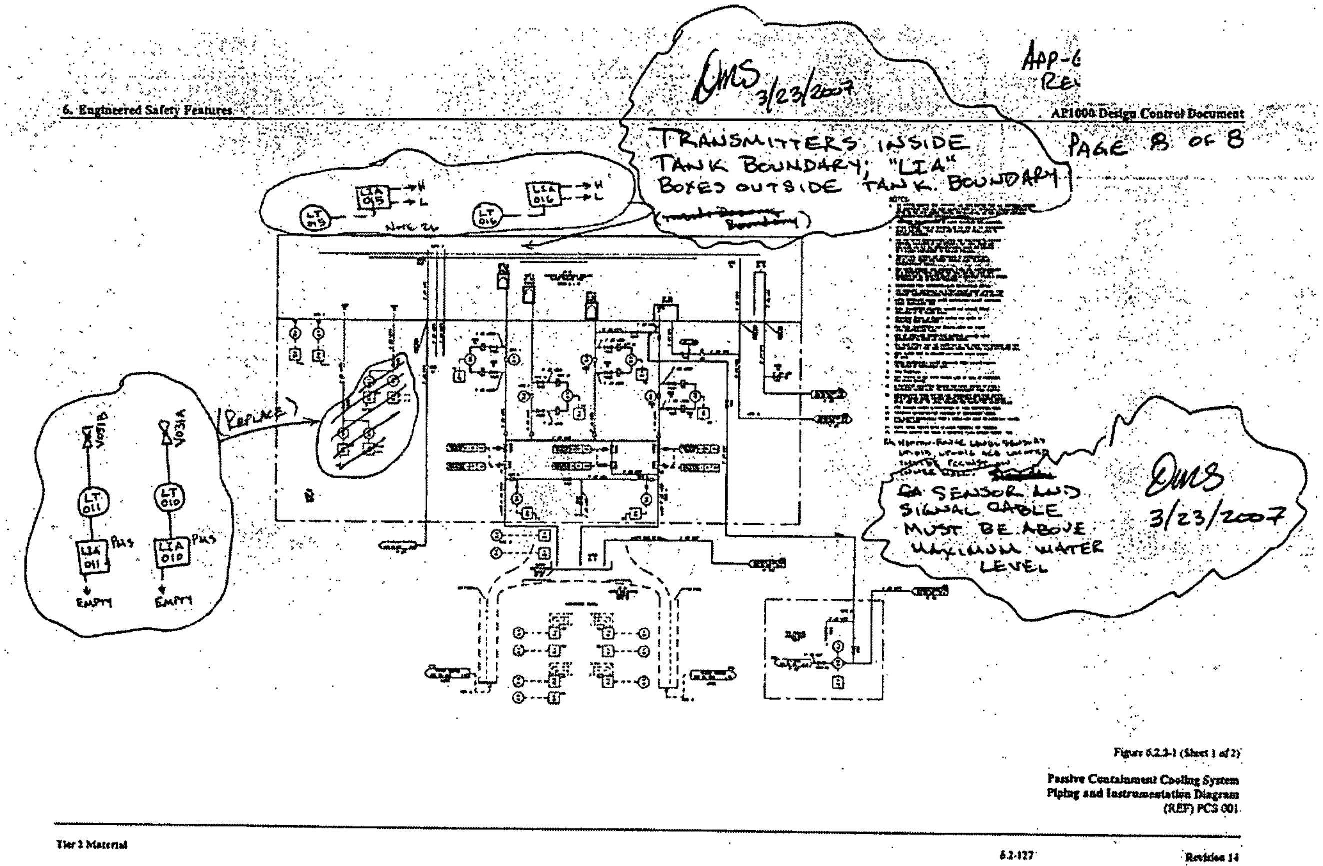


Figure 5.4-7

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes



R15 Figure Mark-up

See Section II.B.9 on page 15 of TR 103 for the description and justification of this change.

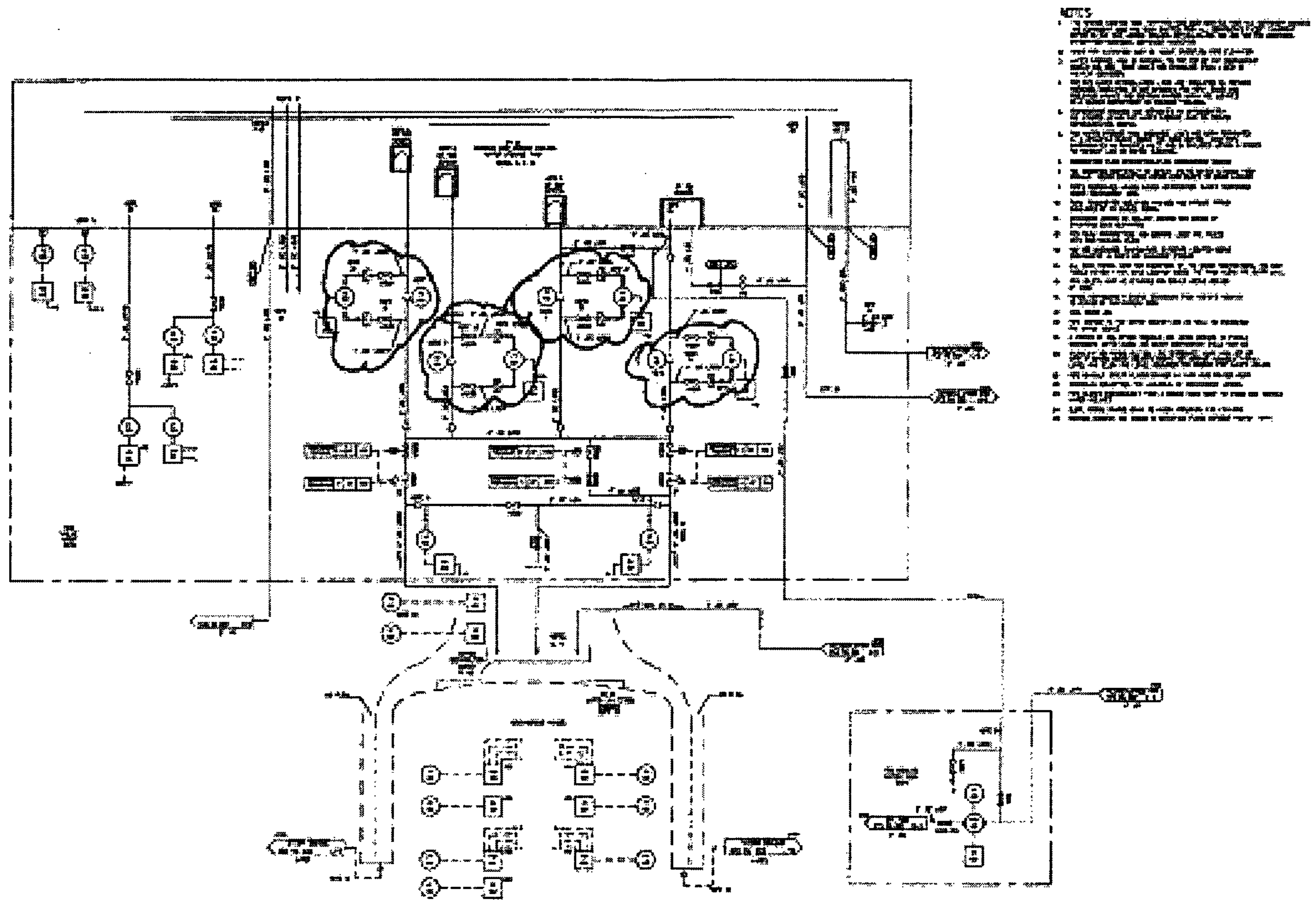


Figure 6.2.2-1 (Sheet 1 of 2)

Passive Containment Cooling System
Piping and Instrumentation Diagram
(REF) PCS 001

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

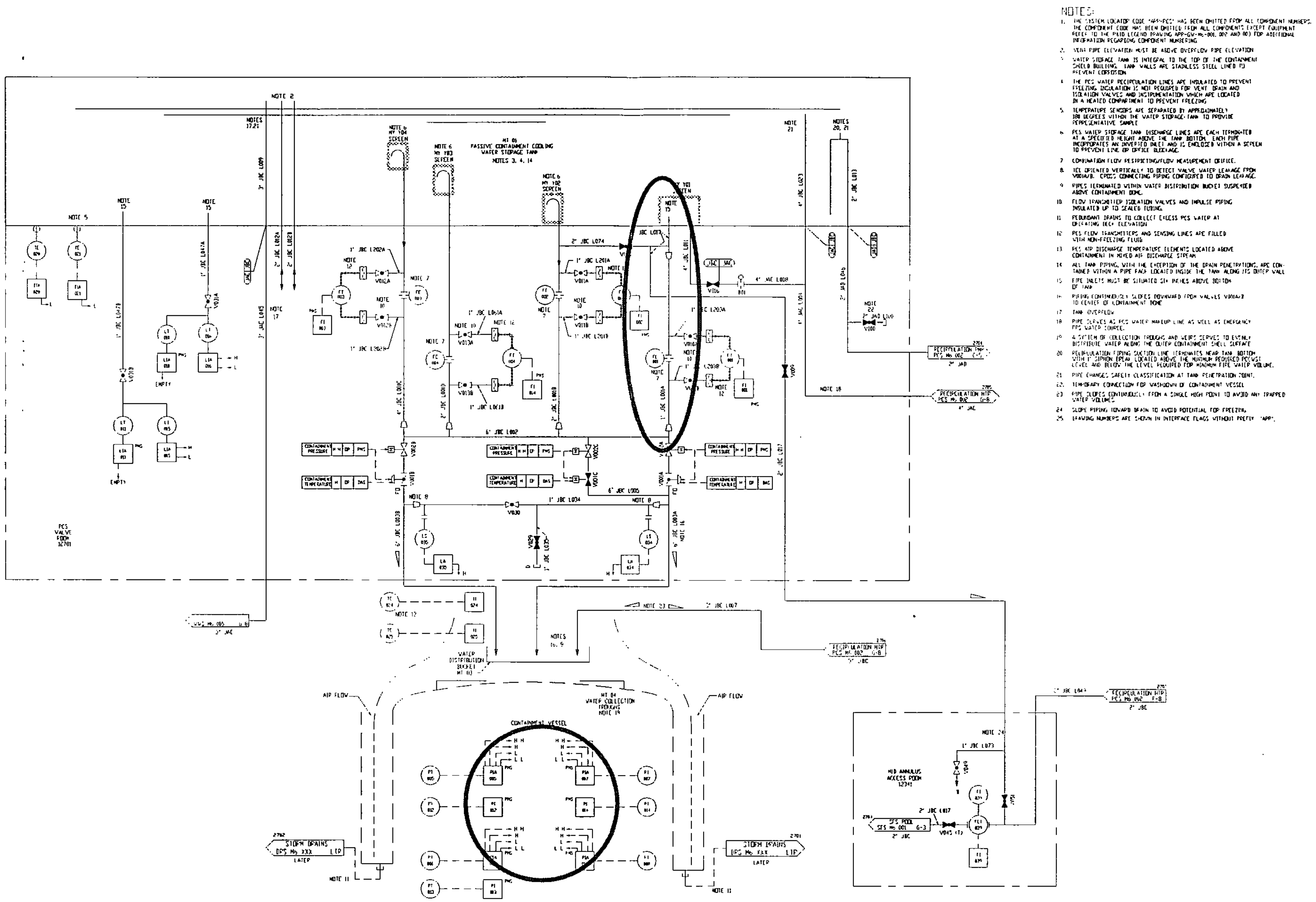


Figure 6.2.2-1 (Sheet 1 of 2)
Passive Containment Cooling System
Piping and Instrumentation Diagram
(REF) PCS 001

R15 Figure Mark-up

See Section II.B.5 on page 12 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

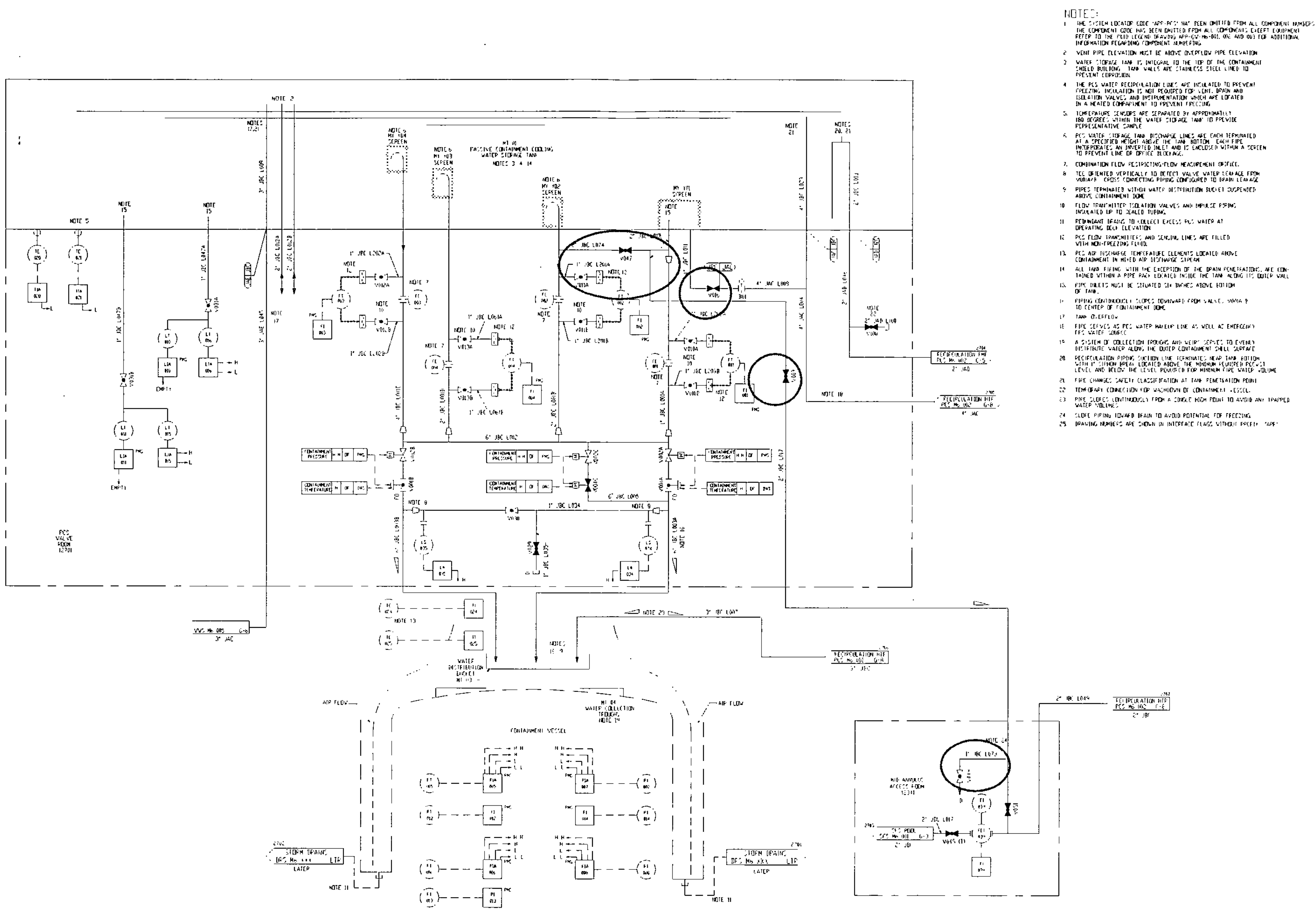


Figure 6.2.2-1 (Sheet 1 of 2)
Passive Containment Cooling System
Piping and Instrumentation Diagram
(REF) PCS 001

R15 Figure Mark-up

See Section II.E.1 on page 23 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

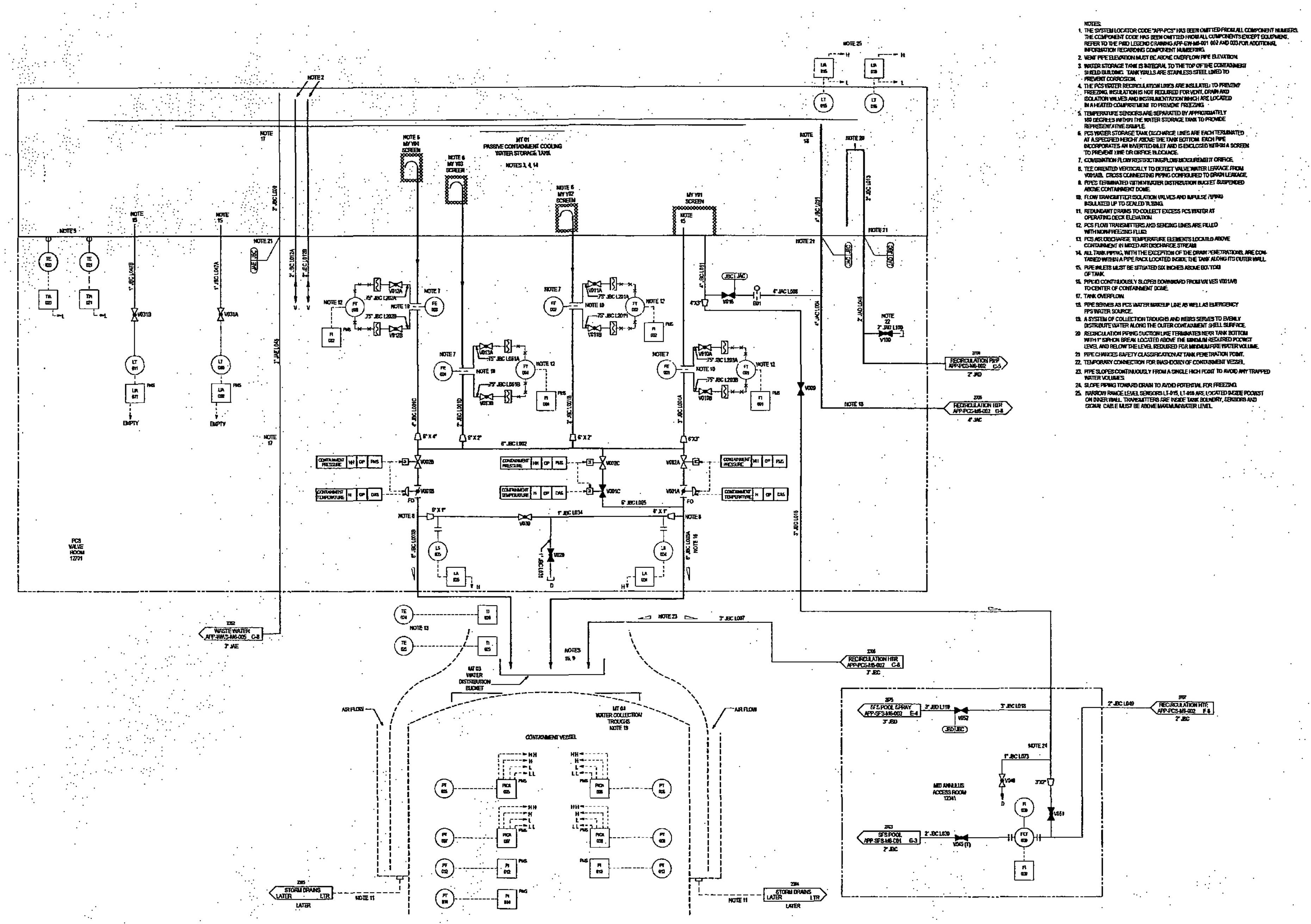
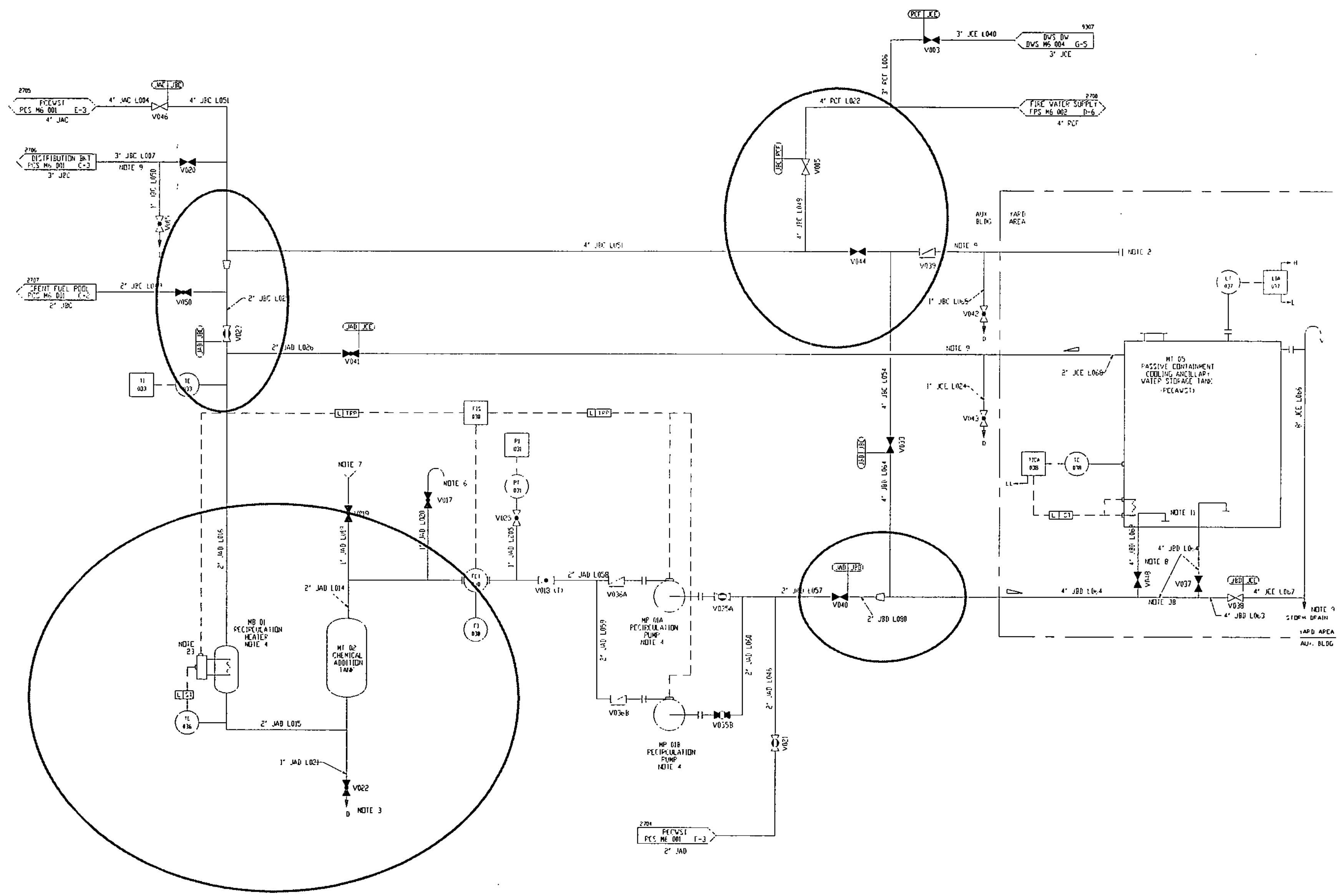


Figure 6.2.2-1 (Sheet 1 of 2)
Passive Containment Cooling System
Piping and Instrumentation Diagram
(REF) PCS

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes



NOTES:

1. THE SYSTEM LOCATOR CODE "APP-PCS" HAS BEEN OMITTED FROM ALL COMPONENT NUMBERS. THE COMPONENT CODE HAS BEEN OMITTED FROM ALL COMPONENTS EXCEPT EQUIPMENT. REFER TO THE P&ID LEGEND DRAWING APP-GW-M6-001, 002 AND 003 FOR ADDITIONAL INFORMATION REGARDING COMPONENT NUMBERING.
2. PIPING SLOPES DOWNWARD TOWARD DRAIN. FLANGED CONNECTION LOCATED AT GROUND LEVEL FOR CONVENIENT USE OF ALTERNATE WATER SOURCE (POST 72 HOUR MAKEUP) AND, FLANGE FITTED WITH FIRE NOZZEL FITTING PER LOCAL FIRE REGULATIONS
3. DRAIN LOCATED TO PROVIDE FOR CHEMICAL ADDITION TANK AND RECIRCULATION HEATER DRAIN
4. PUMP AND HEATER TRIP ON LOW FLOW
5. TANK AND THERMOSTATIC CONTROL ARE PROVIDED BY HEATER VENDOR.
6. SAMPLE CONNECTION
7. OPEN FUNNEL PROVIDES FOR CHEMICAL ADDITION TO CHEMICAL ADDITION TANK
8. TANK AND VALVES V037 AND V043 INSULATED TO AVOID FREEZING WITH OUT POWER TO HEATER FOR SEVEN DAYS.
9. SLOPE PIPING TOWARD DRAIN TO AVOID POTENTIAL FOR FREEZING
10. LINES L014, L015, L019, L016, L020, L026, L046, L053, L057, L058, L059, L060, L063, L064, L069, AND L205 ARE DESIGNED TO WITHSTAND A SAFE SHUTDOWN EARTH QUAKE.
11. TANK VOLUME CONTAINED BETWEEN THE TERMINATION POINTS OF LINES L064 AND L069 SHALL PROVIDE FOR THE MINIMUM FIRE WATER VOLUME
12. DRAWING NUMBERS ARE SHOWN IN INTERFACE FLAGS WITHOUT PREFIX "APP"

Figure 6.2.2-1 (Sheet 2 of 2)
Passive Containment Cooling System
Piping and Instrumentation Diagram
(REF) PCS 002

R15 Figure Mark-up

See Section II.B.1 on page 9 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

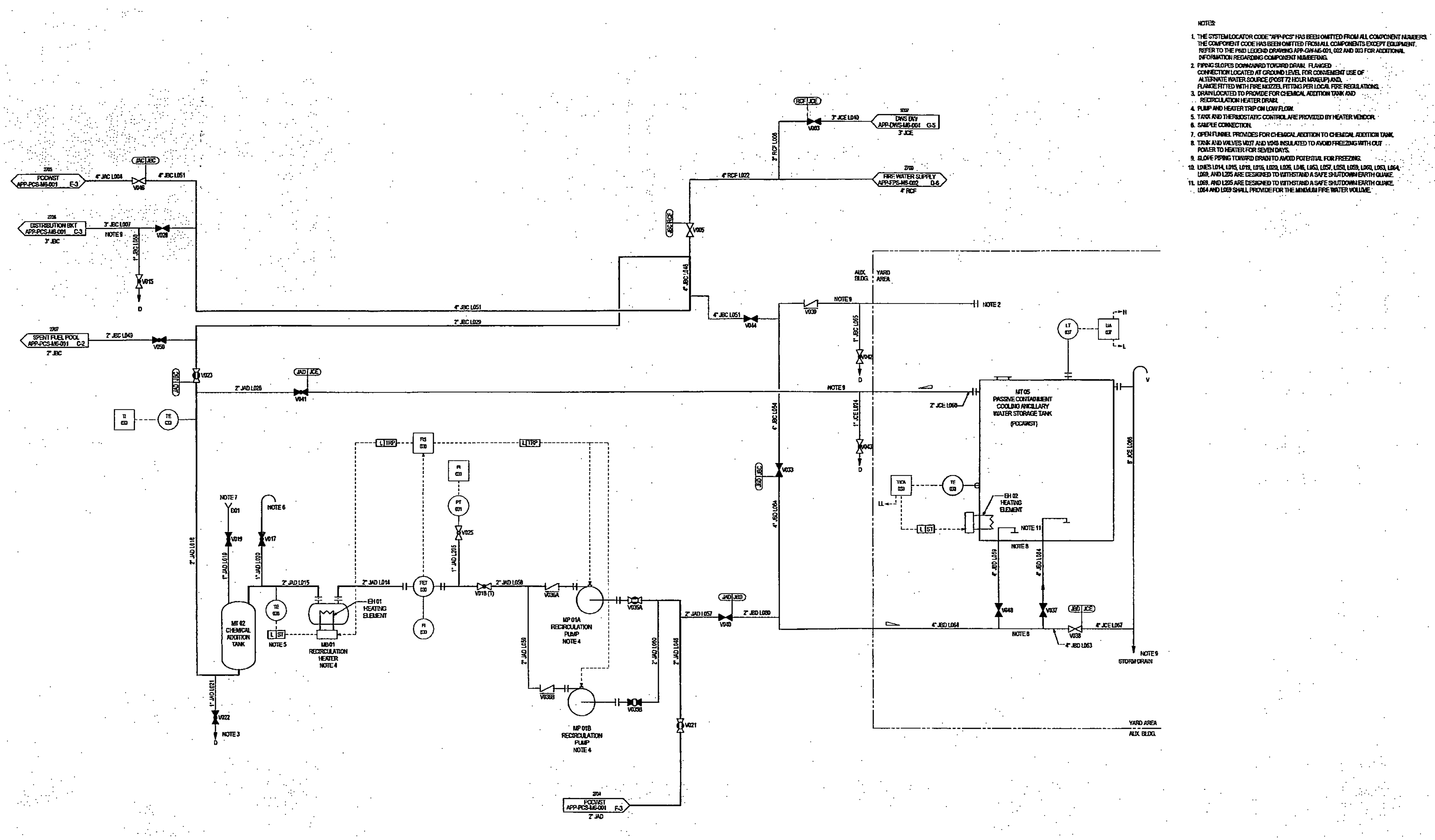


Figure 6.2.2-1 (Sheet 2 of 2)
Passive Containment Cooling System
Piping and Instrumentation Diagram
(REF) PCS 002

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

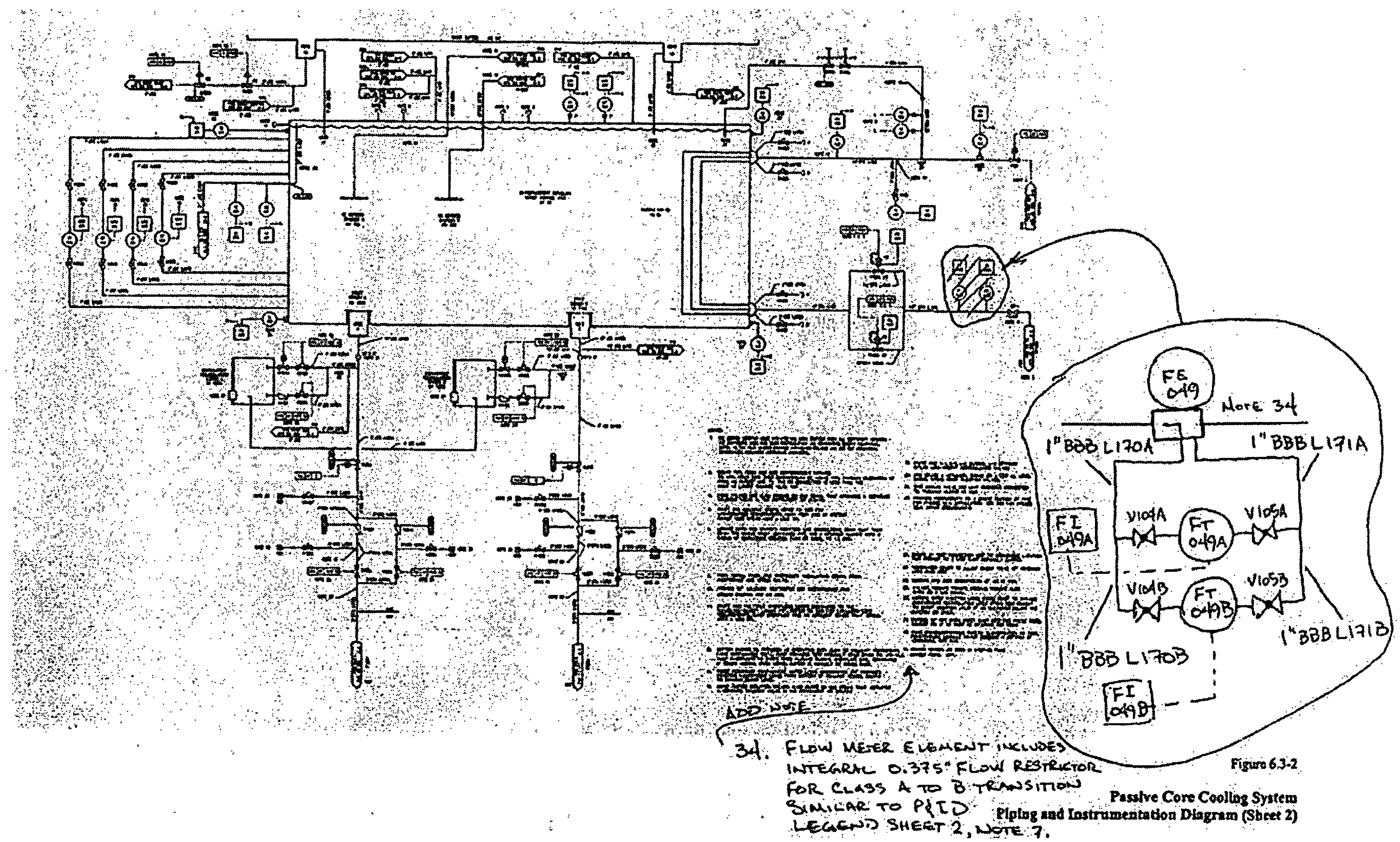


Figure 6.3-2
Differential Pressure Flowmeter for PRHR HX Flow

R15 Figure Mark-up

See Section II.B.8 on page 14 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

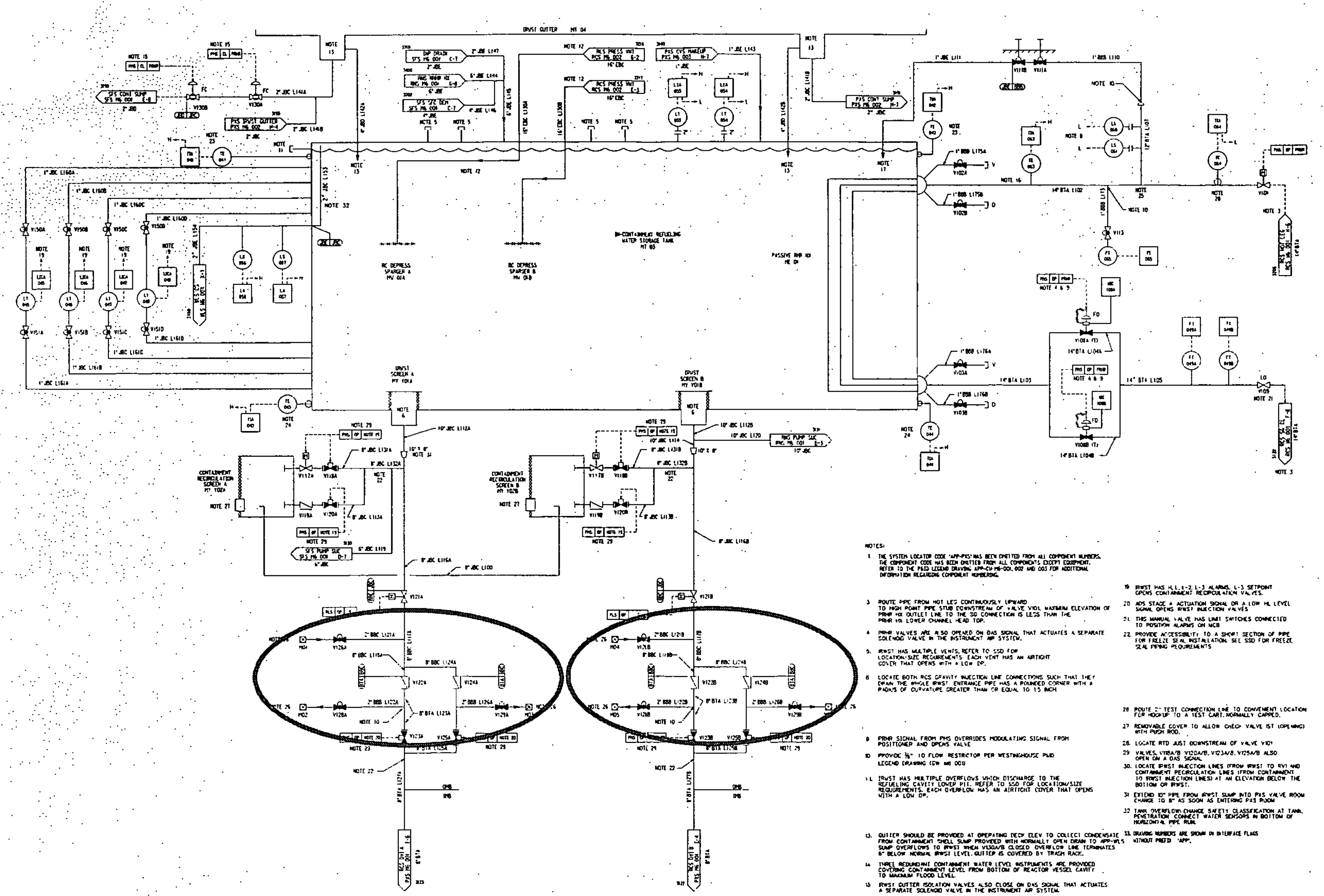


Figure 6.3-2(Sheet 2)
Passive Core Cooling System
Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.B.13 on page 17 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

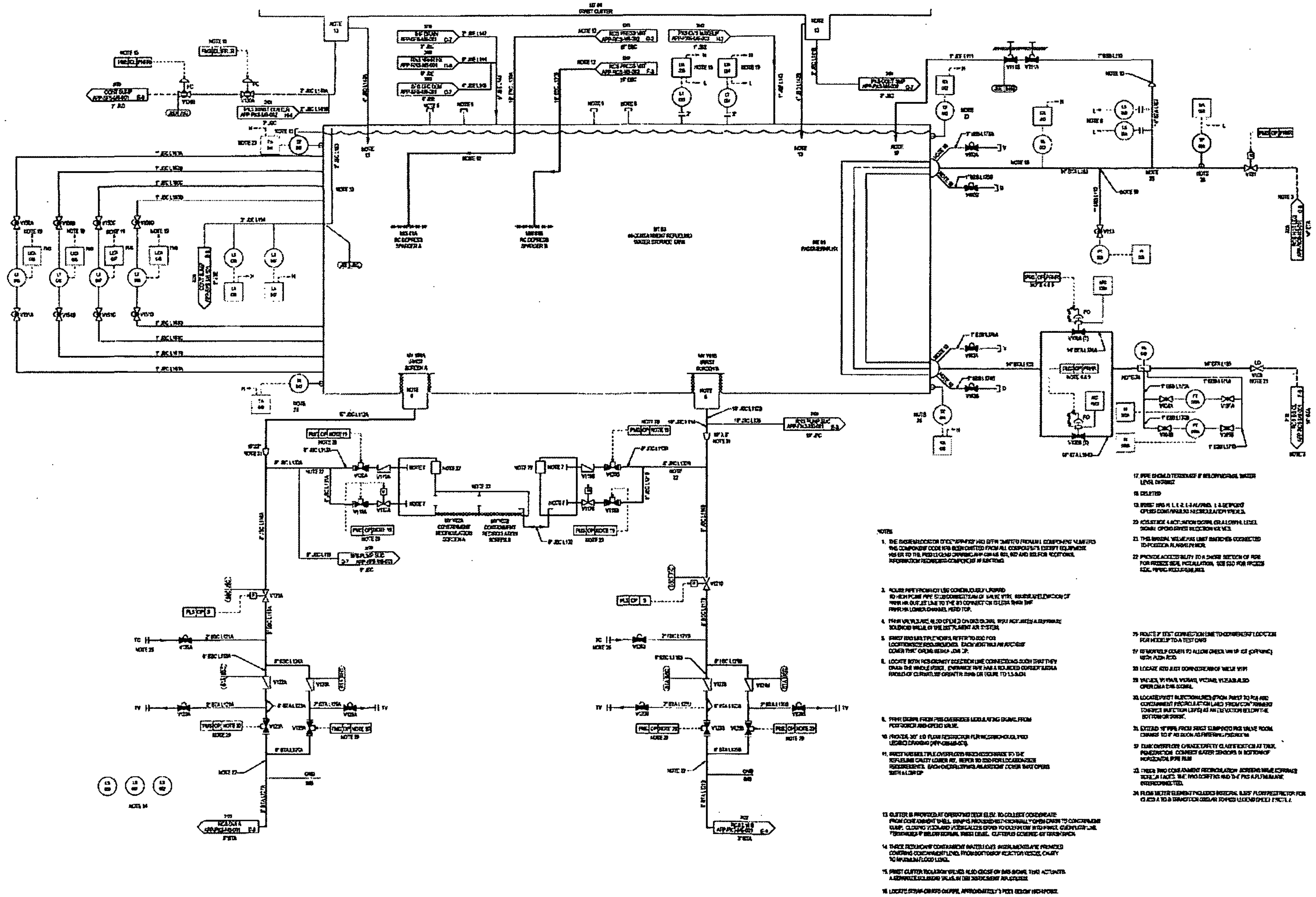


Figure 6.3-2(Sheet 2)
Passive Core Cooling System
Piping and Instrumentation Diagram

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

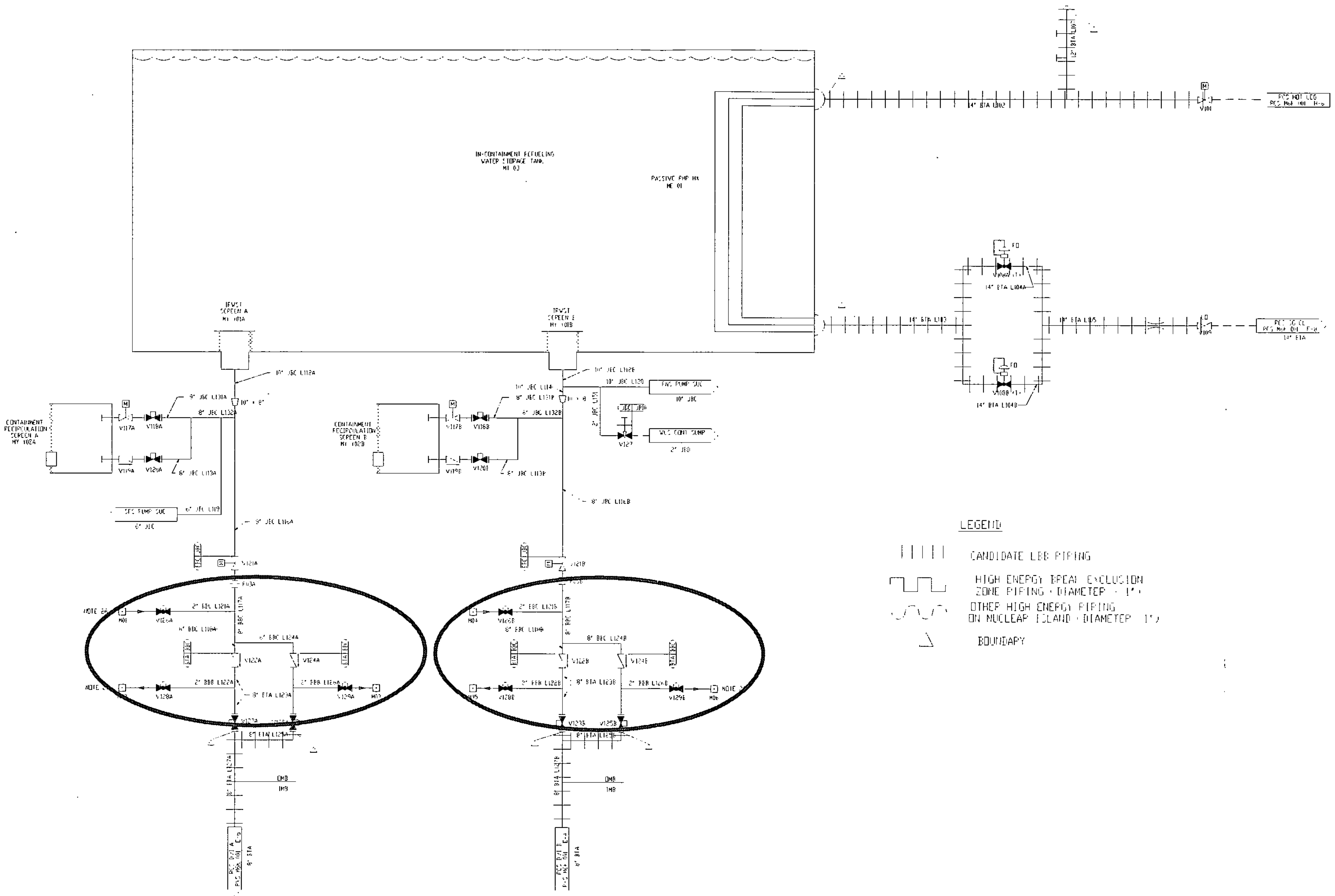


Figure 3E-4 (Sheet 2 of 2)
High Energy Piping – Passive Core Cooling System

R15 Figure Mark-up

See Section II.B.13 on page 17 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

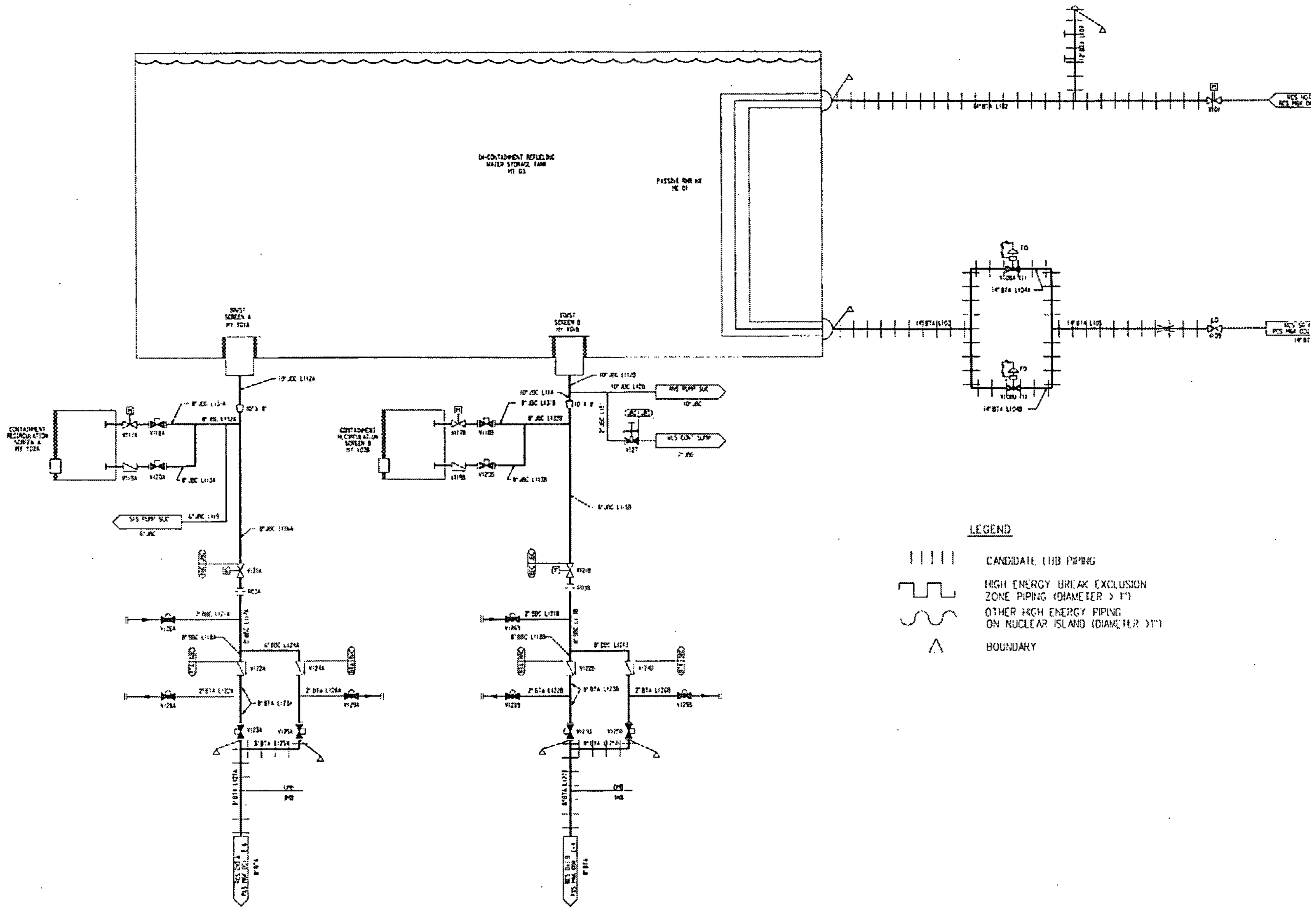


Figure 3E-4 (Sheet 2 of 2)
High Energy Piping – Passive Core Cooling System

Corrected R16 Figure

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

See Section II.A.5 on page 7 of TR 103 for the description and justification of the following changes.

Table 7.5-1 (Sheet 3 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
Startup feedwater flow	0-1000 gpm	F2	Mild	Yes	1/steam generator (Note 11)	1E	No	
Startup feedwater control valve status	Open/ Closed	D2, F3	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
Containment pressure	-5 to 10 psig	B1, C2, D2, F2	Harsh	Yes	3 (Note 4)	1E	Yes	
Containment pressure (extended range)	0 to 240 psig	C1	Harsh	Yes	3 (Note 4)	1E	Yes	
Containment area radiation (high range)	10^0-10^7 R	C1, E2, F2	Harsh	Yes	3 (Note 4)	1E	Yes	
Reactor vessel hot leg water level	0-100% of span	B2, B3	Harsh	Yes	1	1E	Yes	Two instruments are provided
Plant vent radiation level	(Note 3)	C2, E2	Mild	None	1	Non-1E	No	
Remotely operated containment isolation valve status	Open/ Closed	B1, D2	Harsh/mild	Yes	1/valve (Note 7)	1E	Yes	Separate divisions on series valves
Boundary environs radiation	N/A	C3, E3	None	None	N/A	Non-1E	No	Site specific
Hydrogen concentration	0-20%	C3	None	None	1	Non-1E	No	Three instruments are provided

Table 7.5-1 (Sheet 4 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
Class 1E dc switchboard voltages	0-150 Vdc	D2	Mild	Yes	1/switchboard	1E	Yes	
Diesel generator status	On/Off	F3	None	None	1/diesel generator	Non-1E	No	
Diesel generator load	0-6000 kW	F3	None	None	1/diesel generator	Non-1E	No	
Voltage for diesel-backed buses	0-8600V	F3	None	None	3/bus	Non-1E	No	
Power supply to diesel-backed buses	On/Off	F3	None	None	1/supply source/bus	Non-1E	No	
RCP bearing water temperature	70-450°F	F3	None	Yes	1/RCP (Note 10)	1E	No	
RCP breaker status	Open/ Closed	D2, F3	Mild	Yes	1/breaker (Note 11)	1E	No	
Reactor trip breaker status	Open/ Closed	D2	Mild	Yes	1/breaker (Note 11)	1E	No	
MCR air storage bottle pressure	0-5000 psig	D2	Mild	None	1	Non-1E	No	Two instruments are provided
Turbine stop valve status	Open/ Closed	D2	None (Note 12)	None	1/valve	Non-1E	No	
Turbine control valve status	Open/ Closed	D2	None (Note 12)	None	1/valve	Non-1E	No	
Pressurizer pressure	1700-2500 psig	B1, D2	Harsh	Yes	3 (Note 4)	1E	Yes	
Pressurizer safety valve status	Open/ Closed	D2	Harsh	None	1/valve	Non-1E	No	
Pressurizer heater power (current)	0-800 amps	F3	None	None	1/group	Non-1E	No	
Steam generator PORV status	Open/ Closed	D2, F3	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	

Table 7.5-1 (Sheet 5 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
Steam generator PORV block valve status	Open/ Closed	D2, F3	Harsh	Yes	1/valve (Note 7)	1E	Yes	
Steam generator safety valve status	Open/ Closed	D2	Harsh	None	1/valve	Non-1E	No	
Main feedwater isolation valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
Main feedwater flow	0-9x10^6 lb/hr	F3	None	None	1/feedline	Non-1E	No	
Main feedwater control valve status	Open/ Closed	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
Steam generator blowdown isolation valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
Steam flow	0-9x10^6 lb/hr	F3	None	None	1/steam generator	Non-1E	No	
Main steam line isolation valve status	Open/ Closed	D2, F3	Harsh	Yes	1/valve (Note 7)	1E	Yes	
Main steam line isolation bypass valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
Main feedwater pump status	On/Off	D2, F3	Mild	None	1/pump	Non-1E	No	
Main to startup feedwater crossover valve status	Open/ Closed	D2, F3	Mild	None	1/valve	Non-1E	No	
Startup feed-water pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Circulating water pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Condenser backpressure	0-1 atm	F3	None	None	1	Non-1E	No	

Table 7.5-1 (Sheet 6 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
Startup feedwater Isolation valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
Condenser steam dump valve status	Open/ Closed	D2, F3	Mild	None	1/valve	Non-1E	No	
Condensate storage tank water level	0-100% of span	F3	None	None	1	Non-1E	No	
PCS water storage tank isolation valve status (Non-MOV)	Open/ Closed	D2	Mild	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
PCS water storage tank series isolation valve status (MOV)	Open/ Closed	D2	Mild	Yes	1/valve (Note 7)	1E	Yes	
Containment temperature	32-400°F	D2, F3	Harsh	None	1	Non-1E	No	
CCS surge tank level	0-100% of span	F3	None	None	1	Non-1E	No	
CCS flow	0-15,000 gpm	F3	None	None	1	Non-1E	No	
CCS pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
CCS flow to RNS valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
CCS flow to RCPs valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
CCS pump inlet temperature	50-200°F	F3	None	None	1	Non-1E	No	
CCS heat exchanger outlet temperature	50-130°F	F3	None	None	1	Non-1E	No	
Containment fan cooler status	On/Off	F3	None	None	1/fan	Non-1E	No	

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

Table 7.5-1 (Sheet 7 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
Water-cooled chiller status	On/Off	F3	None	None	1/chiller	Non-1E	No	
Water-cooled chilled water pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Water-cooled chilled water valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
Spent fuel pool pump flow	0-1500 gpm	F3	None	None	1/pump	Non-1E	No	
Spent fuel pool temperature	50-250°F	F3	None	None	1	Non-1E	No	
Spent fuel pool water level	0-100% of span	D2, F3	Mild	Yes	3 (Note 4)	1E	Yes	
CMT discharge isolation valve status	Open/ Closed	D2	Harsh	~~No~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
CMT inlet isolation valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
CMT upper water level switch	Above/ Below	D2, F2	Harsh	Yes	1/tank	1E	Yes	
CMT lower water level switch	Above/ Below	D2, F2	Harsh	Yes	1/tank	1E	Yes	
IRWST injection isolation valve (Squib)	Open/ Closed	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
IRWST line isolation valve status (MOV)	Open/ Closed	D3	None	None	1/valve	Non-1E	No	
ADS: first, second and third stage valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	

Table 7.5-1 (Sheet 8 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
ADS fourth stage valve status (Non-MOV)	Open/ Closed	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
ADS fourth stage valve status (MOV)	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
PRHR HX inlet isolation valve status	Open/ Closed	D2	Harsh	Yes	1 (Note 7)	1E	Yes	
PRHR HX control valve status	Position	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
IRWST gutter bypass isolation valve status	Open/ Closed	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
Accumulator pressure	100-800 psig	D2	Harsh	None	1/tank	Non-1E	No	
Accumulator isolation valve status	Open/ Closed	D3	None	None	1/valve	Non-1E	No	
Accumulator vent valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
Pressurizer spray valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
Auxiliary spray line isolation valve status	Open/ Closed	D2, F3	Harsh	~~None~~ Yes	1	~~Non-1E~~ 1E	~~No~~ Yes	
Purification stop valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 11)	1E	No	
Containment recirculation isolation valve status (Non-MOV)	Open/ Closed	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
Containment recirculation isolation valve status (MOV)	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	

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Table 7.5-1 (Sheet 9 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
Purification return line stop valve status	Open/ Closed	D2	Harsh	None	1	Non-1E	No	
Boric acid tank level	0-100%	F3	None	None	1	Non-1E	No	
Demineralized water isolation valve status	Open/ Closed	D2	Mild	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
Boric acid flow	0-300 gpm	F3	None	None	1	Non-1E	No	
Makeup blend valve status	Position	F3	None	None	1	Non-1E	No	
Makeup flow	0-300 gpm	F3	None	None	1	Non-1E	No	
Makeup pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Makeup flow control valve status	Position	F3	None	None	1	Non-1E	No	
Letdown flow	0-250 gpm	F3	None	None	1	Non-1E	No	
RNS hot leg suction isolation valve status	Open/ Closed	D2	Harsh	Yes	1/valve (Note 7)	1E	Yes	
RNS flow	0-3000 gpm	F3	None	None	1/pump	Non-1E	No	

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Table 7.5-1 (Sheet 10 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
IRWST to RNS suction valve status	Open/ Closed	B1, F3	Harsh	Yes	1 (Note 7)	1E	Yes	
RNS discharge to IRWST valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
RNS pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Reactor vessel head vent valve status	Open/ Closed	D2	Harsh	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
MCR return air isolation valve status	Open/ Closed	D2, F3	Mild	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
MCR toilet exhaust isolation valve status	Open/ Closed	D2	Mild	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
MCR supply air isolation valve status	Open/ Closed	D2, F3	Mild	~~None~~ Yes	1/valve	~~Non-1E~~ 1E	~~No~~ Yes	
MCR differential pressure	-1" to +1" wg	D2	Mild	Yes	2	1E	Yes	
MCR air delivery flowrate	0-80 cfm	D2	Mild	Yes	2	1E	Yes	

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Table 7.5-1 (Sheet 11 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
MCR air delivery isolation valve status	Open/ Closed	D2	Mild	~~None~~ <u>Yes</u>	1/valve	~~Non-1E~~ <u>1E</u>	~~No~~ <u>Yes</u>	
Instrument air header pressure	0-125 psig	F3	None	None	1	Non-1E	No	
Service water flow	0-10,000 gpm	F3	None	None	1/pump	Non-1E	No	
Service water pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Service water pump discharge valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
Service water pump discharge temperature	50-150°F	F3	None	None	1/pump	Non-1E	No	
Main control room supply air radiation	Note 5	E3, F3	Mild	Yes	2 (Note 9)	1E	No	
Plant vent air flow	0-110% design flow	E2	Mild	None	1	Non-1E	No	
Turbine island vent discharge radiation level	10^{-6} - 10^{+5} μCi/cc	C2, E2	Mild	None	1	Non-1E	No	
Steam generator blowdown discharge radiation	10^{-6} - 10^{-1} μCi/cc	C2	Mild	None	1	Non-1E	No	
Steam generator blowdown brine radiation level	10^{-6} - 10^{-1} μCi/cc	C2	Mild	None	1	Non-1E	No	

See Section II.A.6 on page 7 of TR 103 for the description and justification of the following changes.

DCD Section 7.7.1.8.1

The transition from the low to the high-power control mode is initiated on the basis of the filtered high range feedwater flow signal. The transition point is set at a feedwater flow corresponding to a power at which reliable steam flow indication is expected. The transition point is also low enough to allow effective feedforward control using wide range water level, and to allow feedwater flow indication within the upper limit of the low range feedwater flow measurement. If feedwater flow indication falls below the lower limit of the effective span of the low range feedwater flow measurement, integration (reset) action of the low-power mode feedwater flow controller is inhibited. Tracking is provided to allow a smooth transition between control modes and between manual and automatic control.

~~The feedwater valve lift required to provide the demanded feedwater flow is computed on the basis of the estimated ΔP available across the feedwater control valve, and the C_V characteristic of the valve. This compensation improves the response to changes in system ΔP, such as following the loss of one feedwater pump during high-power operation.~~

A high steam generator water level signal reduces the feedwater flow demand signal and closes the feedwater control valves.

DCD Section 7.7.1.8.2

The startup feedwater control subsystem regulates the flow of feedwater in a manner which is similar to the way (main) feedwater is controlled in the low-power control mode. Feedwater flow is regulated in response to changes in steam generator wide-range water level and PI-compensated steam generator narrow range water level deviation from setpoint. Tracking is provided to allow a smooth transition between control modes and between manual and automatic control.

~~The startup feedwater control valve lift required to provide the demanded startup feedwater flow is computed on the basis of the estimated ΔP available across the startup feedwater control valve, and the C_V characteristic of the valve. This compensation improves the response to changes in system ΔP, such as during plant heatup or cooldown where the steam pressure can change drastically.~~

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See Section II.B.17 on page 19 of TR 103 for the description and justification of the following changes.

9.1.3.1.3.1 Partial Core

The spent fuel pool cooling system is designed to remove heat from the spent fuel pool such that the spent fuel pool water temperature will be ≤ 120°F following a partial core fuel shuffle refueling. The system is designed to perform this function based on the following:

- The assumed heat load is based on the decay heat generated by the accumulated maximum number of fuel assemblies stored in the fuel pool ~~for 10 years plus~~, which includes 44% of a core (69~~68~~ assemblies) being placed into the pool beginning at 120 hours after shutdown.
- Both trains of the spent fuel pool cooling system are assumed to be operating.
- The component cooling water system (CCS) supply temperature to the spent fuel pool cooling system heat exchangers is based on a service water system heat sink with a maximum normal ambient design wet bulb temperature as defined in Chapter 2, Table 2-1.

9.1.3.1.3.2 Full Core Off-Load

The AP1000 normal refueling basis heat load is from a full core off-load. The spent fuel pool cooling system is designed to remove heat from the spent fuel pool such that the spent fuel pool water temperature will be ≤ 120°F following a full core off-load based upon a service water heat sink at a maximum normal ambient wet bulb temperature as defined by Chapter 2, Table 2-1. The system is designed to perform this function based on the following:

- The assumed heat load is based on the decay heat generated by the accumulated fuel assemblies stored in the fuel pool for 10 years, plus one full core placed in the pool at 120 hours after shutdown. The time during the plant operating cycle at which the full core off-load occurs is chosen to maximize the required spent fuel pool cooling system heat load.
- The assumed heat load is based on the decay heat generated by the accumulated maximum number of fuel assemblies stored in the fuel pool ~~for ten years~~, plus one full core placed in the pool at 120 hours after shutdown. The time during the plant operating cycle at which the full core off-load occurs is chosen to maximize the required spent fuel pool cooling system heat load.

9.1.3.4.3 Abnormal Conditions

The AP1000 spent fuel pool cooling system is not required to operate to mitigate design basis events. In the event the spent fuel pool cooling system is unavailable, spent fuel cooling is provided by the heat capacity of the water in the pool. Connections to the spent fuel pool are made at an elevation to preclude the possibility of inadvertently draining the water in the pool to an unacceptable level.

In the unlikely event of an extended loss of normal spent fuel pool cooling, the water level will drop. Low spent fuel pool level alarms in the control room will indicate to the operator the need to initiate makeup water to the pool. These alarms are provided from safety-related level instrumentation in the spent fuel pool. With the use of makeup water, the pool level is maintained above the spent fuel assemblies for at least 7 days. Initial spent fuel pool water level is controlled by technical specifications. During the first 72 hours any required makeup water is supplied from safety related sources. If makeup water beyond the safety related sources is required between 72 hours and 7 days, water from the passive containment cooling system ancillary water storage tank is provided to the spent fuel pool. The amount of makeup required to provide the 7 day capability depends on the decay heat level of the fuel in the spent fuel pool and is provided as follows:

- When the calculated decay heat level in the spent fuel pool is less than ~~2.3~~ 4.6 MWt, no makeup is needed to achieve spent fuel pool cooling for at least 7 days.
- When the calculated decay heat level in the spent fuel pool is greater than or equal to ~~2.3~~ 4.6 MWt and less than or equal to ~~2.8~~ 5.4 MWt, safety related makeup from the cask washdown pit is sufficient to achieve spent fuel pool cooling for at least 7 days. A minimum level of 13.75 feet in the cask washdown pit is provided for this purpose. Availability of the makeup source is controlled by technical specifications.
- When calculated decay heat level in the spent fuel pool is greater than ~~2.8~~ 5.4 MWt makeup from the passive containment cooling water storage tank or passive containment cooling ancillary water storage tank, or combination of the two tanks, is sufficient to achieve spent fuel pool cooling for at least 7 days.
- When the decay heat level in the reactor is less than 9 MW, the passive containment cooling water storage tank is not needed for containment cooling and this water can be used for makeup to the spent fuel pool. This tank provides safety related makeup for at least 72 hours. Between 72 hours and 7 days the tank continues to provide makeup water as required until it is empty. If the passive containment cooling water storage tank empties in less than 7 days, non-safety makeup water can be provided from the passive containment cooling ancillary water storage tank.

Table 9.1-2

SPENT FUEL POOL COOLING AND PURIFICATION SYSTEM DESIGN PARAMETERS

Spent fuel pool storage capacity	~~10 yrs spent fuel plus one core~~ 889 total fuel assemblies
Spent fuel pool water volume (including racks without fuel at water level of 12 inches below the operating deck) (gallons)	191,500
Fuel transfer canal, including gate, water volume (gallons)	64,100
Minimum combined volume of spent fuel pool and fuel transfer canal above fuel to elevation 6 feet below the operating deck) (gallons)	46,700
Minimum volume of the cask washdown pit (gallons)	30,900
Nominal boron concentration of water (ppm)	2,700
Maximum normal refueling case (full core offload) Water temperature with one spent fuel cooling system cooling train and one normal residual heat removal system cooling train in operation (°F)	<140
Maximum emergency core unload case Water temperature with both spent fuel cooling system cooling trains and one normal residual heat removal system cooling train in operation (°F)	<140

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Table 9.1-4

STATION BLACKOUT/SEISMIC EVENT TIMES[1]

Event	Time to Saturation[1] (hours)	Height of Water Above Fuel at 72 Hours[4] (feet)	Height of Water Above Fuel at 7 Days[4] (feet)
Seismic Event[2] –Refueling Power Operation Immediately Following a ~~44% Core (68 Fuel Assemblies)~~ Refueling[7]	~~8.8~~ 7.8	~~4.6~~ 2.4	~~4.6~~ 2.4[6]
Seismic Event[8] – Refueling, Immediately Following ~~a 44% Core (68 Fuel Assemblies)~~ Spent Fuel Region Offload[3][7]	~~6.4~~ 5.6	8.3[5]	8.3[5]
Seismic Event[8] – Refueling, Emergency Full Core Off-Load[3] Immediately Following ~~a 44% Core (68 Fuel Assemblies)~~ Refueling[7]	~~2.5~~ 3.1	8.3[5]	8.3[6]

Notes:

1. Times calculated neglect heat losses to the passive heat sinks in the fuel area of the auxiliary building.
2. Seismic event assumes water in the pool is initially drained to the level of the spent fuel pool cooling system connection simultaneous with a station blackout. Fuel cooling water sources are spent fuel pool, fuel transfer canal (including gate), and cask washdown pit for 72 hours. Between 72 hours and 7 days fuel cooling water provided from passive containment cooling system ancillary water storage tank.
3. Fuel movement complete, 150 hours after shutdown.
4. See subsection 9.1.3.5 for minimum water level.
5. Alignment of PCS water storage for supply of makeup water permits maintaining pool level at this elevation. Decay heat in reactor vessel is less that 9 MW, thus no PCS water is required for containment cooling.
6. Alignment of the PCS ancillary water storage tank and initiation of PCS recirculation pumps provide a makeup water supply to maintain this pool level or higher above the top of the fuel.
7. ~~Seismic event assumes water in the pool is initially drained to the level of the spent fuel pool cooling system connection simultaneous with a station blackout. Fuel cooling water sources are spent fuel pool, fuel transfer canal (including gate), cask washdown pit, and passive containment cooling system water storage tank for 72 hours. Between 72 hours and 7 days fuel cooling water provided from passive containment cooling system water storage tank and passive containment cooling system ancillary water storage tank.~~
   The number of fuel assemblies refueled has been conservatively established to include the worst case between an 18-month fuel cycle plus 5 defective fuel assemblies (69 total assemblies or 44% of the core) and a 24-month fuel cycle plus 5 defective fuel assemblies (77 total assemblies or 49% of the core).
8. Seismic event assumes water in the pool is initially drained to the level of the spent fuel pool cooling system connection simultaneous with a station blackout. Fuel cooling water sources are spent fuel pool, fuel transfer canal (including gate), cask washdown pit, and passive containment cooling system water storage tank for 7 days.

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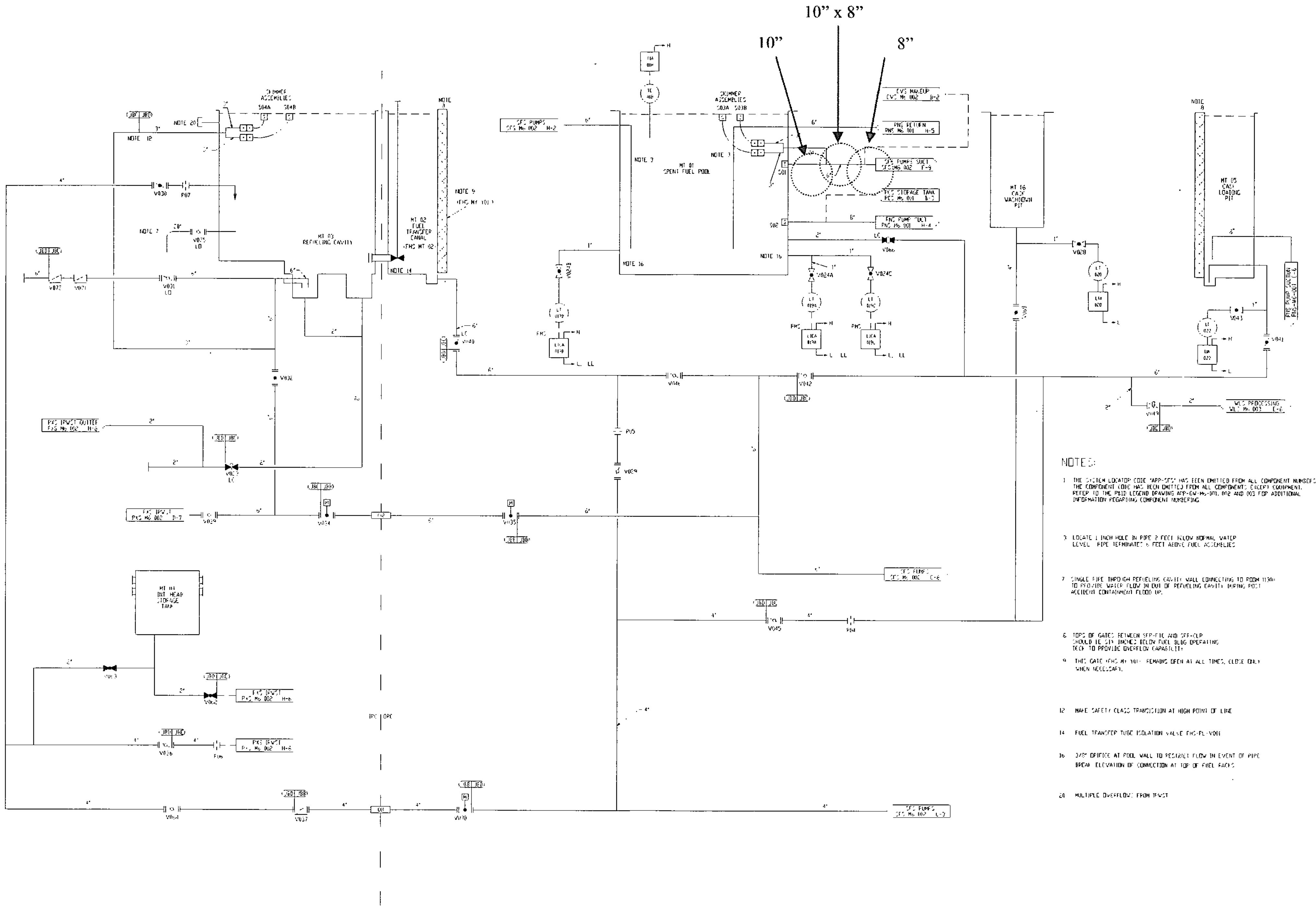

Figure 9.1.6 (Sheet 1 of 2)
SFS Pump Common Suction Pipe (L050) and RCS Engineering Flow Diagram

R15 Figure Mark-up

See Section II.B.6 on page 12 of TR 103 for the description and justification of this change.

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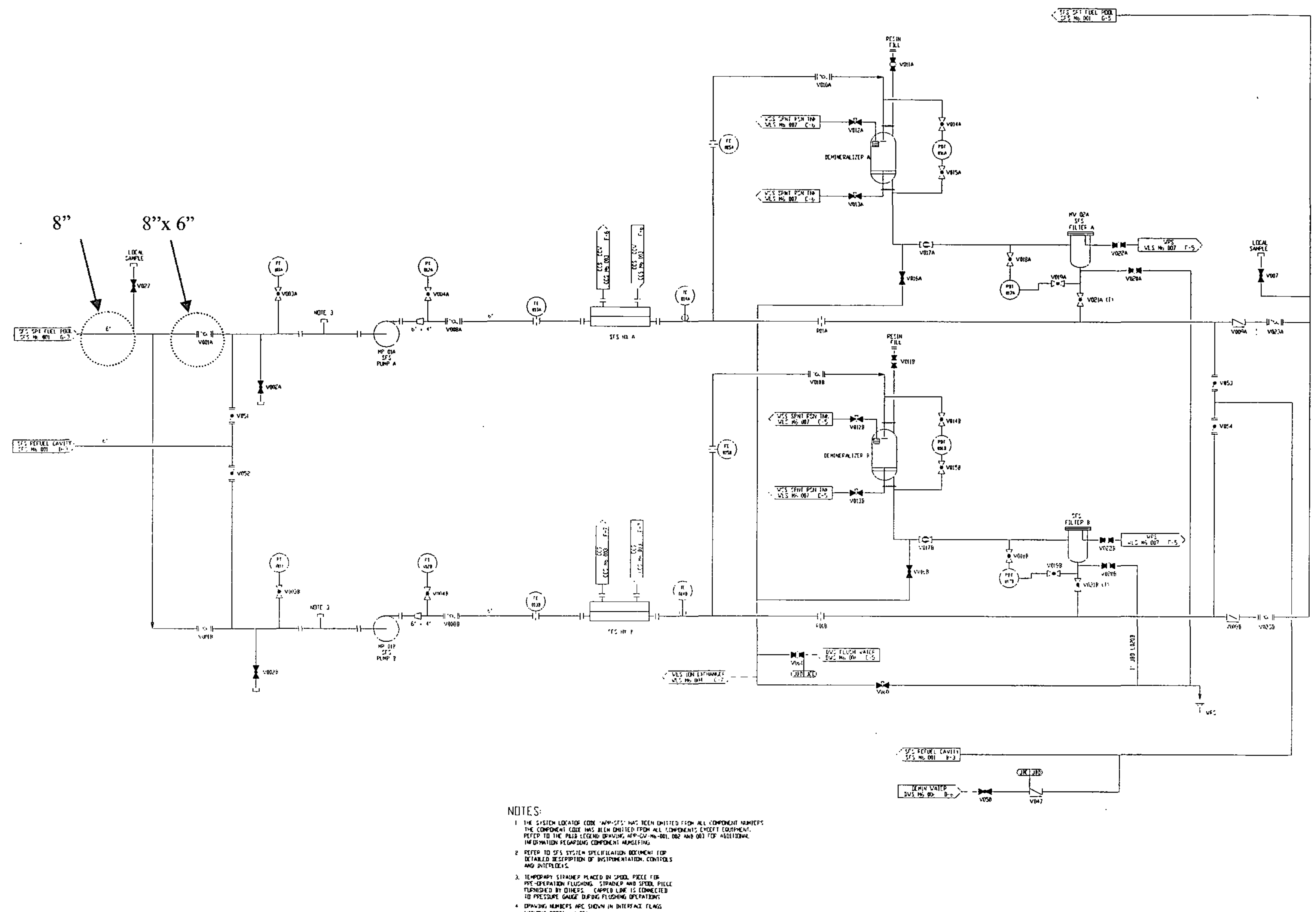

Figure 9.1.6 (Sheet 2 of 2)
SFS Pump Common Suction Pipe (L050) and RCS Engineering Flow Diagram

R15 Figure Mark-up

See Section II.B.6 on page 12 of TR 103 for the description and justification of this change.

See Section II.D.1 on page 21 of TR 103 for the description and justification for the following changes.
9.2.1.2.2 (Page 9.2-4)

circulating water pipe trench area of the turbine building. The pumps are powered from the normal ac power system and are backed by the standby power source for occurrences of loss of normal ac power. Each pump provides 100 percent of the normal power operation flow requirements and is therefore capable of supporting normal power operation with one pump out of service for maintenance.

The starting logic for the service water pumps requires at least one of the cooling tower valves to be open prior to pump start to provide a flow path through the cooling tower or tower bypass. The pump starting logic also interlocks with the motor operated valve at the discharge of each pump. The pump starts with the discharge valve closed and the valve then opens at a controlled rate to slowly admit water to the system while maintaining pump minimum flow. This feature results in reduced fluid velocities during system start to minimize transient effects that may occur as the system sweeps out air that may be present and obtains a water solid condition.

Piping

Service water piping is made of carbon steel and is designed, fabricated, installed and tested in accordance with ANSI B31.1 Power Piping Code. Cooling water supply and return piping is accessible for inspection and/or wall thickness determination. Nonmetallic piping may be used in accordance with ASME B31.1 and as demonstrated by evaluation. Cooling water supply and return piping that runs in the yard is either routed within trenches or may be inspected from the inside.

The service water system is designed to accommodate transient effects that may be generated by the normal starting and stopping of pumps, opening and closing of valves, or other normal operating events. The system pumps water from the basin at the cooling tower, through piping and equipment, to a high point located at the cooling tower riser; the cooling water is then discharged in a spray fashion above the cooling tower basin. The system arrangement is such that high points in the system piping do not lead to the formation of vapor pressure voids upon loss of system pumping. Therefore, the potential for water hammer due to vapor collapse upon pump start is minimized.

See Section II.D.2 on page 22 of TR 103 for the description and justification for the following changes.

9.2.1.5 Instrument Applications

Pressure indication, with low and high alarms, is provided for the discharge of each service water pump. A low pressure signal automatically starts the standby pump. Flow indication, with low and high alarms, is also provided for each service water pump. Due to the system configuration, pump flow indication can also normally be used to monitor flow through the heat exchanger or heat exchangers in service.

Temperature indication is provided for the service water supply to each component cooling water heat exchanger and for the discharge from each heat exchanger to determine the temperature differential across the heat exchanger. Heat exchanger inlet temperature indication also is used for performance monitoring of the service water cooling tower. Low and high heat exchanger inlet temperature alarms are provided. A high alarm is provided for the outlet temperature from each heat exchanger. Temperature instrumentation is provided for the service water return to each cooling tower cell to automatically control the operation of the associated cell fan.

Differential pressure measurement across each service water strainer is provided and will initiate backwash of the strainer on high differential. A high-high differential pressure alarm across the strainer is provided.

Power actuated valves in the SWS are provided with valve position indication instrumentation. In addition, the tower bypass valves are provided with position indication instrumentation.

Level indication is provided for the cooling tower basin along with high and low level alarms. The basin level signal is also used to control the normal makeup water supply valve to maintain the proper level in the cooling tower basin. ~~Flow indication of cooling tower basin normal makeup is provided using instrumentation internal to the makeup valve.~~

A radiation monitor with a high alarm is provided to monitor the service water blowdown flow for detection of potentially radioactive leakage into the SWS from the component cooling water heat exchangers. Provisions are also available for taking local fluid samples. ~~Flow indication of the blowdown flow is provided using instrumentation internal to the blowdown control valve.~~

See Section II.D.1 on page 21 of TR 103 for the description and justification for the following changes.

9.2.2.3.5 Piping Requirements

Component cooling water system piping is made of carbon steel. Piping joints and connections are welded, except where flanged connections are required as indicated on the component cooling water system piping and instrumentation diagram (Figure 9.2.2-2). Nonmetallic piping may be used in accordance with ASME B31.1 and as demonstrated by evaluation.

Maintained at a higher pressure than the circulating water so leakage of circulating water into the closed cooling water system does not occur. The heat exchangers are constructed of titanium plates with a carbon steel frame.

9.2.8.2.2 Component Description

Piping

System piping is made of carbon steel. Piping joints and connections are welded, except where flanged connections are used for accessibility and maintenance of components. Nonmetallic piping may be used in accordance with ASME B31.1 and as demonstrated by evaluation.

See Section II.C.2 on page 22 of TR 103 for the description and justification for the following changes.

9.2.7 Central Chilled Water System

...

Component Description

...

Valves

High capacity subsystem temperature control valves are located upstream of each cooling coil or group of coils, except for the containment recirculation cooling system coils. The containment recirculation cooling system coils are provided with three-way modulating valves. These valves bypass chilled water flow around the containment recirculation cooling system coils, as needed, to maintain the temperature within the design conditions. The flow control valves fail open upon loss of control air or electrical power. A pressure control valve is installed on the bypass line around the chiller system to maintain a constant chiller flow rate as the load demand changes. The bypass valve fails closed upon loss of control air or electrical power.

Low capacity subsystem three-way modulating temperature control valves are provided for each group of nuclear island nonradioactive ventilation system cooling coils. These valves bypass chilled water flow around the coils, as needed, to maintain the temperature within the design conditions.

~~The modulating control valves provide process parameters such as flow rate, temperature, and pressure to the plant control system. From this data, the plant control system calculates the required process variables.~~

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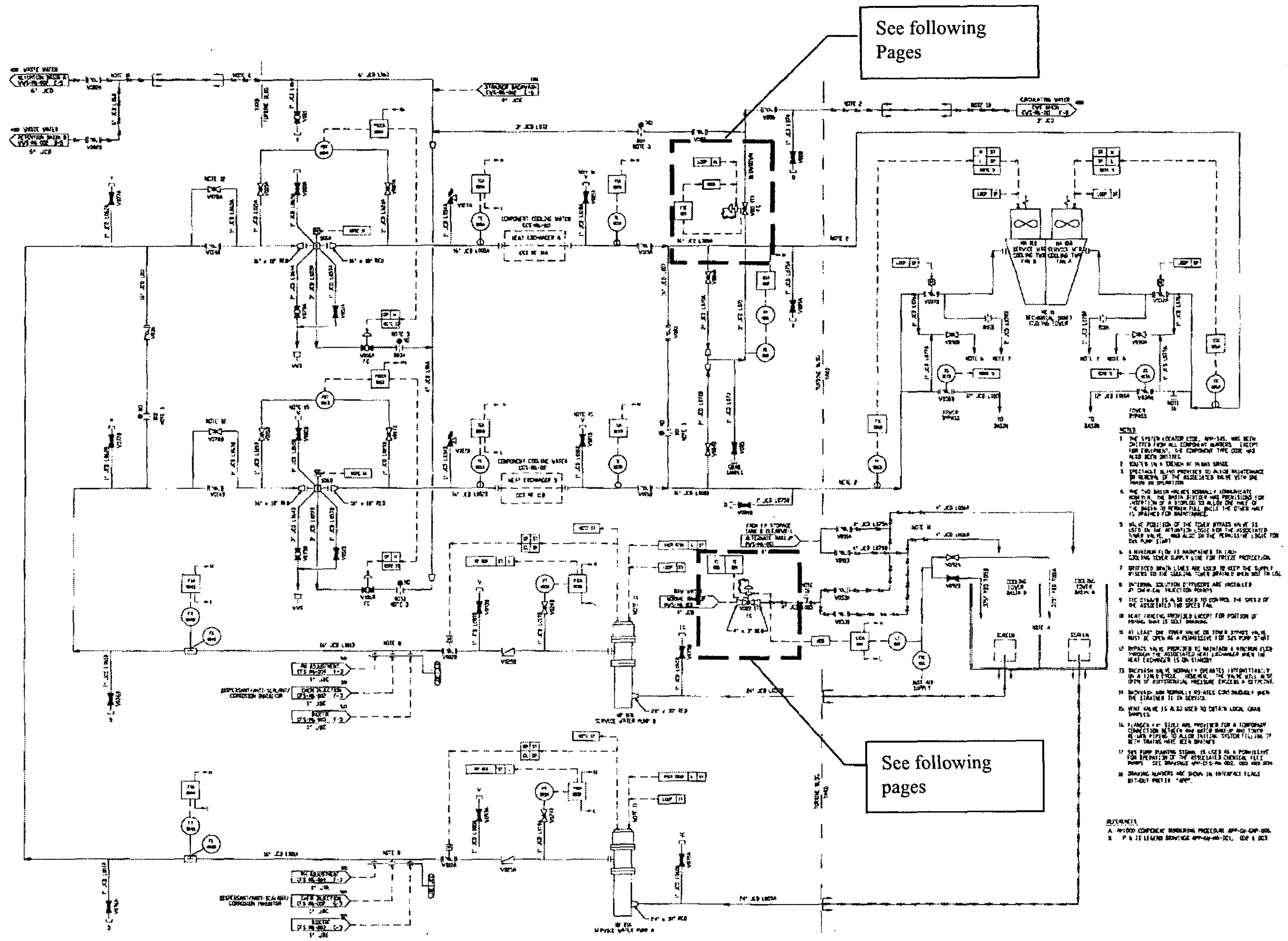

Figure 9.2.1-1
Service Water Systems
Piping and Instrumentation Diagram
(REF) SWS 001

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

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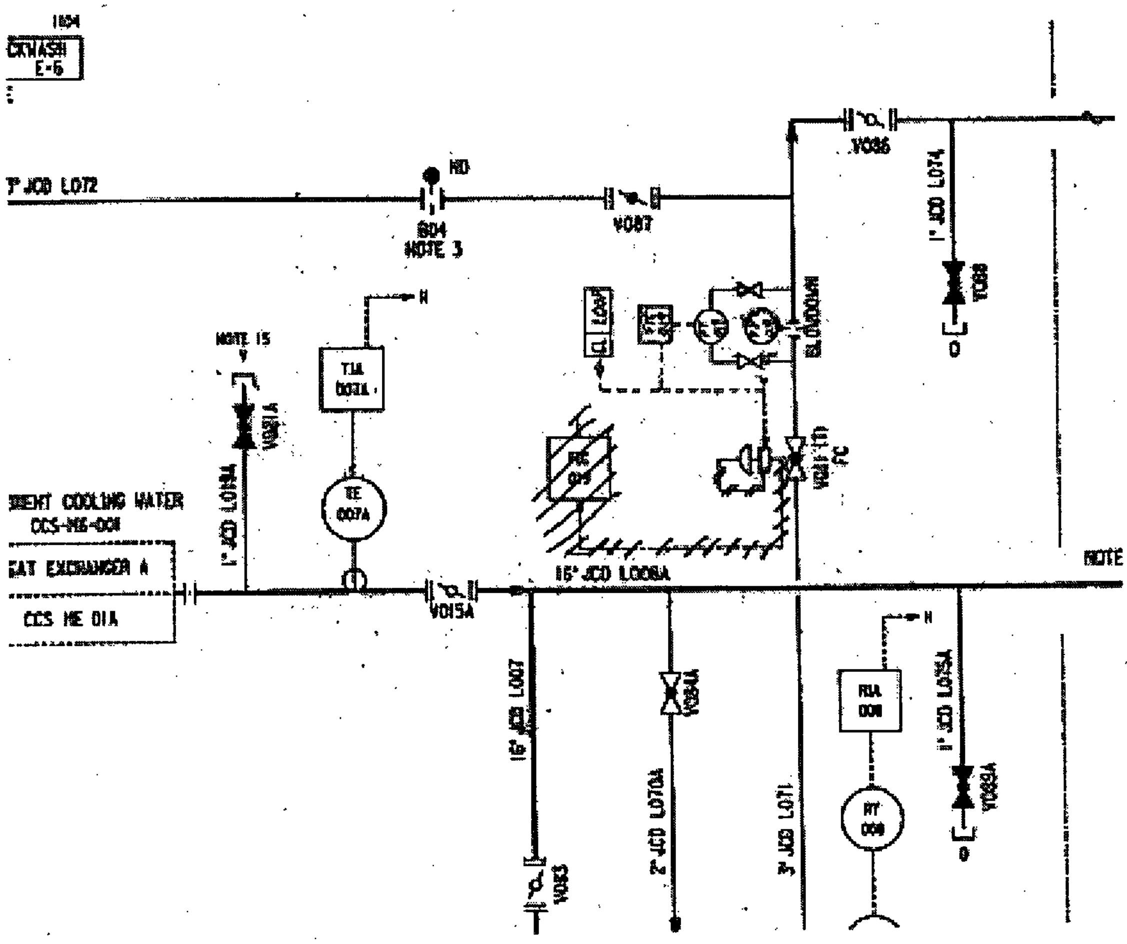

FIGURE 9.2.1-1

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

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Title: Fluid System Changes

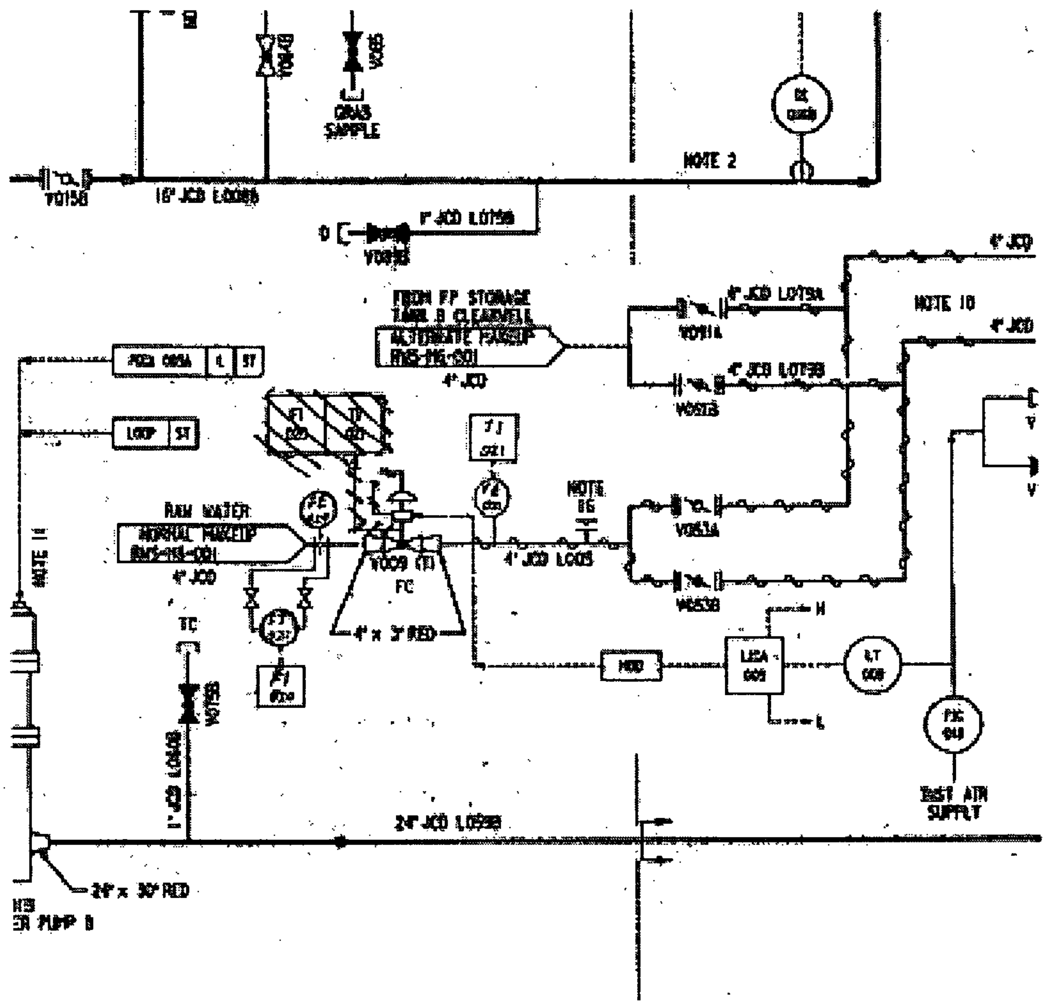

FIGURE 9.2.1-1

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

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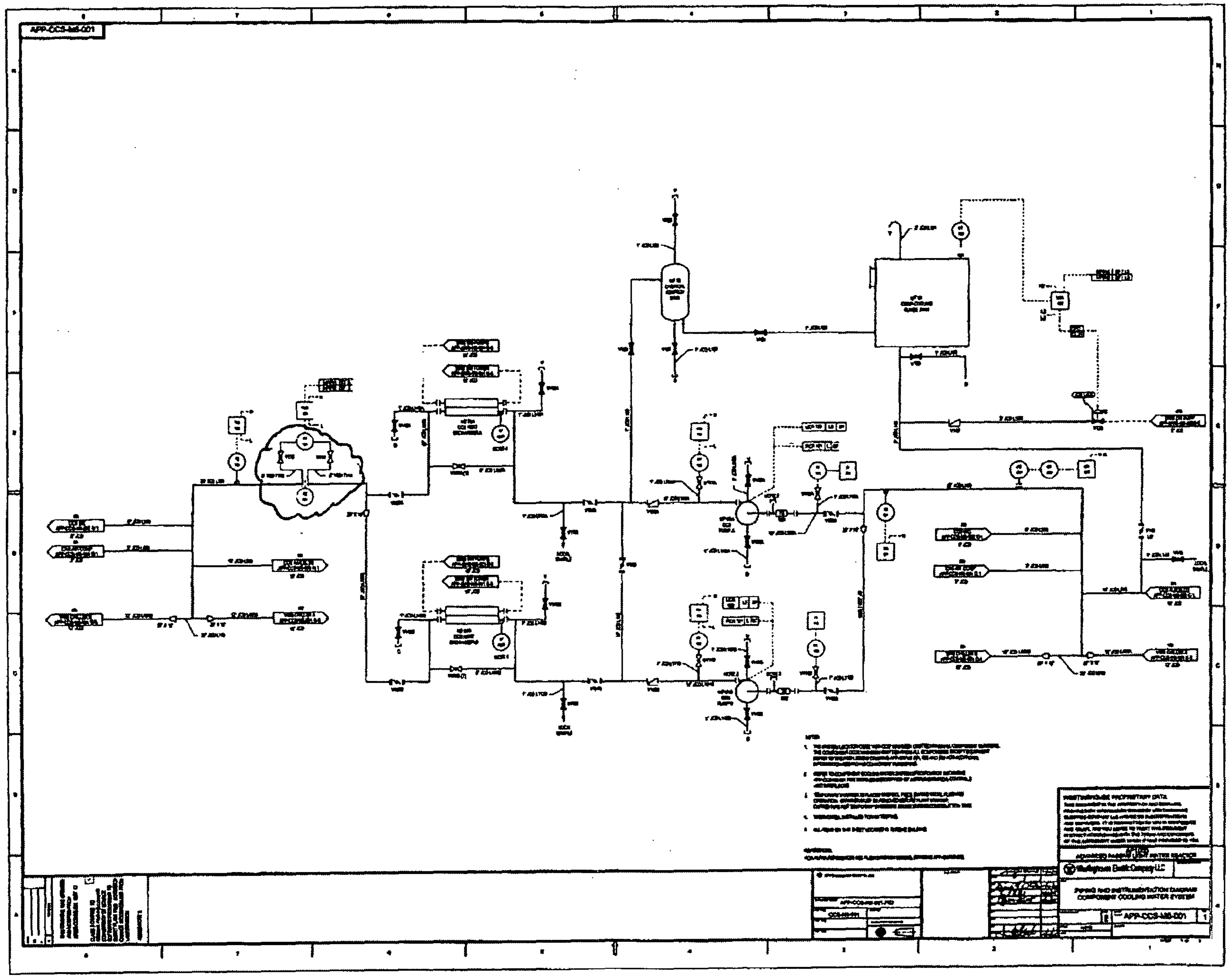

Figure 9.2.2-2 (Sheet 1 of 5)
Component Cooling Water System
Piping and Instrumentation Diagram
(REF CCS 001)

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

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Title: Fluid System Changes

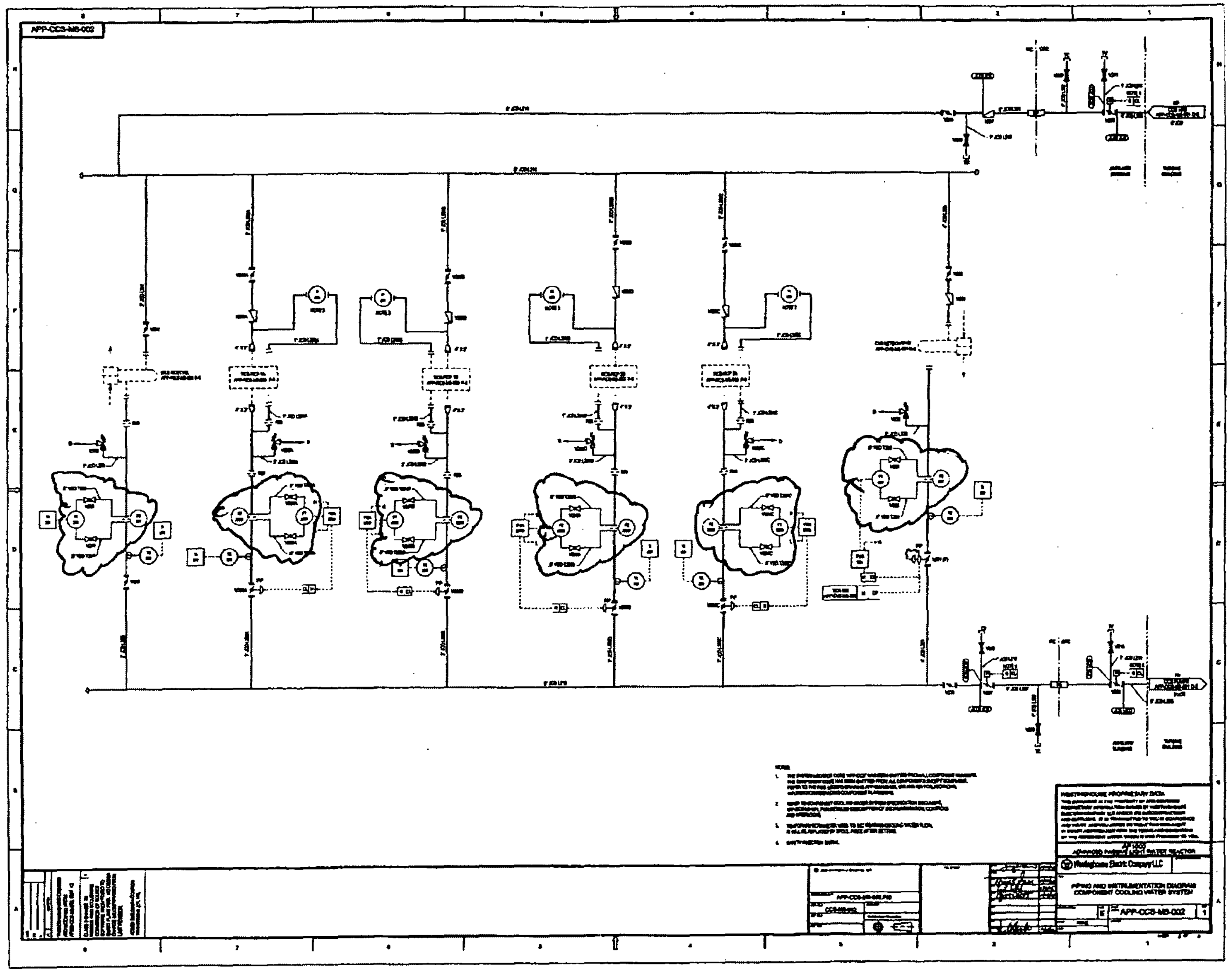


Figure 9.2.2-2 (Sheet 3 of 5)
Component Cooling Water System
Piping and Instrumentation Diagram
(REF) CCS 003

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

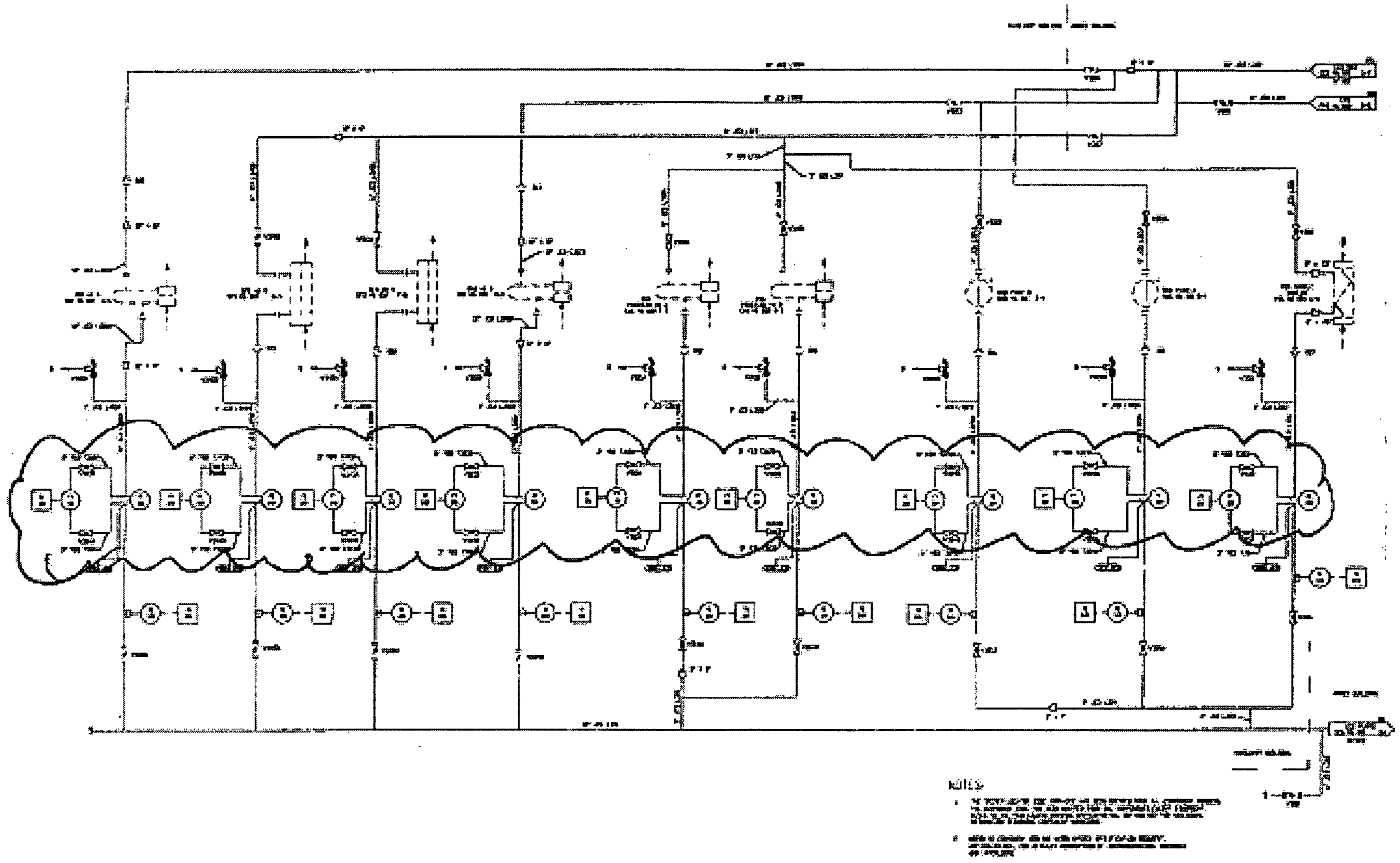


Figure 9.2.2-2 (Sheet 3 of 5)

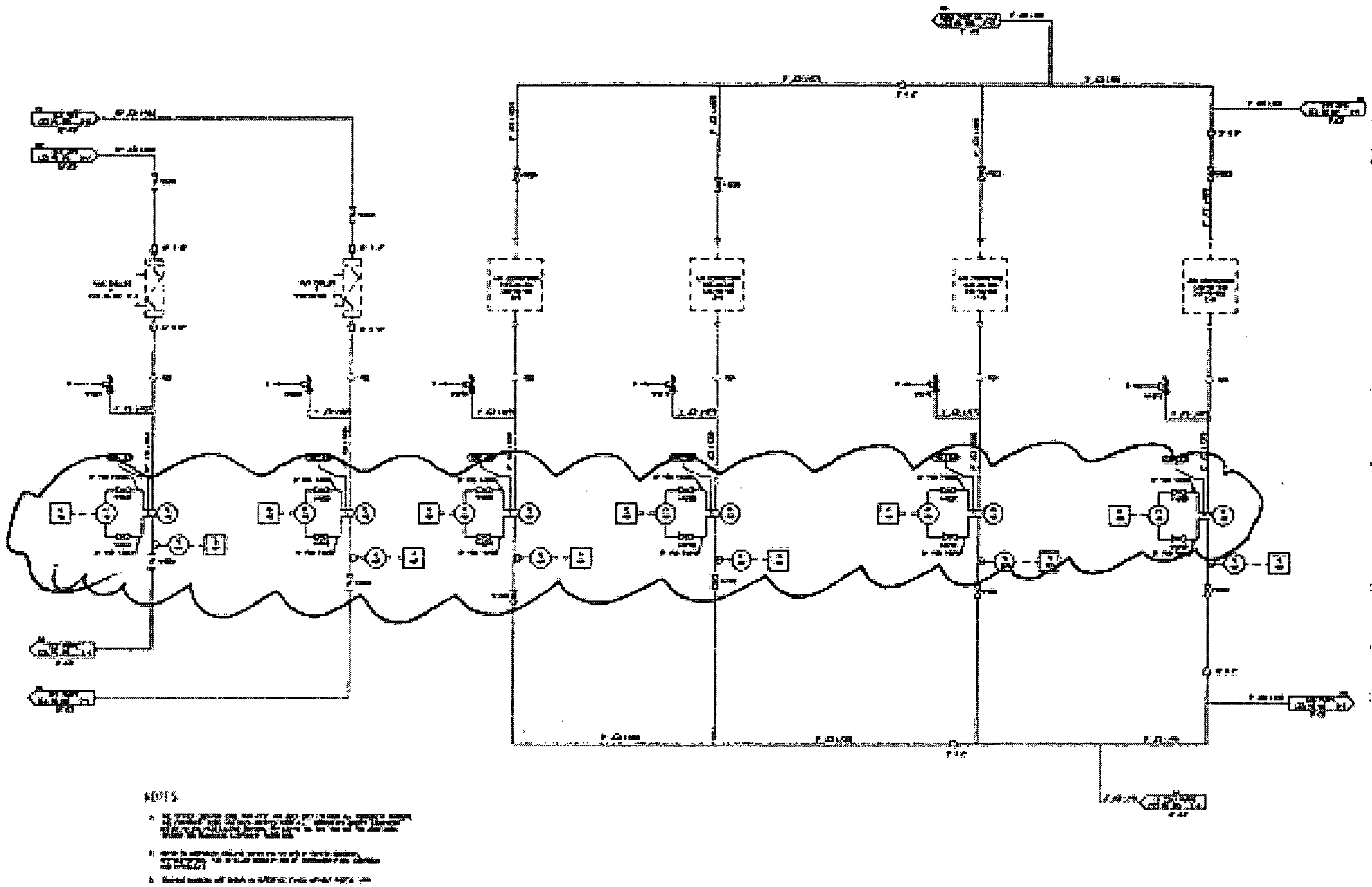
Component Cooling Water System
Piping and Instrumentation Diagram
(REF) CCS 003

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes



Inside Turbine Building

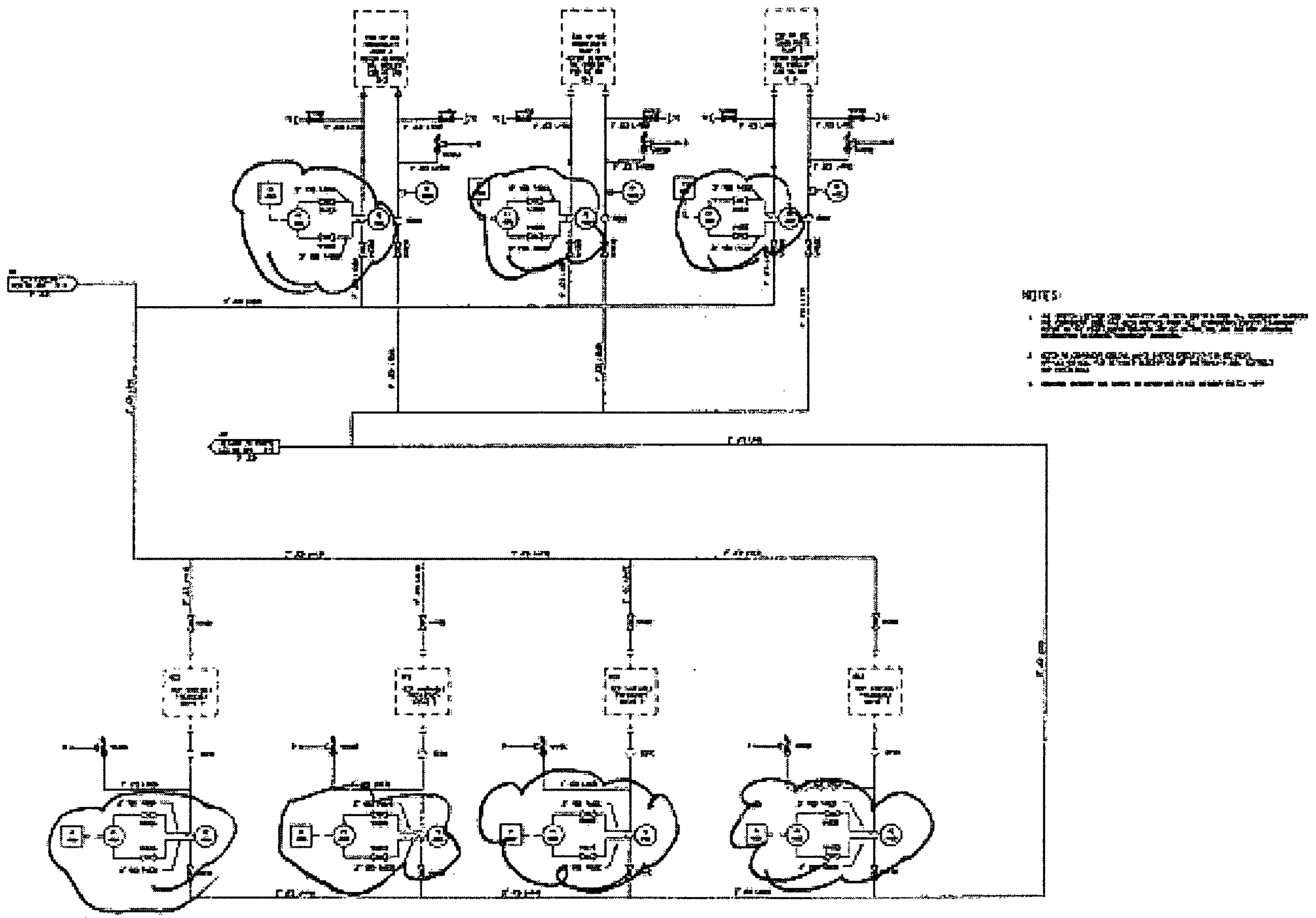
Figure 9.2.2-2 (Sheet 4 of 5)

Component Cooling Water System
Piping and Instrumentation Diagram
(REF) CCS 004

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes



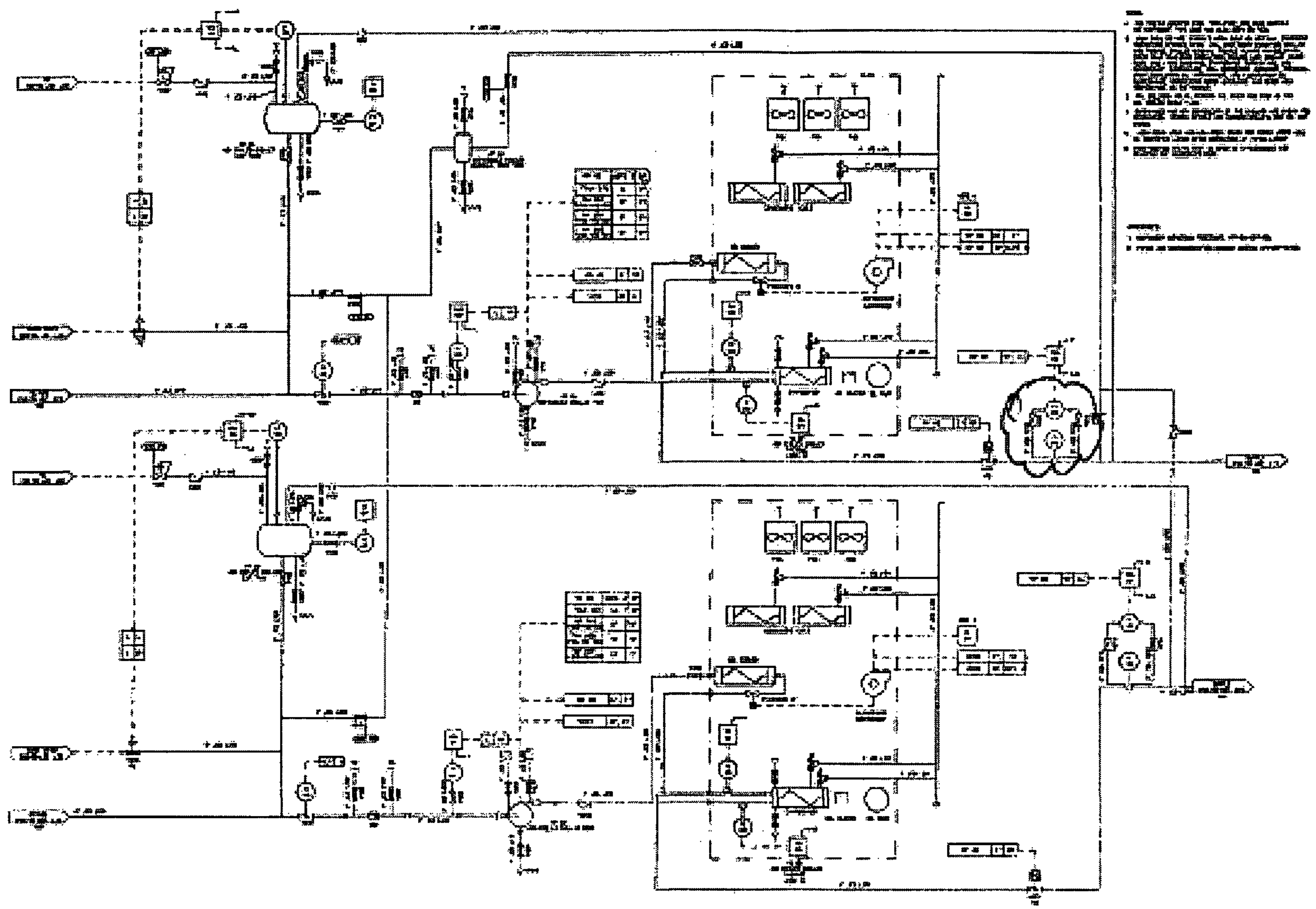
Inside Turbine Building

Figure 9.2.2-2 (Sheet 5 of 5)

Component Cooling Water System
Piping and Instrumentation Diagram
(REF) CCS 005

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.



Inside Auxiliary Building

Figure 9.2.7-1 (Sheet 1 of 3)

Central Chilled Water System
Piping and Instrumentation Diagram
(REF) VWS 006

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

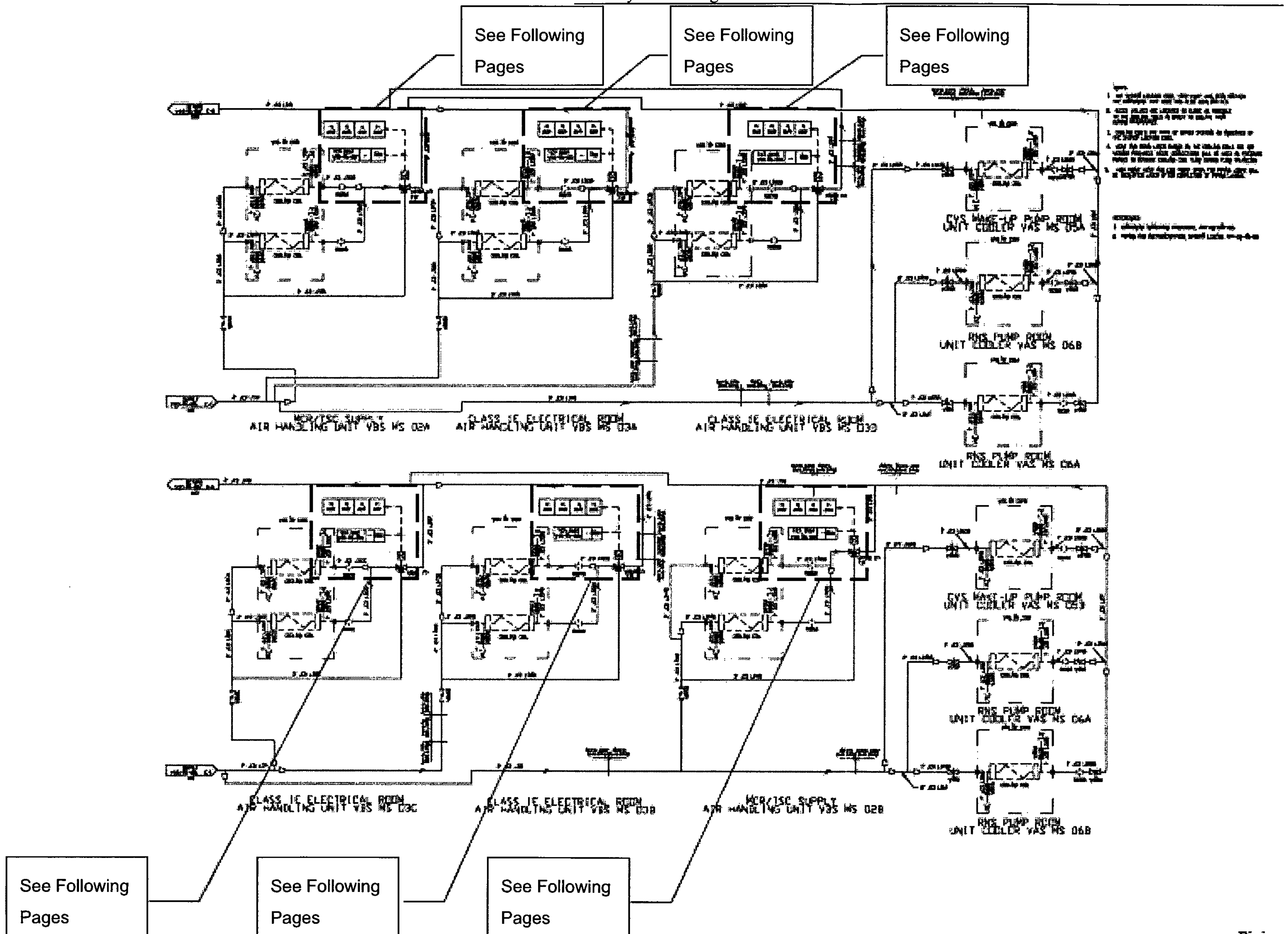


Figure 9.2.7-1 (Sheet 2 of 3)

Central Chilled Water System
Piping and Instrumentation Diagram
(REF) VWS 007

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

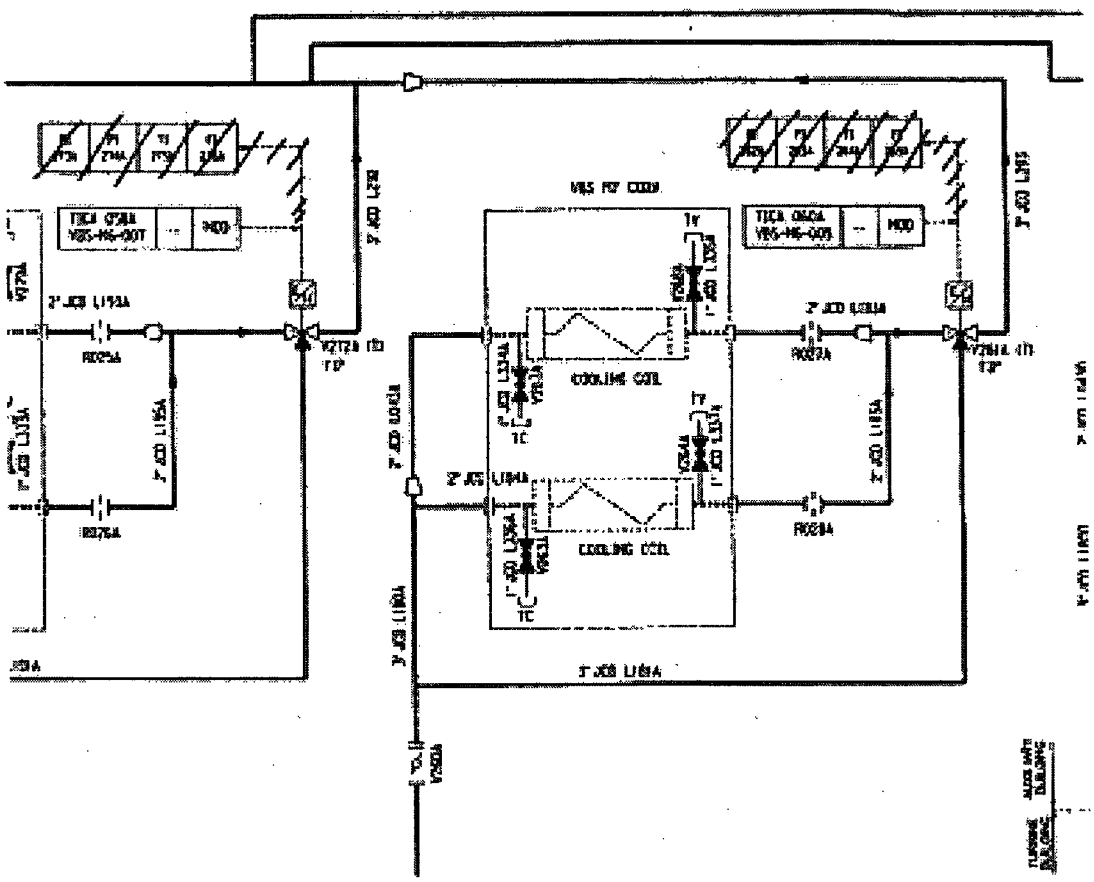


Figure 9.2.7-1

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

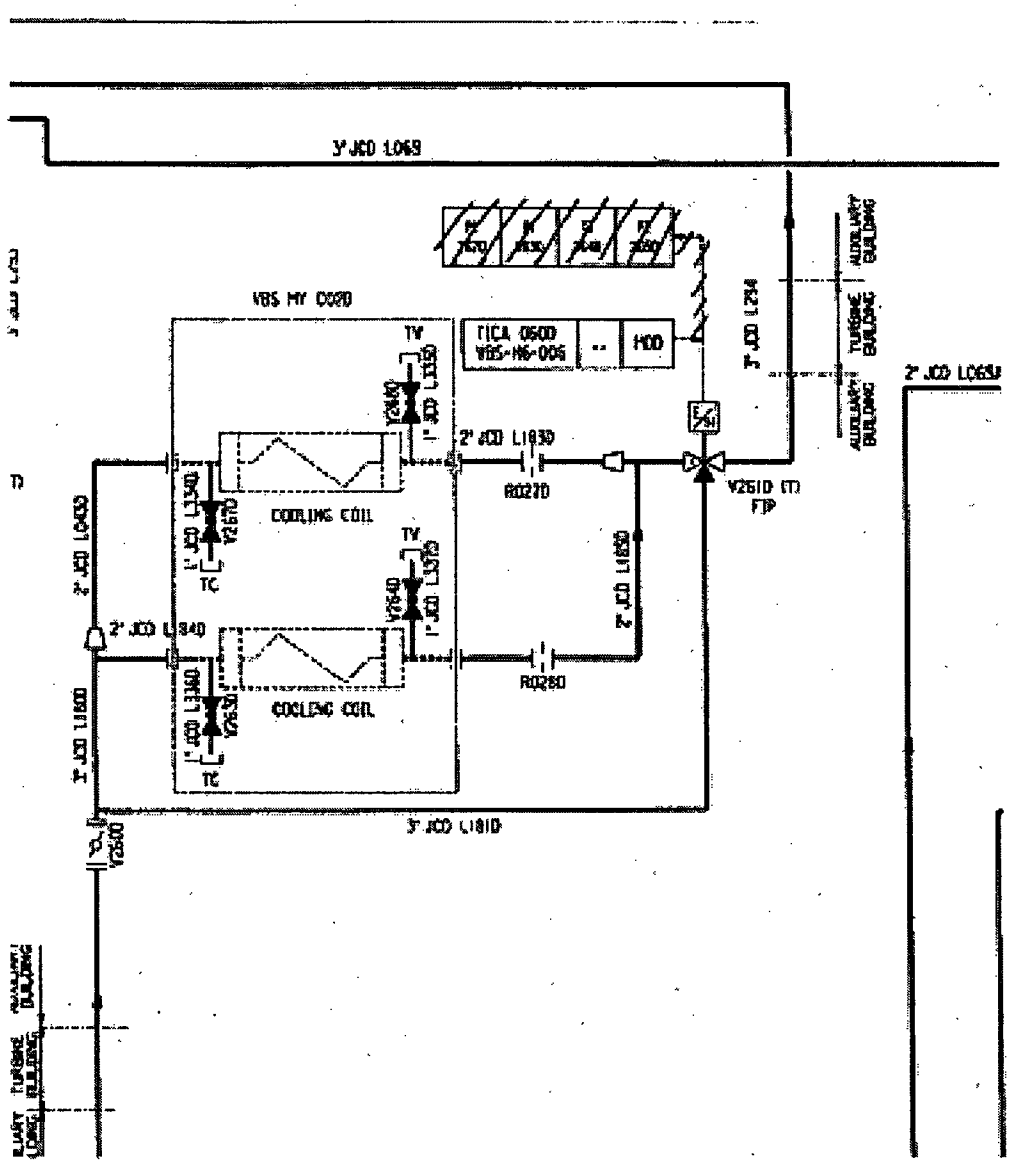


Figure 9.2.7-1

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

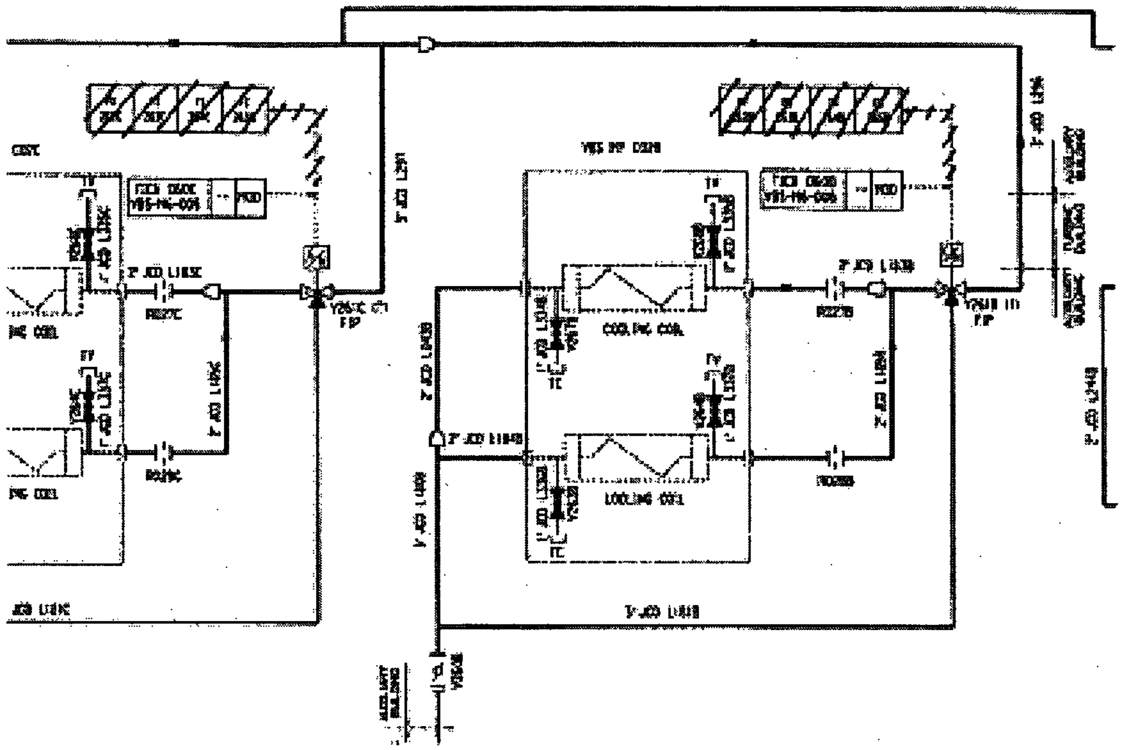


Figure 9.2.7-1

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

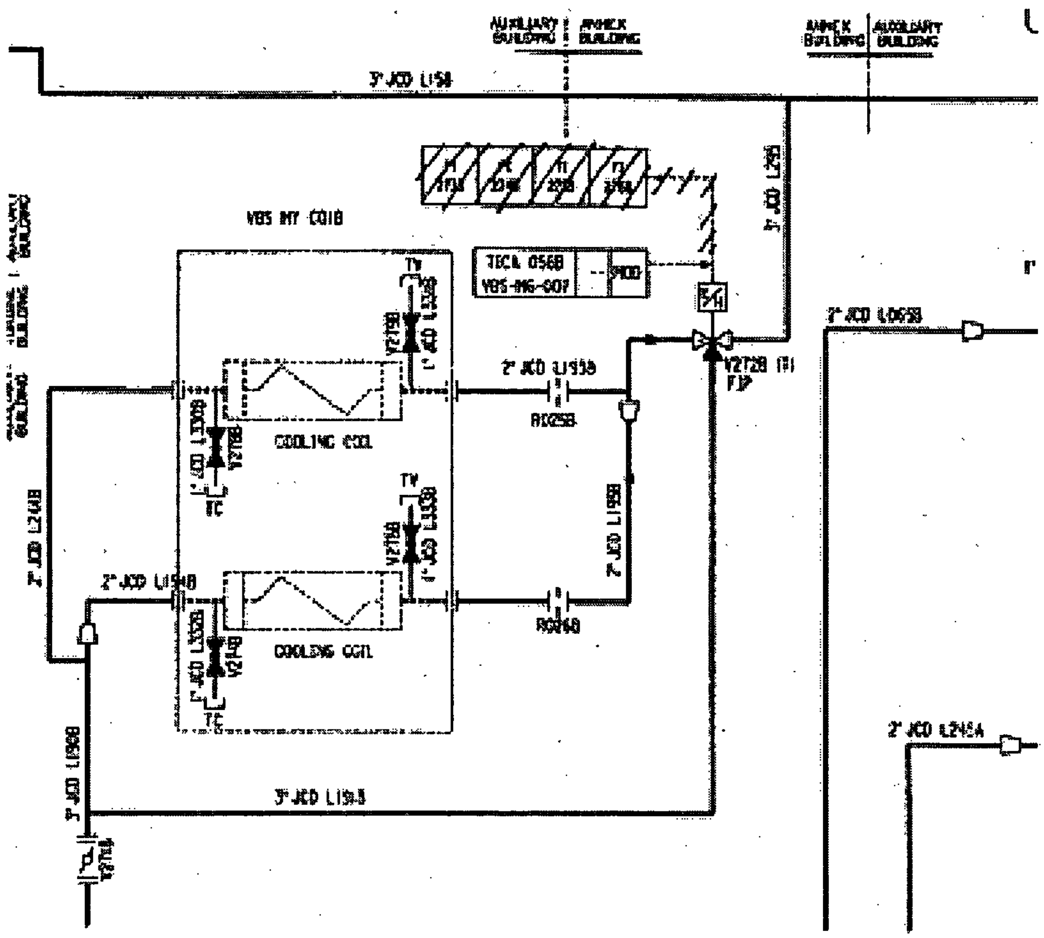


Figure 9.2.7-1

R15 Figure Mark-up

See Section II.D.2 on page 22 of TR 103 for the description and justification of this change.

See Section II.D.4 on page 23 of TR 103 for the description and justification of the following changes.

9.2.8 Turbine Building Closed Cooling Water System

The turbine building closed cooling water system (TCS) provides chemically treated, demineralized cooling water for the removal of heat from nonsafety-related heat exchangers in the turbine building and rejects the heat to the [[circulating water system]].

9.2.8.1 Design Basis

Safety Design Basis

The turbine building closed cooling water system has no safety-related function and therefore has no nuclear safety design basis.

9.2.8.1.2 Power Generation Design Basis

The turbine building closed cooling water system provides corrosion-inhibited, demineralized cooling water to the equipment shown in Table 9.2.8-1 during normal plant operation.

During power operation, the turbine building closed cooling water system provides a continuous supply of cooling water to turbine building equipment at a temperature of ~~95~~ 105°F or less assuming a [[circulating water]] temperature of ~~90~~ 100°F or less.

The cooling water is treated with a corrosion inhibitor and uses demineralized water for makeup. The system is equipped with a chemical addition tank to add chemicals to the system.

The heat sink for the turbine building closed cooling water system is the [[circulating water system]]. The heat is transferred to [[circulating water]] through plate type heat exchangers which are components of the turbine building closed cooling water system.

A surge tank is sized to accommodate thermal expansion and contraction of the fluid due to temperature changes in the system.

One of the turbine building closed cooling system pumps or heat exchangers may be unavailable for operation or isolated for maintenance without impairing the function of the system.

The turbine building closed cooling water pumps are provided ac power from the 6900V switchgear bus. The pumps are not required during a loss of normal ac power.

9.2.8.2 System Description

General Description

Classification of equipment and components is given in Section 3.2. The system consists of two 100-percent capacity pumps, three 50-percent capacity heat exchangers (connected in parallel), one surge tank, one chemical addition tank, and associated piping, valves, controls, and instrumentation. Heat is removed from the turbine building closed cooling water system by the [[circulating water system]] via the heat exchangers.

The pumps take suction from a single return header. Either of the two pumps can operate in conjunction with any two of the three heat exchangers. Discharge flows from the heat exchangers combine into a single supply header. Branch lines then distribute the cooling water to the various coolers in the turbine building. The flow rates to the individual coolers are controlled either by flow restricting orifices or by control valves, according to the requirements of the cooled systems. Individual coolers can be locally isolated, where required, to permit maintenance of the cooler while supplying the remaining components with cooling water. A bypass line with a manual valve is provided around the turbine building closed cooling water system heat exchangers to help avoid overcooling of components during startup/low-load conditions or cold weather operation.

The system is kept full of demineralized water by a surge tank which is located at the highest point in the system. The surge tank connects to the system return header upstream of the pumps. The surge tank accommodates thermal expansion and contraction of cooling water resulting from temperature changes in the system. It also accommodates minor leakage into or out of the system. Water makeup to the surge tank, for initial system filling or to accommodate leakage from the system, is provided by the demineralized water transfer and storage system. The surge tank is vented to the atmosphere.

A line from the pump discharge header back to the pump suction header contains valves and a chemical addition tank to facilitate mixing chemicals into the closed loop system to inhibit corrosion in piping and components.

A turbine building closed cooling water sample is periodically taken and analyzed to verify that water quality is maintained.

9.2.8.2.2 Component Description

Surge Tank

A surge tank accommodates changes in the cooling water volume due to changes in operating temperature. The tank also temporarily accommodates leakage into or out of the system. The tank is constructed of carbon steel.

Chemical Addition Tank

The chemical addition tank is constructed of carbon steel. The tank is normally isolated from the system and is provided with a hinged closure for addition of chemicals.

Pumps

Two pumps are provided. Either pump provides the pumping capacity for circulation of cooling water throughout the system. The pumps are single stage, horizontal, centrifugal pumps, are constructed of carbon steel, and have flanged suction and discharge nozzles. Each pump is driven by an ac powered induction motor.

Heat Exchangers

Three heat exchangers are arranged in a parallel configuration. Two of the heat exchangers are in use during normal power operation and turbine building closed cooling water flow divides between them.

The heat exchangers are plate type heat exchangers. Turbine building closed cooling water circulates through one side of the heat exchanger while [[circulating water]] flows through the other side. During system operation, the turbine building closed cooling water in the heat exchanger is maintained at a higher pressure than the [[circulating water]] so leakage of [[circulating water]] into the closed cooling water system does not occur. The heat exchangers are constructed of titanium plates with a carbon steel frame.

Valves

Manual isolation valves are provided upstream and downstream of each pump. The pump isolation valves are normally open but may be closed to isolate the non-operating pump and allow maintenance during system operation. Manual isolation valves are provided upstream and downstream of each turbine building closed cooling water heat exchanger. One heat exchanger is isolated from system flow during normal power operation. A manual bypass valve can be opened to bypass flow around the turbine building closed cooling water heat exchangers when necessary to avoid low cooling water supply temperatures.

Flow control valves are provided to restrict or shut off cooling water flow to those cooled components whose function could be impaired by overcooling. The flow control valves are air operated and fail open upon loss of control air or electrical power. An air operated valve is provided to control demineralized makeup water to the surge tank for system filling and for accommodating leakage from the system. The makeup valve fails closed upon loss of control air or electrical power.

A TCS heat exchanger can be taken out of service by closing the inlet isolation valve. Water chemistry in the isolated heat exchanger train is maintained by a continuous flow of circulating water through a small bypass valve around the inlet isolation valve.

Backwashable strainers are provided upstream of each TCS heat exchanger. They are actuated by a timer and have a backup starting sequence initiated by a high differential pressure across each individual strainer. The backwash can be manually activated.

Piping

System piping is made of carbon steel. Piping joints and connections are welded, except where flanged connections are used for accessibility and maintenance of components.

9.2.8.2.3 System Operation

The turbine building closed cooling water system operates during normal power operation. The system does not operate with a loss of normal ac power.

Startup

The turbine building closed cooling water system is placed in operation during the plant startup sequence [[after the circulating water system is in operation but]] prior to the operation of systems that require turbine building closed cooling water flow. The system is filled by the demineralized water transfer and storage system through a fill line to the surge tank. The system is placed in operation by starting one of the pumps.

Normal Operation

During normal operation, one turbine building closed cooling water system pump and two heat exchangers provide cooling to the components listed in Table 9.2.8-1. The other pump is on standby and aligned to start automatically upon low discharge header pressure.

During normal operation, leakage from the system will be replaced by makeup from the demineralized water transfer and storage system through the automatic makeup valve. Makeup can be controlled either manually, or automatically upon reaching low level in the surge tank.

Shutdown

The system is taken out of service during plant shutdown when no longer needed by the components being cooled. The standby pump is taken out of automatic control, and the operating pump is stopped.

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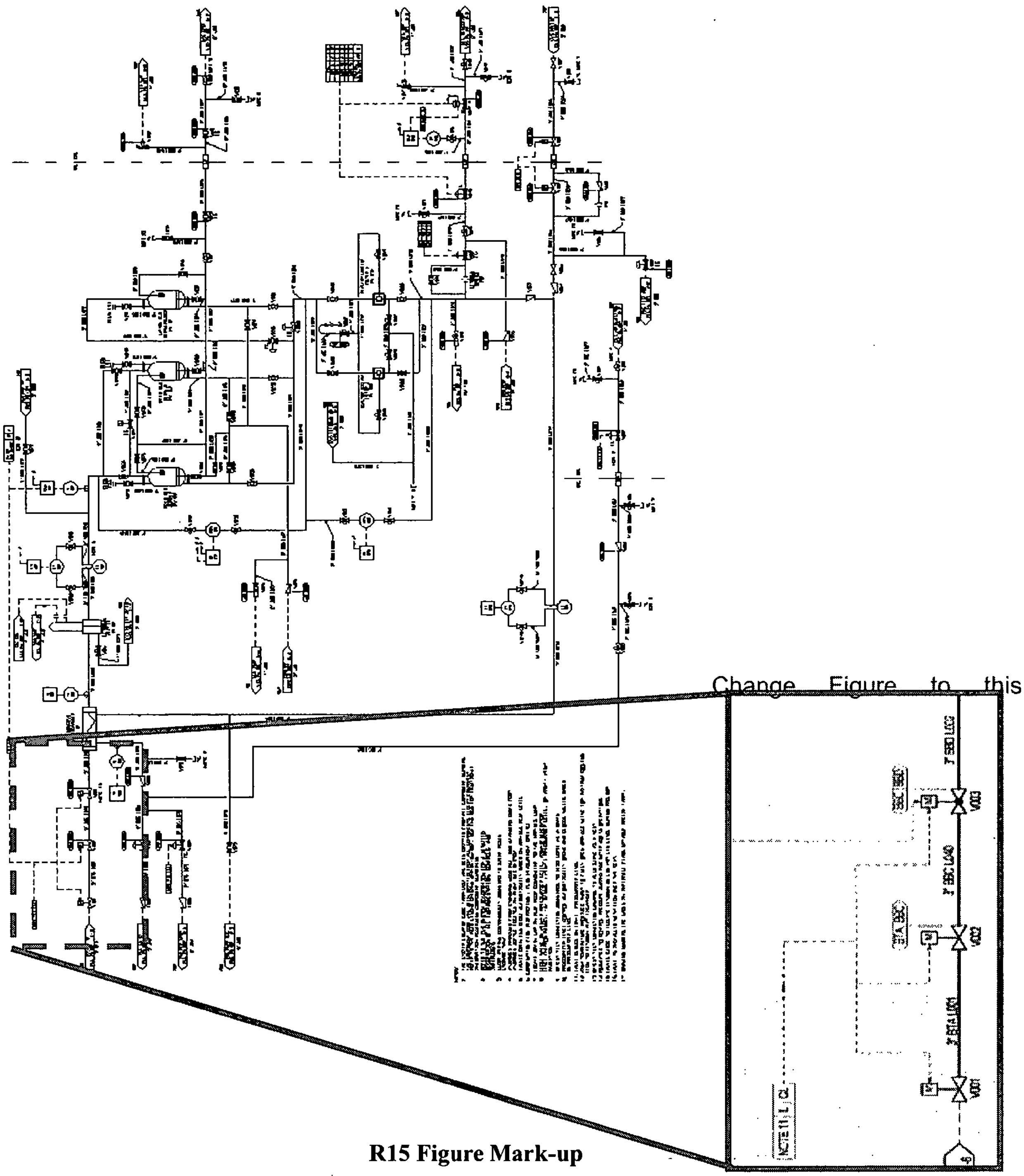
Figure 9.3.6-1, Sheet 1 of 2



R15 Figure Mark-up

See Section II.B.7 on page 13 of TR 103 for the description and justification of this change.

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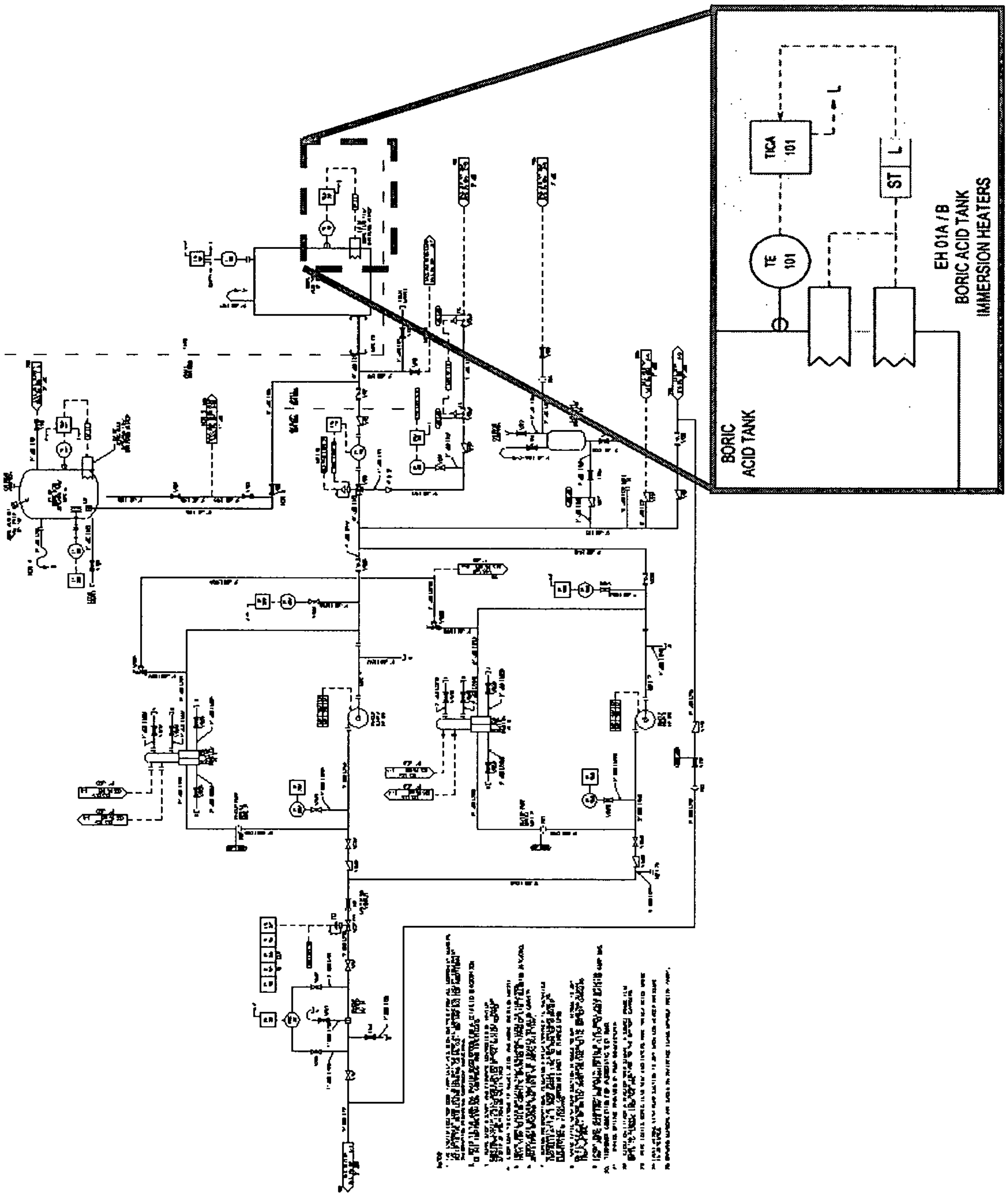
Figure 9.3.6-1, Sheet 2 of 2

Change Figure to this Markup



R15 Figure Mark-up

See Section II.B.7 on page 13 of TR 103 for the description and justification of this change.

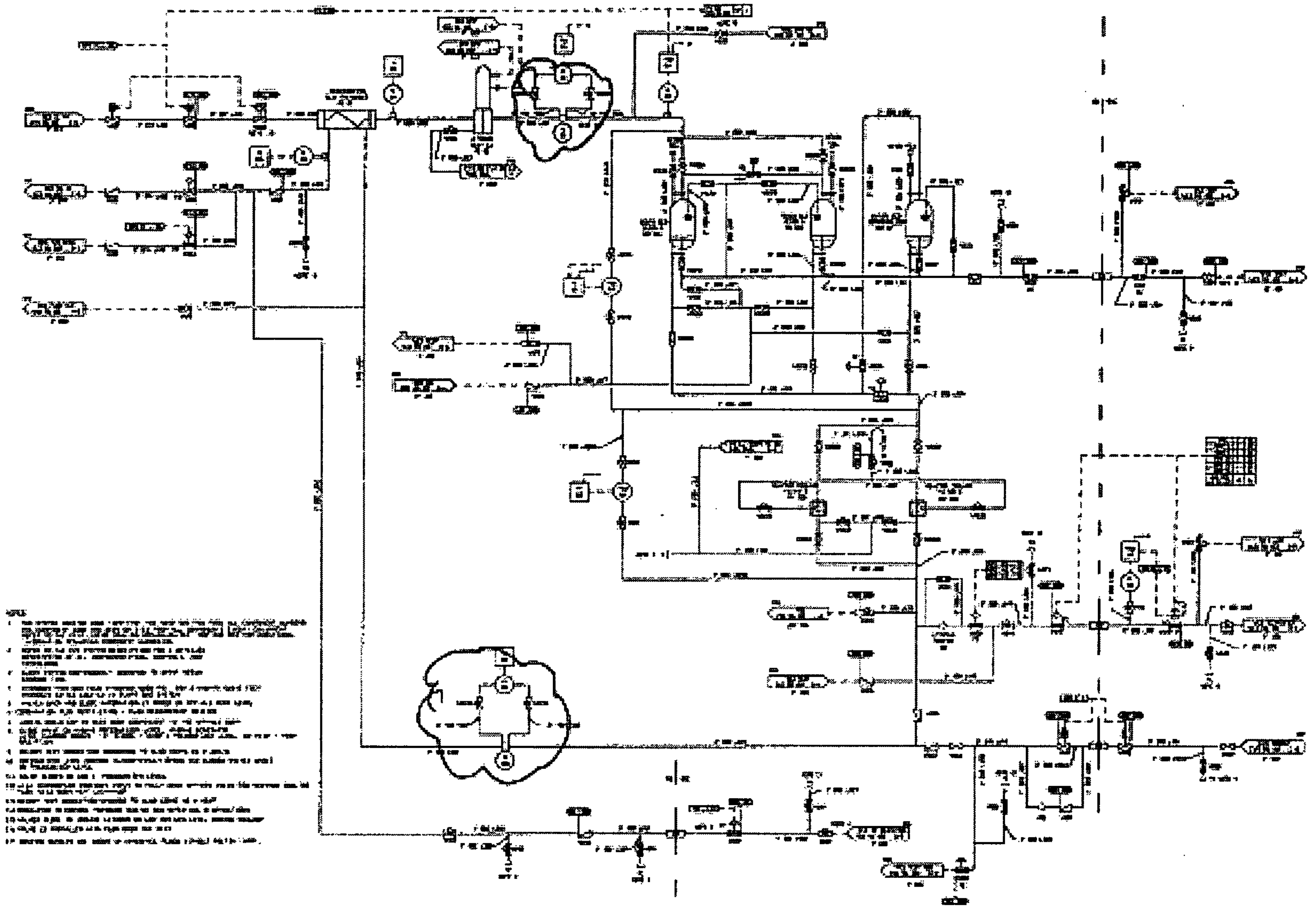


Figure 9.3.6-1 (Sheet 1 of 2)

Chemical and Volume Control System Piping and Instrumentation Diagram (REF) CVS 001

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

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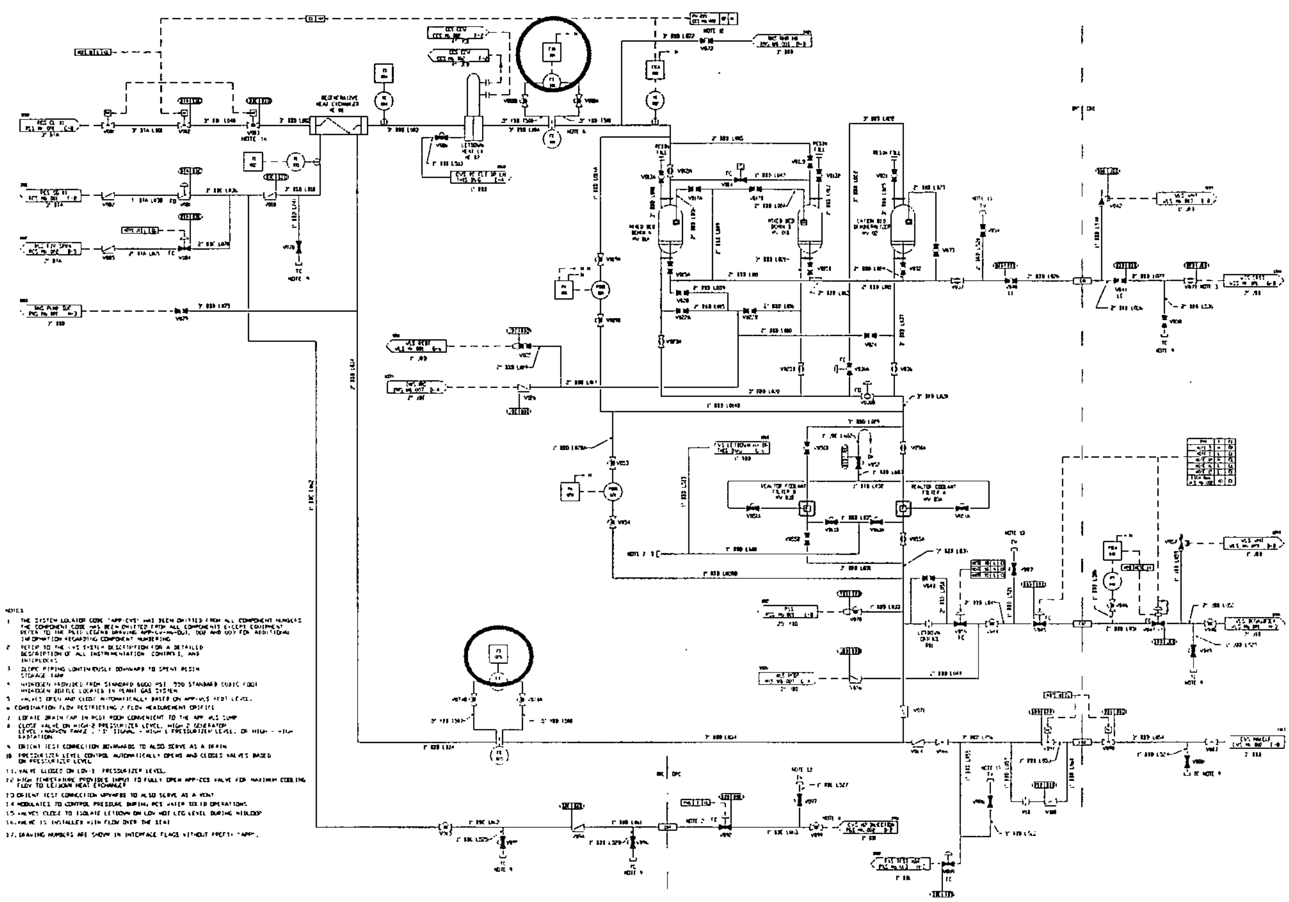

Figure 9.3.6-1 (Sheet 1 of 2)
Chemical and Volume Control
System Piping and Instrumentation Diagram
(REF) CVS 001

R15 Figure Mark-up

See Section IIB.14 on page 18 of TR 103 for the description and justification of this change.

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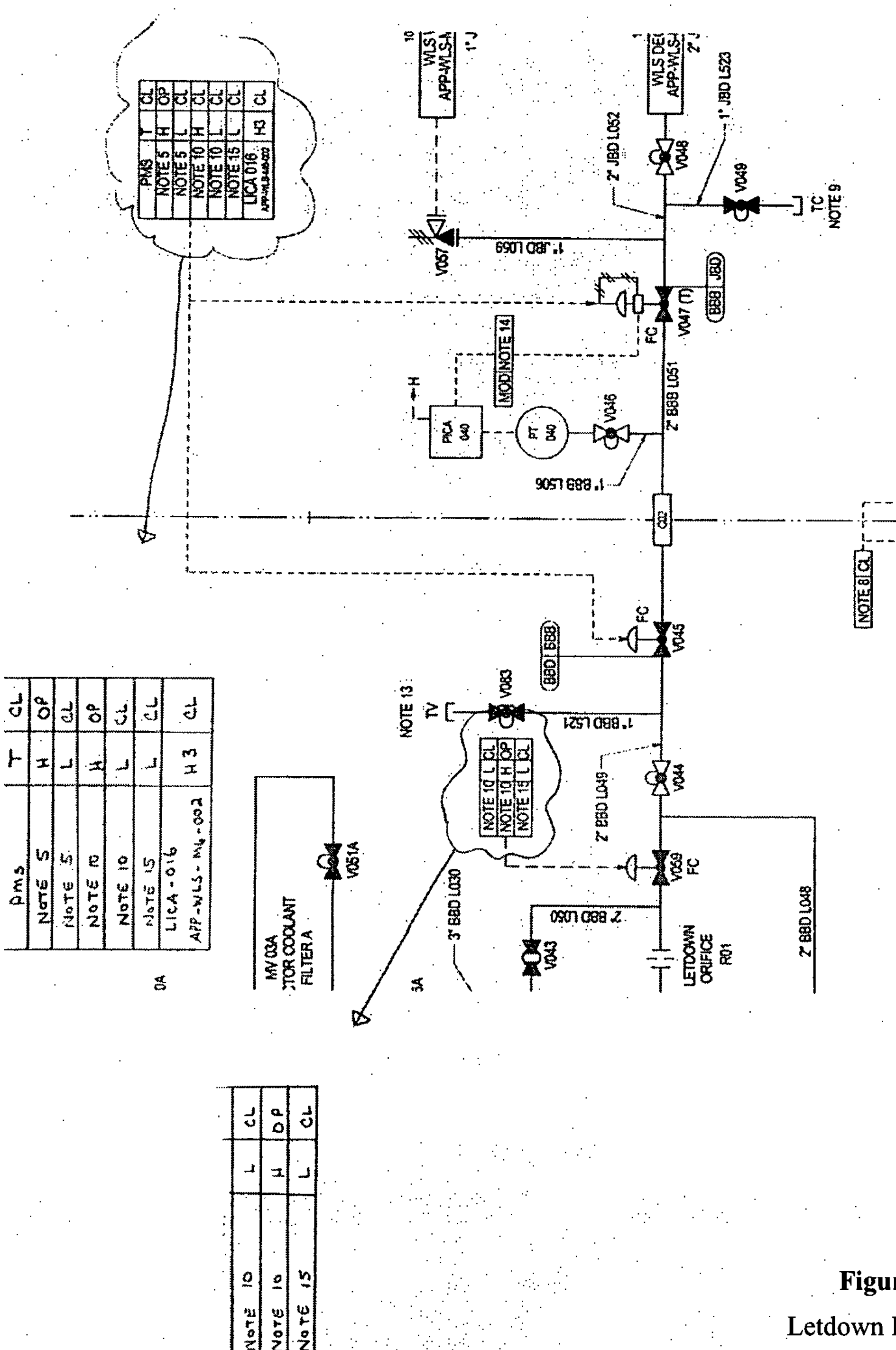

Figure 9.3.6-1 (Sheet 1 of 2)
Letdown Isolation Valve Controls

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

7. LOCATE DRAIN CAP IN RCDT ROOM CONVENIENT TO THE APP-WLS SUMP.
8. CLOSE VALVE ON HIGH-2 PRESSURIZER LEVEL, HIGH-2 GENERATOR LEVEL (NARROW RANGE), 'S' SIGNAL + HIGH 1 PRESSURIZER LEVEL, OR HIGH - HIGH RADIATION.
9. ORIENT TEST CONNECTION DOWNWARDS TO ALSO SERVE AS A DRAIN.
10. PRESSURIZER LEVEL CONTROL AUTOMATICALLY OPENS AND CLOSES VALVES BASED ON PRESSURIZER LEVEL.
11. VALVE CLOSES ON LOW-1 PRESSURIZER LEVEL.
12. HIGH TEMPERATURE PROVIDES INPUT TO FULLY OPEN APP-CCS VALVE FOR MAXIMUM COOLING FLOW TO LETDOWN HEAT EXCHANGER.
13. ORIENT TEST CONNECTION UPWARDS TO ALSO SERVE AS A VENT.
14. MODULATES TO CONTROL PRESSURE DURING RCS WATER SOLID OPERATIONS.
15. ~~VALVES CLOSE TO ISOLATE LETDOWN ON LOW HOT LEG LEVEL DURING MIDLOOP.~~
16. VALVE IS INSTALLED WITH FLOW OVER THE SEAT.

15. VALVES CLOSE TO ISOLATE LETDOWN ON LOW HOT LEG LEVEL DURING MIDLOOP ON RCS-LICA 160 A&B

Figure 9.3.6-1 (Sheet 1 of 2)

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

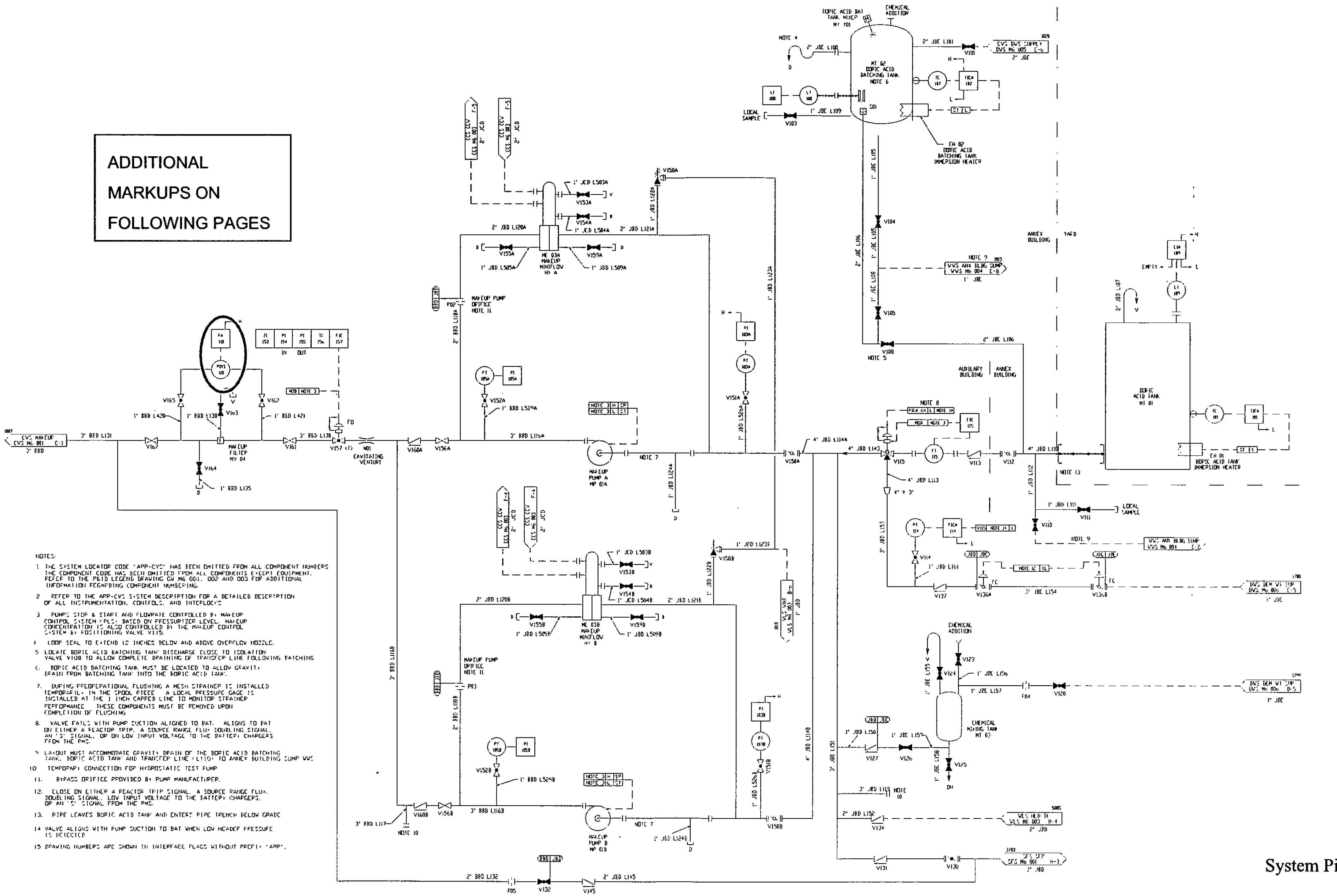

Figure 9.3.6-1 (Sheet 2 of 2)
Chemical and Volume Control
System Piping and Instrumentation Diagram
(REF) CVS 002

R15 Figure Mark-up

See Section II.B.14 on page 18 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

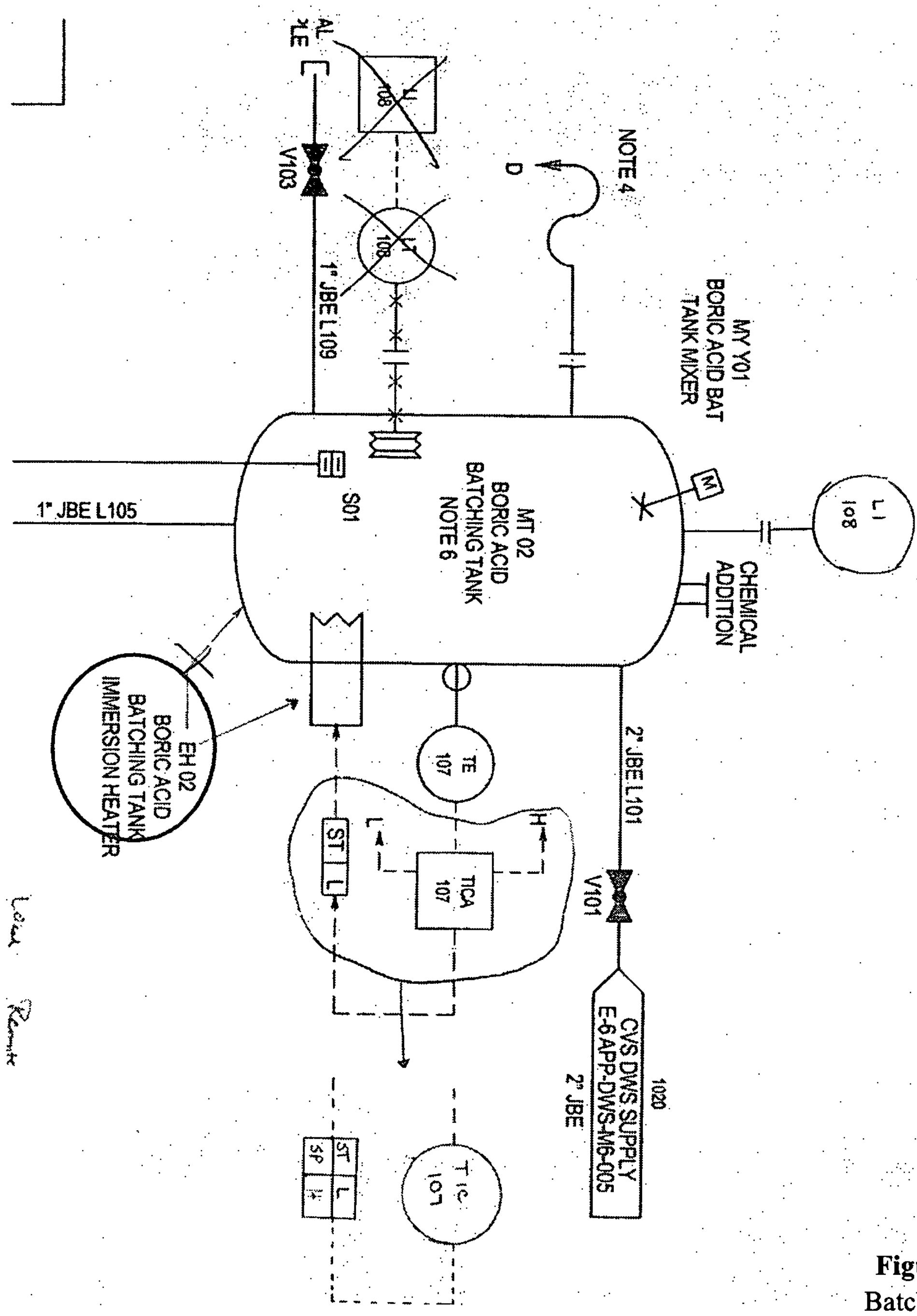

Figure 9.3.6-1 (Sheet 2 of 2)
Batching Tank Heater Control

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

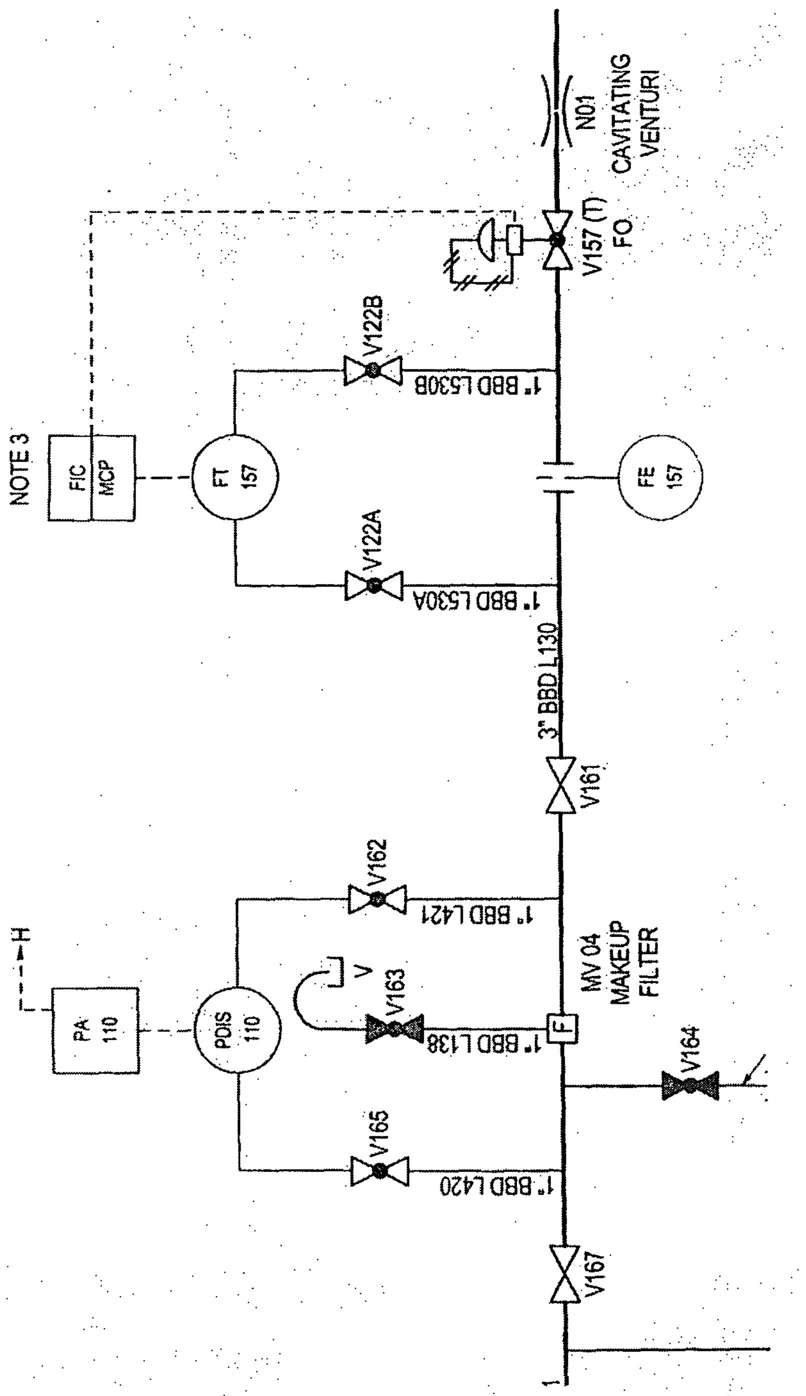

Figure 9.3.6-1 (Sheet 2 of 2)
Makeup Control Valve

R15 Figure Mark-up

See Section II.B.10 on page 16 of TR 103 for the description and justification of this change.

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Title: Fluid System Changes

See Section II.B.18 on page 20 of TR 103 for the description and justification of the following changes.

9.4.1.2.2 Component Description

Page 9.4-8

Electric Heating Coils

The electric heating coils are multi-stage fin tubular type. The electric heating coils meet the requirements of UL-1995 (Reference 10). Electric heating coils used in battery rooms meet the requirements of UL 823 (Reference 34) for Class 1 Division I, Group B hazardous locations. The coils for the supplemental air filtration subsystem are constructed, qualified, and tested in accordance with ASME AG-1 (Reference 36), Section CA.

Electric Convection Heaters

The electric convection heaters are of the single-stage or two-stage fin tubular type. The electric unit heaters are UL-listed and meet the requirements of UL-1996 (Reference 26) and the National Electric Code NFPA 70 (Reference 28). Convection heaters meet the requirements of UL 1278 (Reference 40) or UL 1042 (Reference 41). Convection heaters are controlled by an integral temperature sensor or by a temperature sensor located in the space served by the heater.

Electric Unit Heaters

The electric unit heaters are single-stage or two-stage fin tubular type. The electric unit heaters are UL-listed and meet the requirements of UL-1996 (Reference 26) and the National Electrical Code NFPA 70 (Reference 28).

See Section II.B.3 on page 11 of TR 103 for the description and justification of the following changes.

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Cooling Coils

The chilled water cooling coils are counterflow, finned tubular type. The cooling coils are designed and rated in accordance with ASHRAE 33 (Reference 11) and ANSI/ARI 410 (Reference 12).

Humidifiers

The humidifiers are packaged electric steam generator type which converts water to steam and distributes it through the air handling system. The humidifiers are designed and rated in accordance with ARI ~~620~~ 640 (Reference 13).

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Combination Fire/Smoke Dampers

Combination fire/smoke dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers. The combination fire/smoke dampers meet the design, leakage testing, and installation requirements of UL-555S (Reference 25).

Ductwork and Accessories

Ductwork, duct supports, and accessories are constructed of galvanized steel. Ductwork subject to fan shutoff pressures is structurally designed to accommodate fan shutoff pressures. Ductwork, supports, and accessories meet the design and construction requirements of SMACNA Industrial Rectangular and Round Duct Construction Standards (References 16 and 34) and SMACNA HVAC Duct Construction Standards – Metal and Flexible (Reference 17). The supplemental air filtration and main control room/~~technical~~ control support ~~center~~ area HVAC subsystem's ductwork, including the air filtration units and the portion of the ductwork located outside of the main control room envelope, that maintains integrity of the main control room/~~technical~~

control support center area pressure boundary during conditions of abnormal airborne radioactivity are designed in accordance with ASME AG-1 (Reference 36), Article SA-4500, to provide low leakage components necessary to maintain main control room/-technical control support center area habitability.

9.4.1.2.3 System Operation

9.4.1.2.3.1 Main Control Room/Technical Control Support Center Area HVAC Subsystem

Normal Plant Operation

During normal plant operation, one of the two 100 percent capacity supply air handling units and return/exhaust air fans operates continuously. Outside makeup air supply to the supply air handling units is provided through an outside air intake duct. The outside airflow rate is automatically controlled to maintain the main control room and technical control support center area at a slightly positive pressure with respect to the surrounding areas and the outside environment.
The main control room/-technical control support center area supply air handling units are sized to provide cooling air for personnel comfort, equipment cooling, and to maintain the main control room emergency habitability passive heat sink below its initial ambient air design temperature. The temperature of the air supplied by each air handling unit is controlled by temperature sensors located in the main control room return air duct and in the computer room B return air duct to maintain the ambient air design temperature within its normal design temperature range by modulating the electric heat or chilled water cooling. Some spaces have convection heaters for temperature control.

The outside air is continuously monitored by smoke monitors located at the outside air intake plenum and the return air is monitored for smoke upstream of the supply air handling units. The supply air to the main control room is continuously monitored for airborne radioactivity while the supplemental air filtration units remain in a standby operating mode.

Page 9.4-12

The main control room and technical control support center area ventilation supply and return/exhaust ducts can be remotely or manually isolated from the main control room.

If a high concentration of smoke is detected in the outside air intake, an alarm is initiated in the main control room and the main control room/~~technical~~ control support ~~center~~ area HVAC subsystem is manually realigned to the recirculation mode by closing the outside air and toilet exhaust duct isolation valves. The main control room and ~~technical~~ control support ~~center~~ area toilet exhaust fans are tripped upon closure of the isolation valves. The main control room/~~technical~~ control support ~~center~~ areas are not pressurized when operating in the recirculation mode. The main control room/~~technical~~ control support ~~center~~ area HVAC supply air subsystem continues to provide cooling, ventilation, and temperature control to maintain the emergency habitability passive heat sink below its initial ambient air design temperature and maintains the main control room and ~~technical~~ control support ~~center~~ areas within their design temperatures.

In the event of a fire in the main control room or ~~technical~~ control support ~~center~~ area, in response to heat from the fire or upon receipt of a smoke signal from an area smoke detector, the combination fire/smoke dampers close automatically to isolate the fire area. The subsystem continues to provide ventilation/cooling to the unaffected area and maintains the unaffected areas at a slightly positive pressure. The main control room/ ~~technical~~ control support ~~center~~ area HVAC subsystem can be manually realigned to the once-through ventilation mode to supply 100 percent outside air to the unaffected area. Realignment to the once-through ventilation mode minimizes the potential for migration of smoke or hot gas from the fire area to the unaffected area. Smoke and hot gases can be removed from the affected area by reopening the closed combination fire/smoke damper(s) from outside of the affected fire area during the once-through ventilation mode. In the once-through ventilation mode, the outside air intake damper to the air handling unit mixing plenum opens and the return air damper to the air handling unit closes to provide 100 percent outside air to the supply air handling unit. In this mode, the subsystem exhaust air isolation damper opens to exhaust the return air directly to the turbine building vent.

Power is supplied to the main control room/~~technical~~ control support ~~center~~ area HVAC subsystem by the plant ac electrical system. In the event of a loss of the plant ac electrical system, the main control room/ ~~technical~~ control support ~~center~~ area ventilation subsystem can be transferred to the onsite standby diesel generators. The convection heaters and duct heaters are not transferred to the onsite standby diesel generator.

9.4.1.2.3.2 Class 1E Electrical Room HVAC Subsystem

The Class 1E electrical room HVAC equipment that serves electrical division A and C equipment is described in this section. The operation of the Class 1E electrical room HVAC equipment that serves electrical division B and D is similar.

Normal Plant Operation

During normal plant operation, one of the redundant supply air handling units, return fans, and battery room exhaust fans operate continuously to provide room temperature control, to maintain the Class 1E electrical room emergency passive heat sink below its initial ambient air temperature, and to purge and prevent build-up of hydrogen gas concentration in the Class 1E Battery Rooms. The temperature of the air supplied by each air handling unit is controlled by temperature sensors located in the return air duct to maintain the room air temperature within the normal design range by modulating electric heating or chilled water cooling. Duct heaters are controlled by temperature sensors located in the space served by the heater.

During normal plant operation, the exhaust airflow from the Class 1E battery rooms is vented directly to the turbine building vent to limit the concentration of hydrogen gas in the rooms to less than 2 percent by volume in accordance with the guidelines of Regulatory Guide 1.128.

The outside makeup air to the supply air handling units is provided through an outside air intake duct. The outside airflow rate is manually balanced during system startup to provide adequate makeup air for the battery room exhaust fans.

The standby supply air handling unit and the corresponding return/exhaust fans are started automatically if one of the following conditions occurs:

- Airflow rate of the operating fan is above or below predetermined set points
- Return air temperature is above or below predetermined setpoints.
- 8. Loss of electrical and/or control power to the operating unit.

Abnormal Plant Operation

The operation of the Class 1E electrical room HVAC subsystem is not affected by the detection of airborne radioactivity in the main control room supply air duct of the main control room/~~technical~~ control support ~~center~~ area HVAC subsystem. During a design basis accident (DBA), if the plant ac electrical system is unavailable, the Class 1E electrical room passive heat sink provides area temperature control. Refer to Section 6.4 for further details.

Page 9.4-23

Electric Heating Coils

The electric heating coils are multi-stage fin tubular type. The electric heating coils meet the requirements of UL 1995 (Reference 10).

Electric Unit Heaters

The electric unit heaters are single-stage or two-stage fin tubular type. The electric unit heaters are UL-listed and meet the requirements of UL 1996 (Reference 26) and the National Electric Code NFPA 70 (Reference 28).

Humidifier

The humidifier is a packaged electric steam generator type which converts water to steam and distributes it through the supply duct system. The humidifier is performance rated in accordance with ARI ~~620~~ 640 (Reference 13).

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ANSI/AMCA 210 (Reference 4), ANSI/AMCA 211 (Reference 5), and ANSI/AMCA 300 (Reference 6).

Unit Coolers

Each unit cooler consist of a low efficiency filter bank, a chilled water cooling coil bank and a supply fan. The normal residual heat removal system pump room unit coolers have redundant cooling coil banks. The principal construction code is the manufacturer's standard.

Low and High Efficiency Filters

The low efficiency (25 percent) filters and high efficiency (80 percent) filters have a rated dust spot efficiency based on ASHRAE 52 and 126 (References 7 and 35). The filters minimum average dust spot efficiencies for the defense in depth filters are shown in Table 9.4.3-1. The filters meet UL 900 (Reference 8) Class I construction criteria.

Electric Unit Heaters

The electric unit heaters are single-stage or two-stage fin tubular type. The electric unit heater are UL-listed and meet the requirements of UL-1996 (Reference 26) and National Electric Code (Reference 28).

Hot Water Heating Coils

The hot water heating coils are finned tubular type. The outside supply air heating coils are provided with integral face and bypass dampers to prevent freeze damage when modulating the heat output. Coils are performance rated in accordance with ANSI/ARI 410 (Reference 12).

Electric Heating Coils

The electric heating coils are multistage fin tubular type. The electric heating coils meet the requirements of UL 1995 (Reference 10).

Cooling Coils

The chilled water cooling coils are counterflow, finned tubular type. The cooling coils are designed and rated in accordance with ASHRAE 33 (Reference 11) and ANSI/ARI 410 (Reference 12).

Humidifier

The humidifier is a packaged electric steam generator type which converts water to steam and distributes it through the supply duct system. The humidifier is performance rated in accordance with ARI ~~620~~ 640 (Reference 13).

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Shutoff, Control, Balancing, and Backdraft Dampers

Multiblade, two-position remotely operated shutoff dampers are parallel-blade type. Multiblade, control and balancing dampers are opposed-blade type. Backdraft dampers are provided to prevent backflow through shut down fans. Air handling unit and fan shutoff dampers are designed for maximum fan static pressure at shutoff flow. Dampers meet the performance requirements of ANSI/AMCA 500 (Reference 14).

Unit Heaters

Unit heaters are the down-blow type with propeller type fans directly connected to the fan motor. Each unit heater is equipped with a four-way discharge outlet. The coil ratings are in accordance with ANSI/ARI 410 (Reference 12).

Electric Duct Heaters

Electric duct heaters are open grid type. The duct heaters are UL-listed for zero clearance and meet requirements of NFPA 70 (Reference 28).

Humidifiers

A humidifier is a packaged electric steam generator type which converts water to steam and distributes it through the air handling system. The humidifier is designed and rated in accordance with ARI ~~620~~ 640 (Reference 13).

Page 9.4-70

Supply and Exhaust Air Fans

The supply and exhaust fans are centrifugal type, single width single inlet (SWSI) or double width double inlet (DWDI), with high efficiency wheels and backward inclined blades to produce non-overloading horsepower characteristics. The fans are designed and rated in accordance with ANSI/AMCA 210 (Reference 4), ANSI/AMCA 211 (Reference 5), and ANSI/AMCA 300 (Reference 6).

Low Efficiency Filters and High Efficiency Filters

The low efficiency (25 percent) filters and high efficiency (80 percent) filters have a rated dust spot efficiency based on ASHRAE 52 and 126 (References 7 and 35). The filters meet UL 900 (Reference 8) Class I construction criteria.

Cooling Coils

The chilled water cooling coils are counterflow, finned tubular type. The cooling coils are designed and rated in accordance with ASHRAE 33 (Reference 11) and ANSI/ARI 410 (Reference 12).

Heating Coils

The hot water heating coils are counterflow, finned tubular type. The heating coils are provided with integral face and bypass dampers to prevent freeze damage when modulating heat output. The heating coils are designed and rated in accordance with ASHRAE 33 (Reference 11) and ANSI/ARI 410 (Reference 12).

Humidifier

The humidifier is a packaged electric steam generator type which converts water to steam and distributes it through the air handling system. The humidifier is designed and rated in accordance with ARI ~~620~~ 640 (Reference 13).

Page 9.4-73

6. "Reverberant Room Method of Testing Fans For Rating Purposes," ANSI/AMCA 300-85.
7. Gravimetric and Dust Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter, ASHRAE 52.1, 1992.
8. "Test Performance of Air-Filter Units," UL-900, 1994.
9. "High-Efficiency, Particular, Air-Filter Units," UL-586, 1996.
10. "Heating and Cooling Equipment," UL 1995, 1995.

11. "Methods of Testing for Rating Forced Circulation Air Cooling and Air Heating Coils," ASHRAE 33-78.
12. "Forced-Circulation Air Cooling and Air Heating Coils," ANSI/ARI 410-91.
13. ~~"Self-Contained Humidifiers," ARI 620-96.~~

    "Commercial and Industrial Humidifiers," ARI 640-96

14. "Testing Methods for Louvers, Dampers, and Shutters," ANSI/AMCA 500-89.
15. "Fire Dampers," UL-555, 1999.
16. "Rectangular Industrial Duct Construction Standards," SMACNA, 1980.
17. "HVAC Duct Construction Standards – Metal and Flexible," SMACNA, 1995.
18. "HVAC Duct Leakage Test Manual," SMACNA, 1985.
19. "HVAC Systems – Testing, Adjusting, and Balancing," SMACNA, 1993.
20. Code of Federal Regulations, Title 10, Part 50, Appendix I.
21. Code of Federal Regulations, Title 10, Part 20.
22. "Heat-Stress Management Program for Nuclear Power Plants," EPRI NP-4453 by Westinghouse Electric Corporation, dated February 1986.
23. Branch Technical Position CSB 6-4 to "Containment Isolation System," Standard Review Plan 6.2.4 of NUREG-0800 Rev. 2, July 1981.
24. "Military Specification Filter, Particulate, High-Efficiency, Fire Resistant," MIL-F-51068F.
25. "Leakage Rated Dampers for Use in Smoke Control System," UL-555S, 1999.
26. "Electric Duct Heaters," UL-1996, 1996.
27. "Standard for Installation of Air Conditioning and Ventilation Systems," NFPA 90A, 1999.
28. "National Electrical Code," NFPA 70, 1999.
29. "Loss of Charcoal from Adsorber Cells," IE Bulletin 80-03, 1980.
30. "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmospheric Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Regulatory Guide (RG) 1.140-2001, Revision 2.
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32. "Ventilation for Acceptable Indoor Air Quality," ASHRAE Standard 62-1999.
33. NFPA 92A-2000, "Recommended Practice for Smoke Control Systems."

34. "Round Industrial Duct Construction Standards," SMACNA, 1999.

35. "Method of Testing HVAC Air Ducts," ASHRAE 126, 2000.

36. "Code on Nuclear Air and Gas Treatment," ASME/ANSI AG-1-1997.

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39. Electric Heaters For Use in Hazardous (Classified) Locations, UL 823.

40. Movable and Wall or Ceiling Hung Electrical Room Heaters, UL 1278.

41. Electrical Baseboard Heating Equipment, UL 1042.

Document Number: APP-GW-GLN-019   **Revision Number:** 2

Title: Fluid System Changes

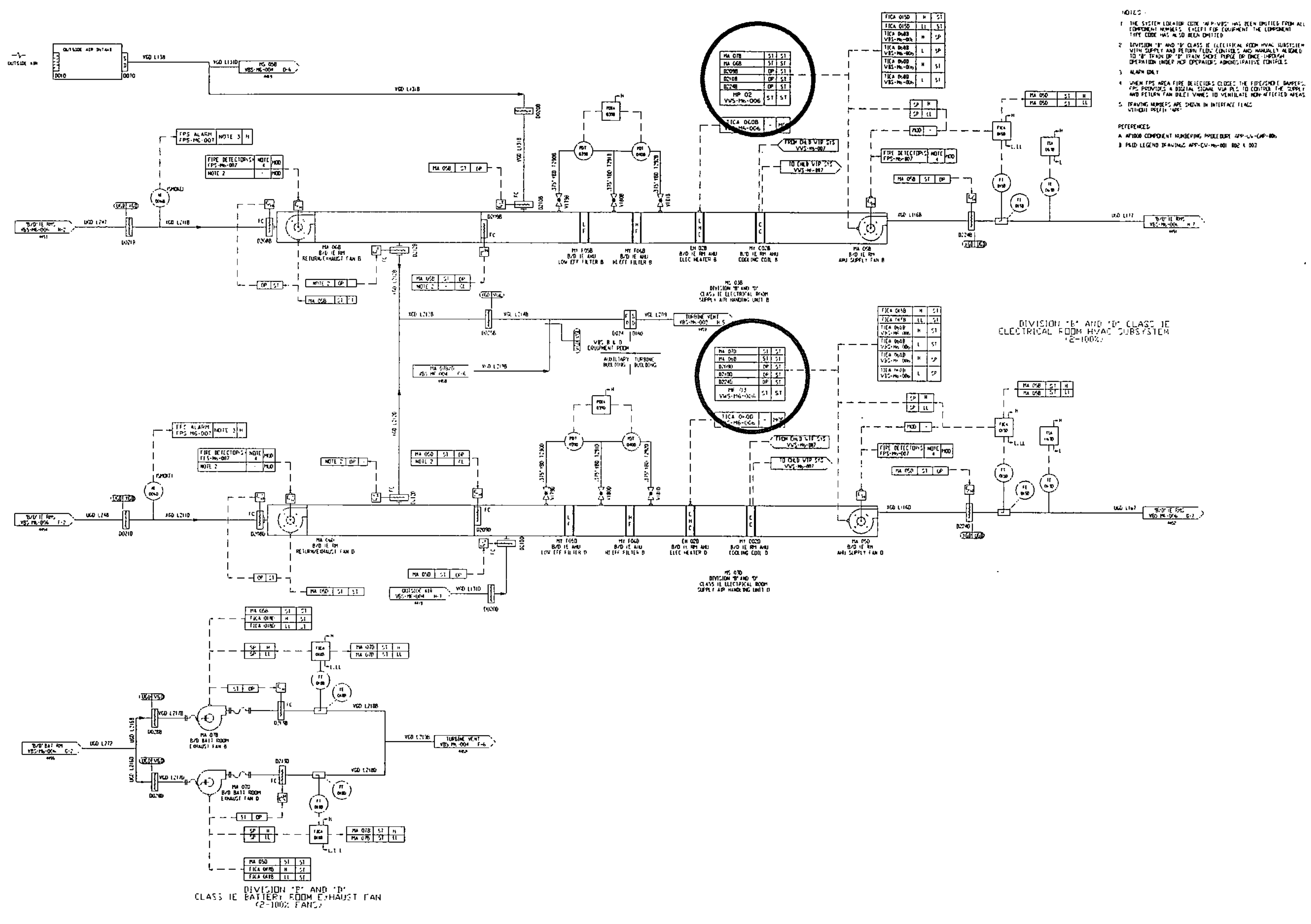


Figure 9.4.1-1 (Sheet 4 of 7)

Nuclear Island Non-Radioactive Ventilation System

Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.A.3 on page 6 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

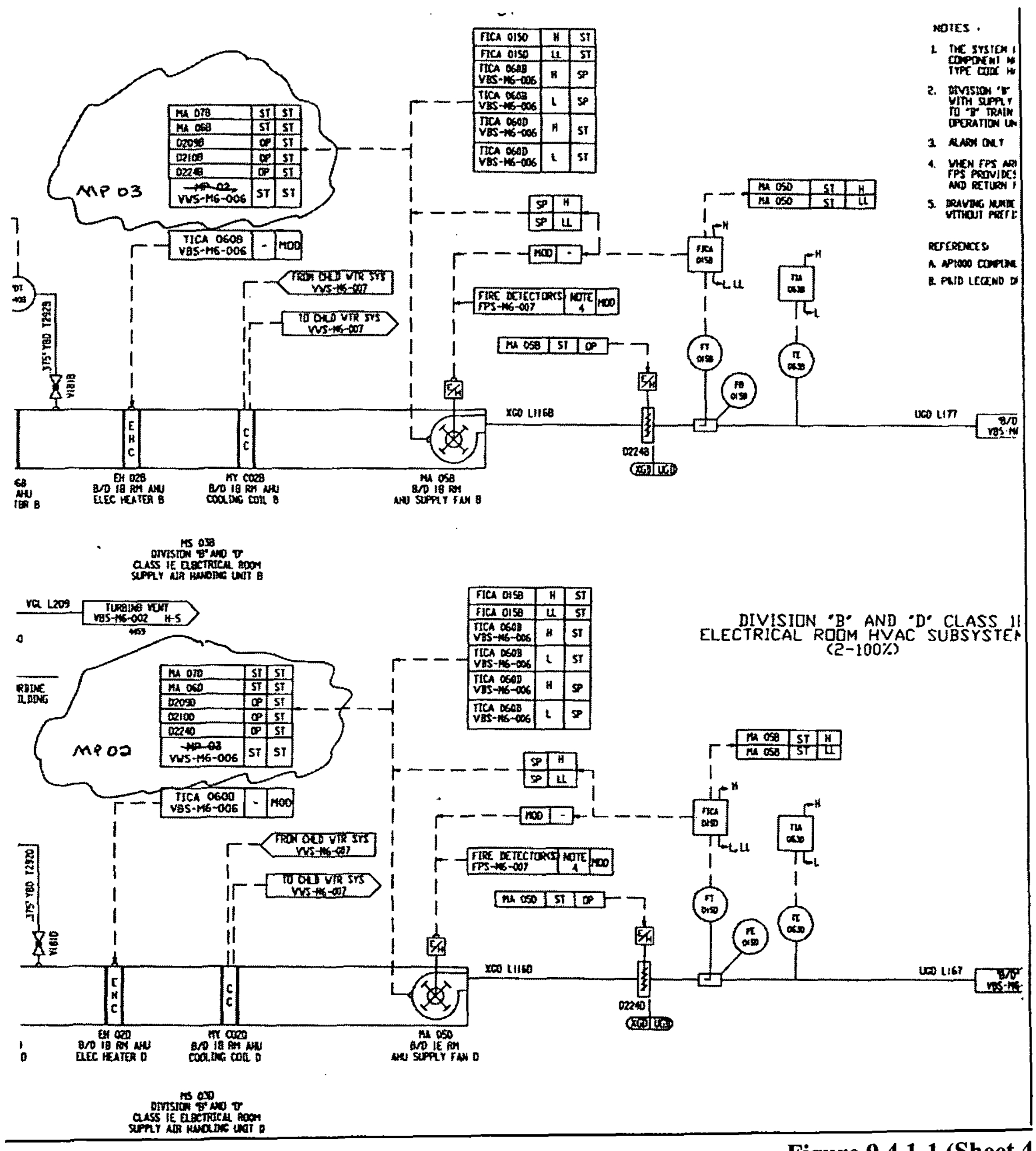


Figure 9.4.1-1 (Sheet 4 of 7)
Nuclear Island Non-Radioactive Ventilation System
Piping and Instrumentation Diagram
(REF) VBS 004

R15 Figure Mark-up

See Section II.A.3 on page 6 of TR 103 for the description and justification of this change.

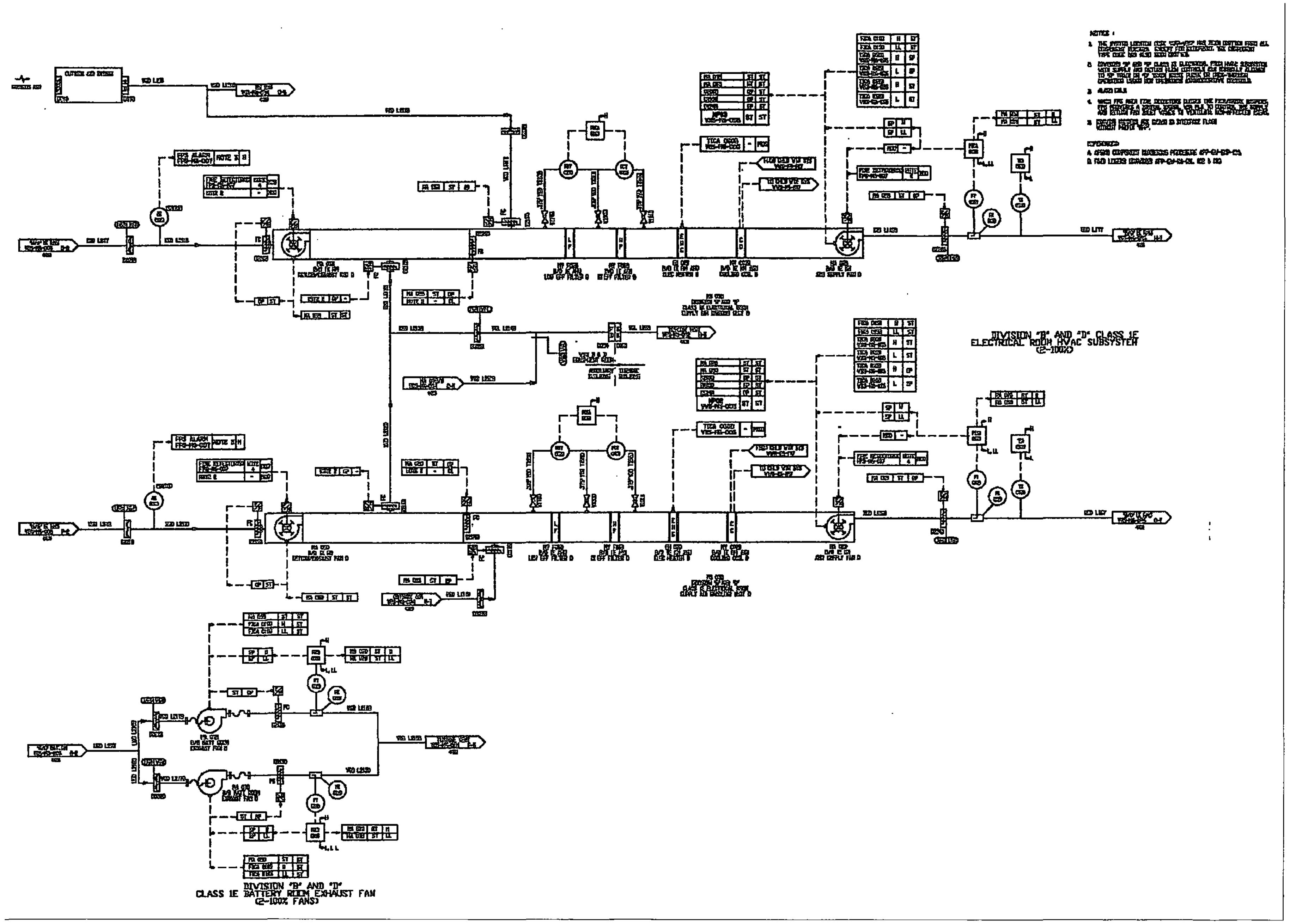


Figure 9.4.1-1 (Sheet 4 of 7)

Nuclear Island Non-Radioactive Ventilation System Piping and Instrumentation Diagram

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

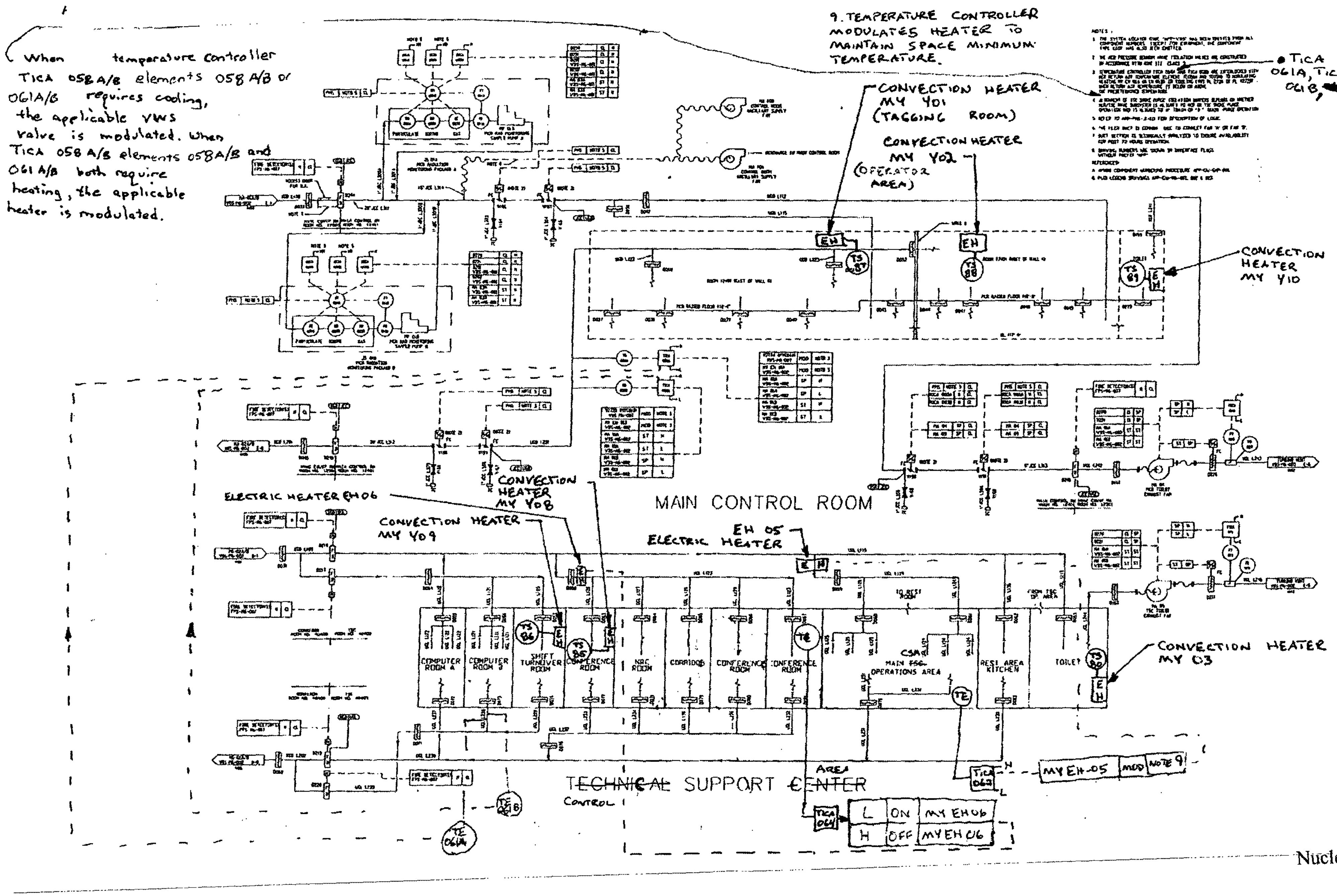


Figure 9.4.1-1 (Sheet 5 of 7)
Nuclear Island Non-Radioactive Ventilation System
Piping and Instrumentation Diagram

R15 Figure Mark-up
See Section II.B.18 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

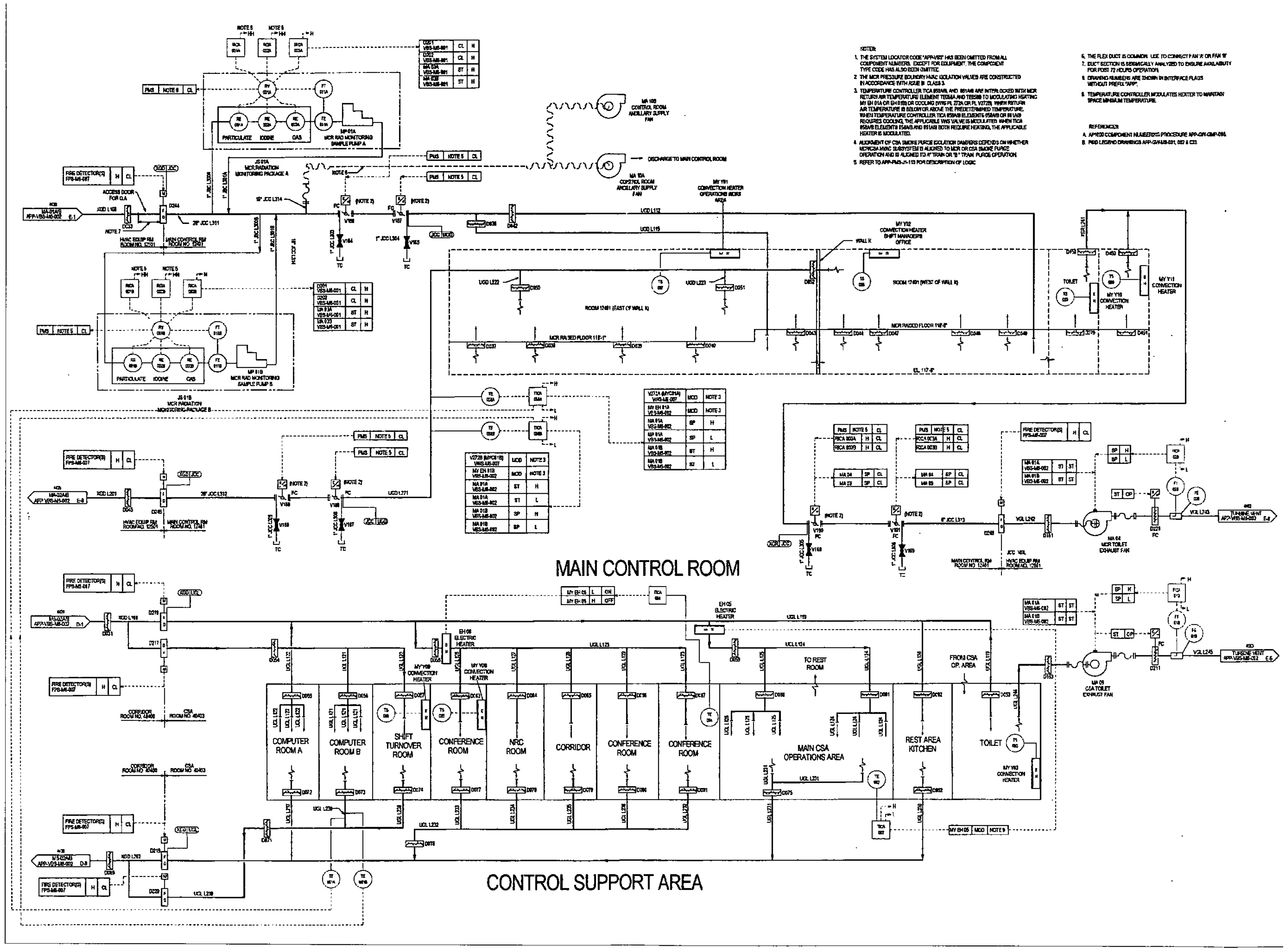


Figure 9.4.1-1 (Sheet 5 of 7)

Nuclear Island Non-Radioactive Ventilation System
Piping and Instrumentation Diagram

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

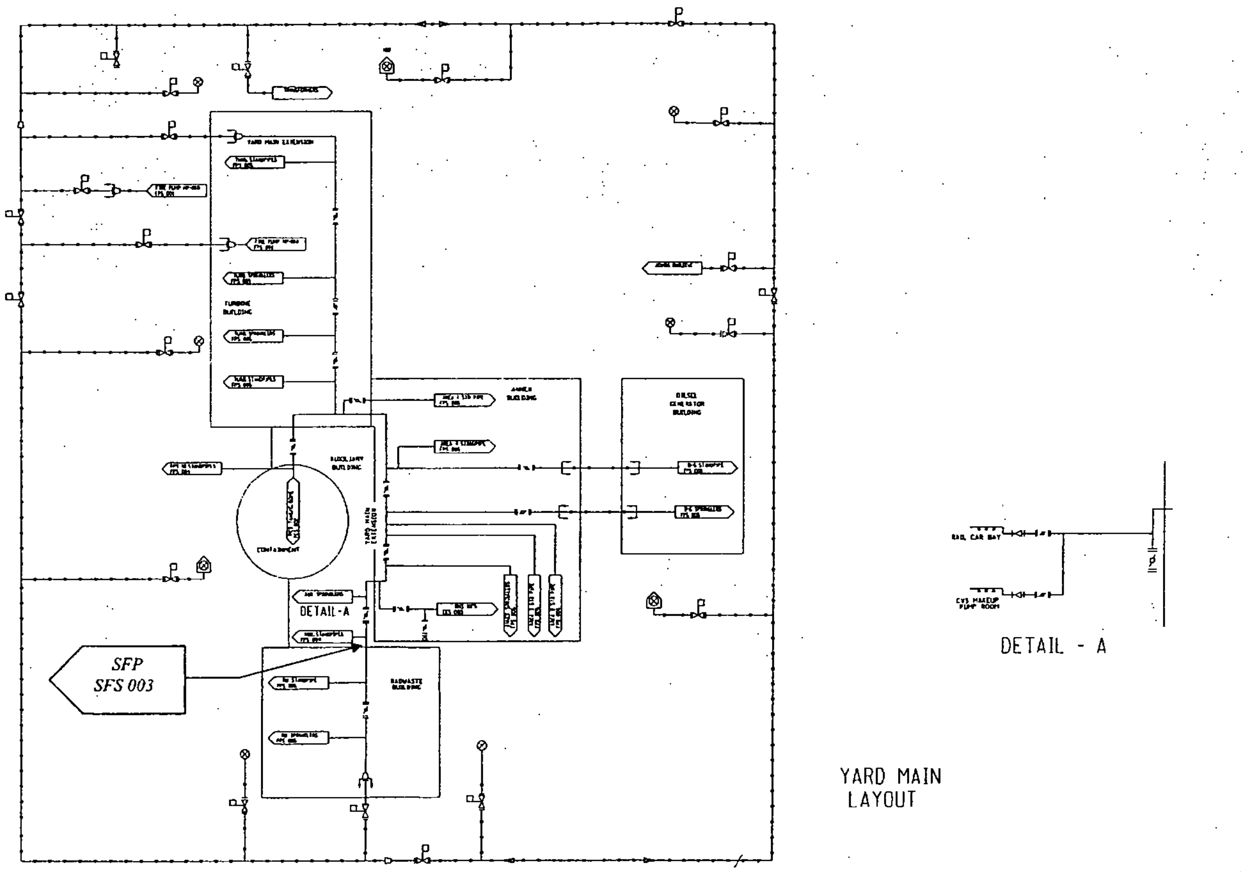


Figure 9.5.1-1 (Sheet 2 of 3)
Fire Protection System
Piping and Instrumentation Diagram
(REF) FPS 002, 004

R15 Figure Mark-up

See Section II.E.1 on page 23 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

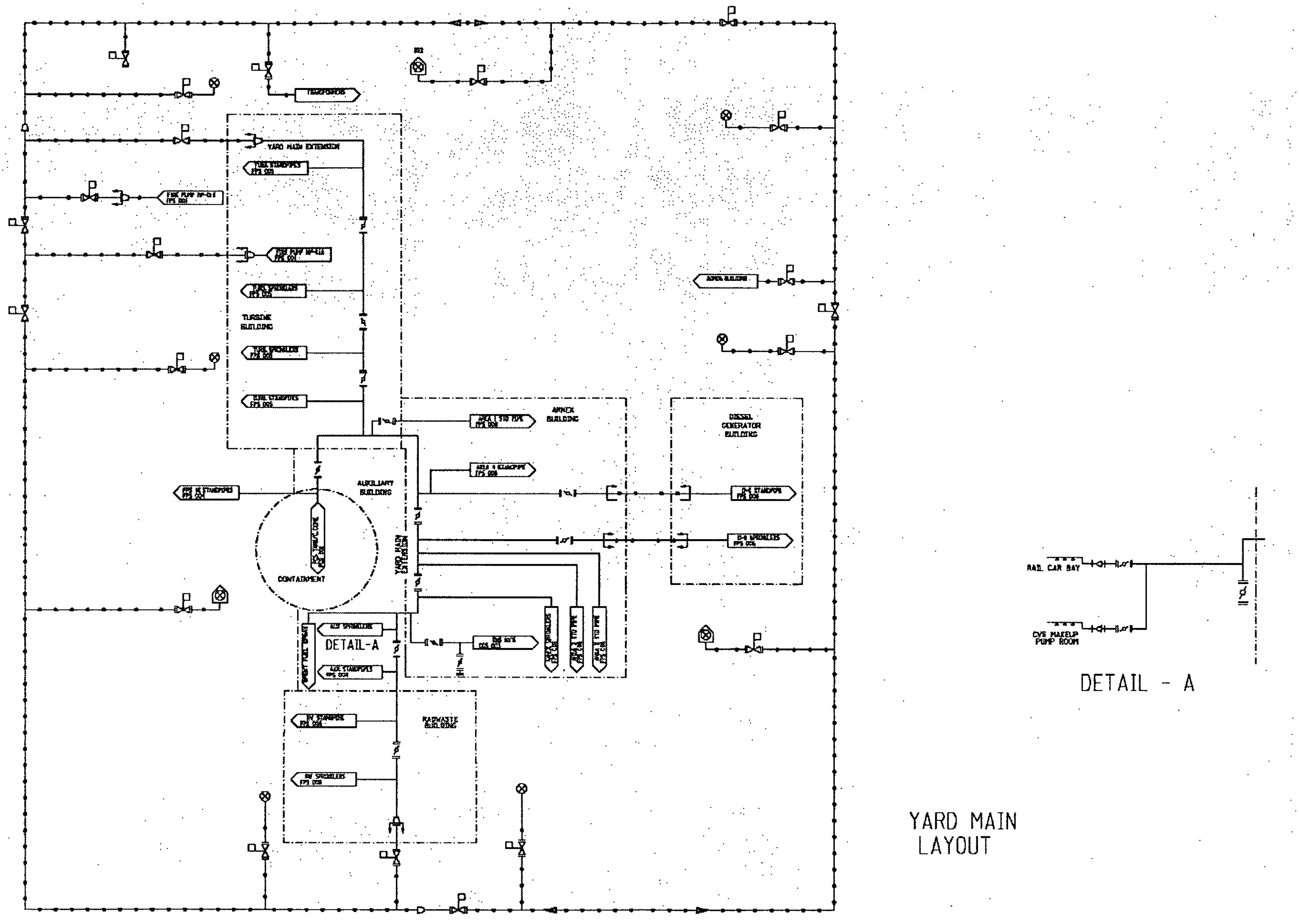


Figure 9.5.1-1 (Sheet 2 of 3)

Fire Protection System
Piping and Instrumentation Diagram

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

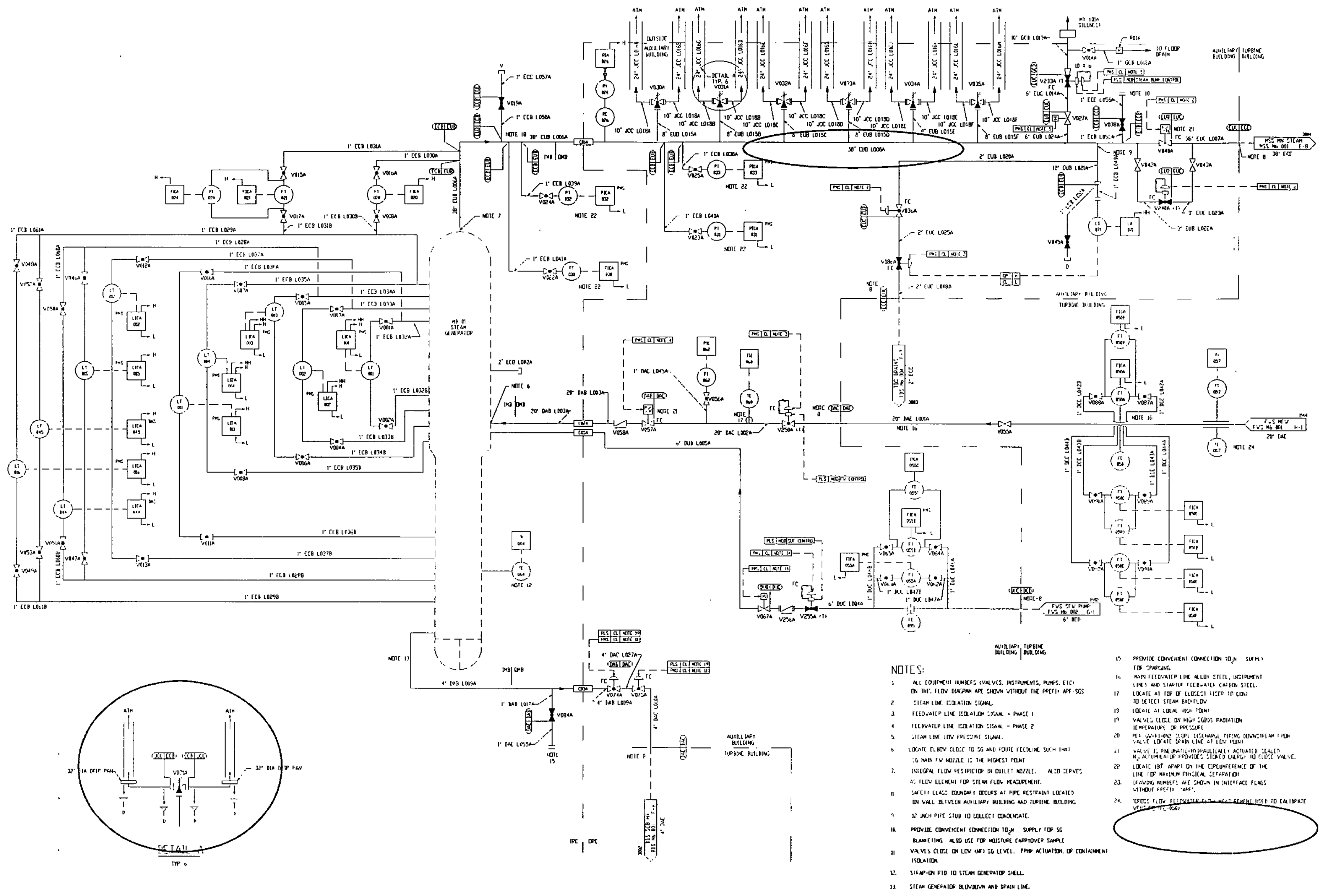


Figure 10.3.2-1 (Sheet 1 of 2)
Main Steam Piping and Instrumentation
Diagram (Safety-Related System)
(REF) SGS 001

R15 Figure Mark-up

See Section II.B.2 on page 10 of TR 103 for the description and justification of this change.

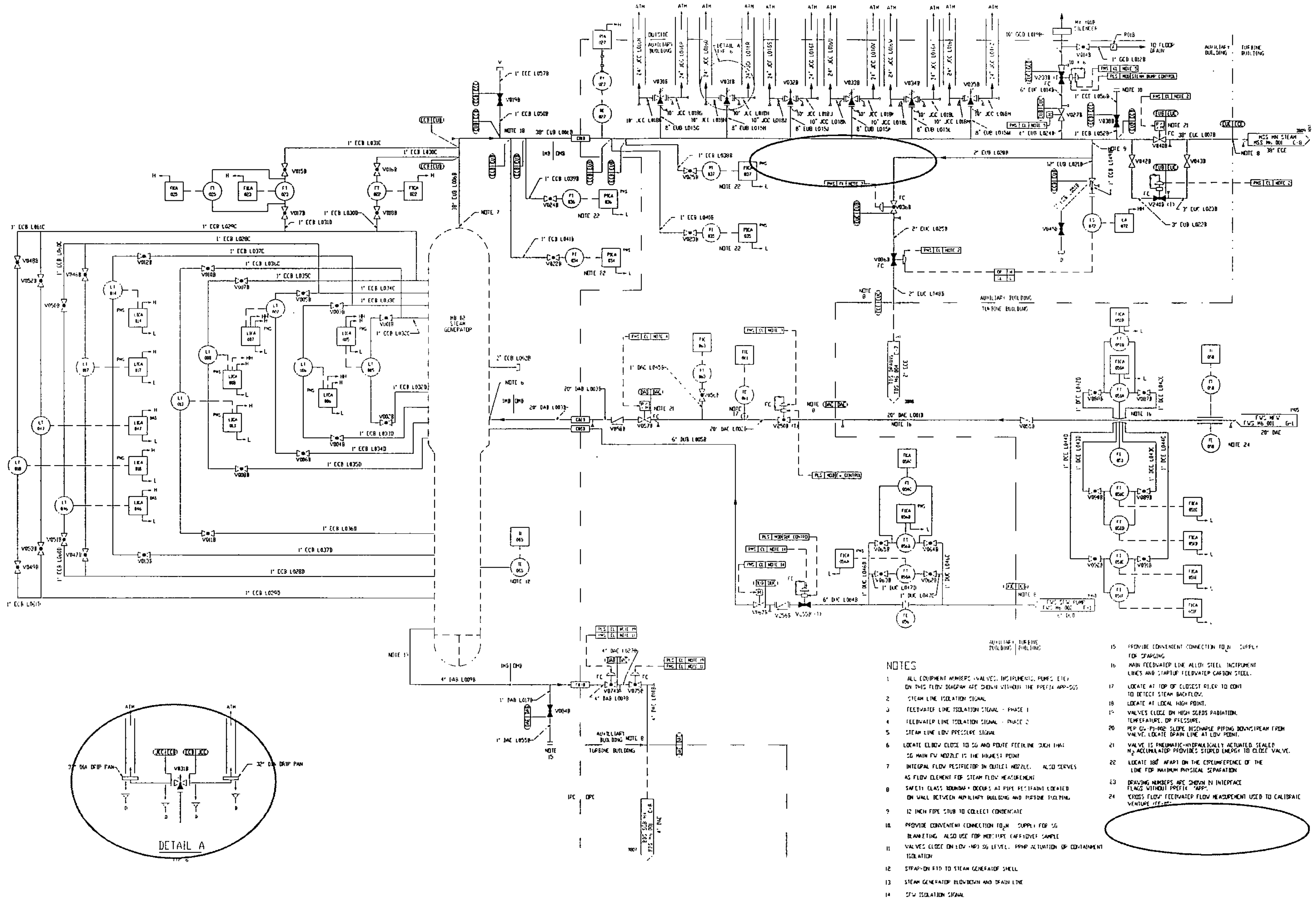


Figure 10.3.2.1 (Sheet 2 of 2)

Main Steam Piping and Instrumentation Diagram (Safety-Related System) (REF) SGS 002

R15 Figure Mark-up

See Section II.B.2 on page 10 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

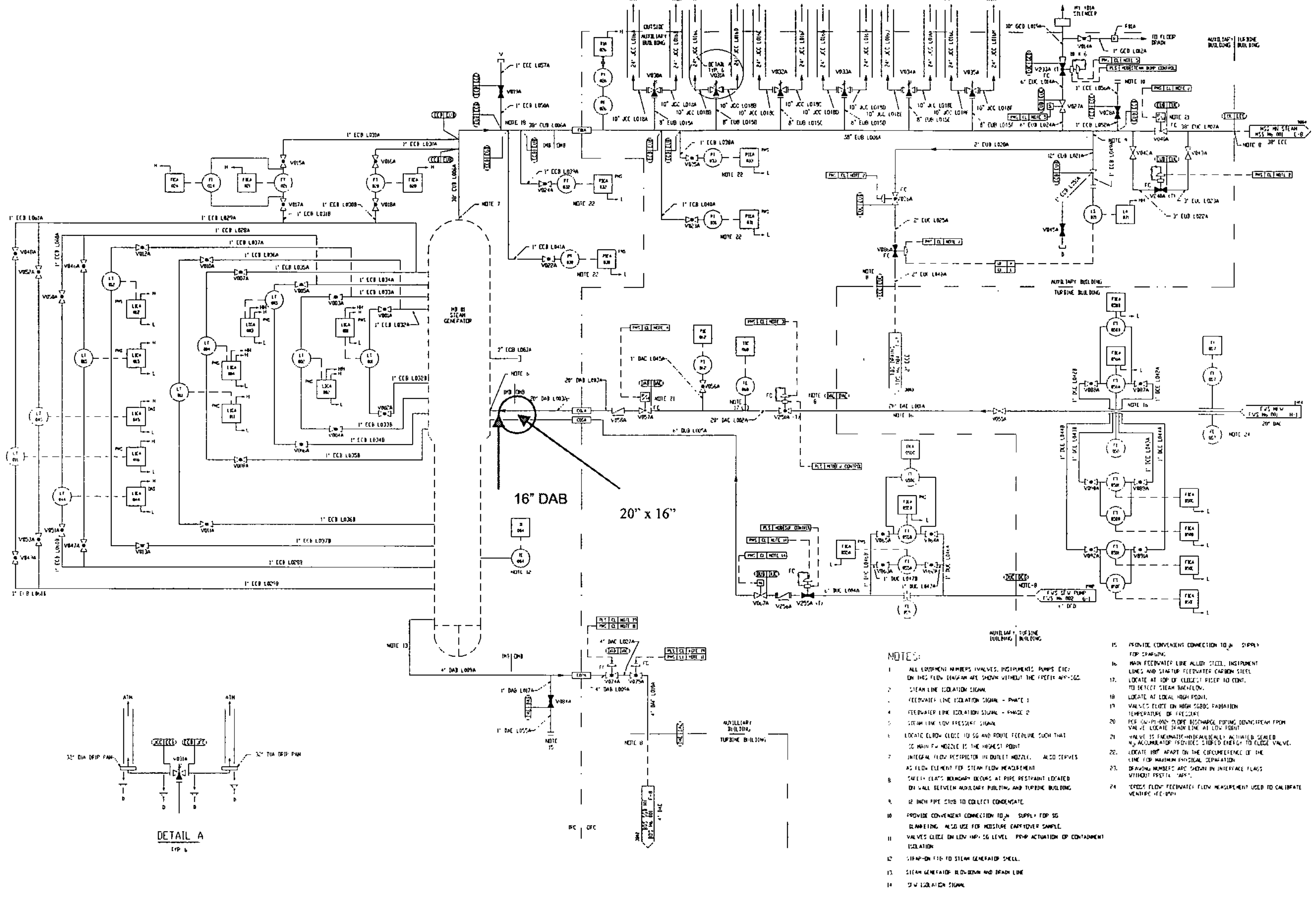


Figure 10.3.2-1
Main Steam Piping and Instrumentation
Diagram (Safety-Related System)
(REF) SGS 001

R15 Figure Mark-up

See Section IIB.4 on page 11 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

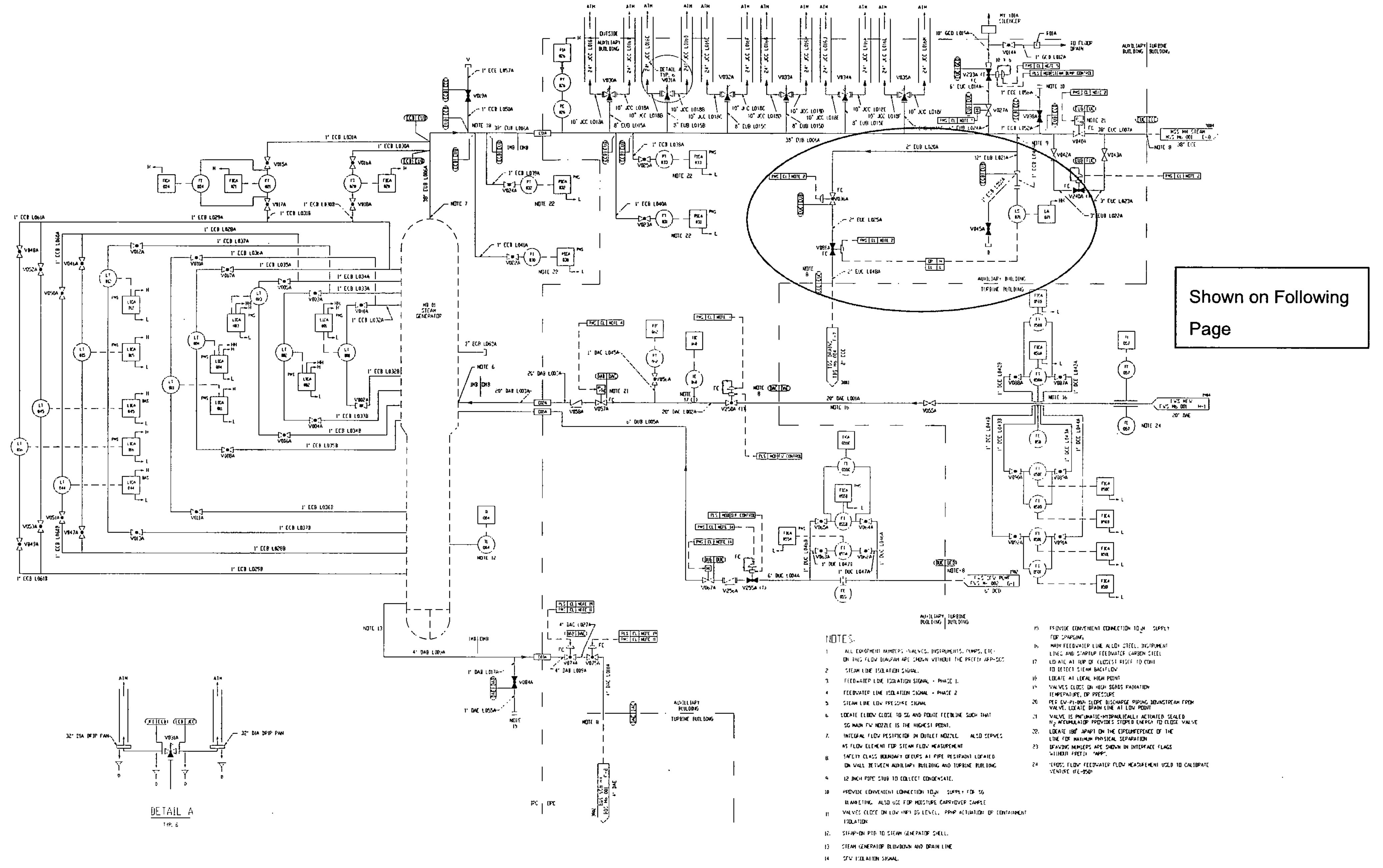


Figure 10.3.2-1
Main Steam Piping and Instrumentation Diagram (Safety-Related System) (REF) SGS 001

R15 Figure Mark-up

See Section II.B.16 on page 19 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

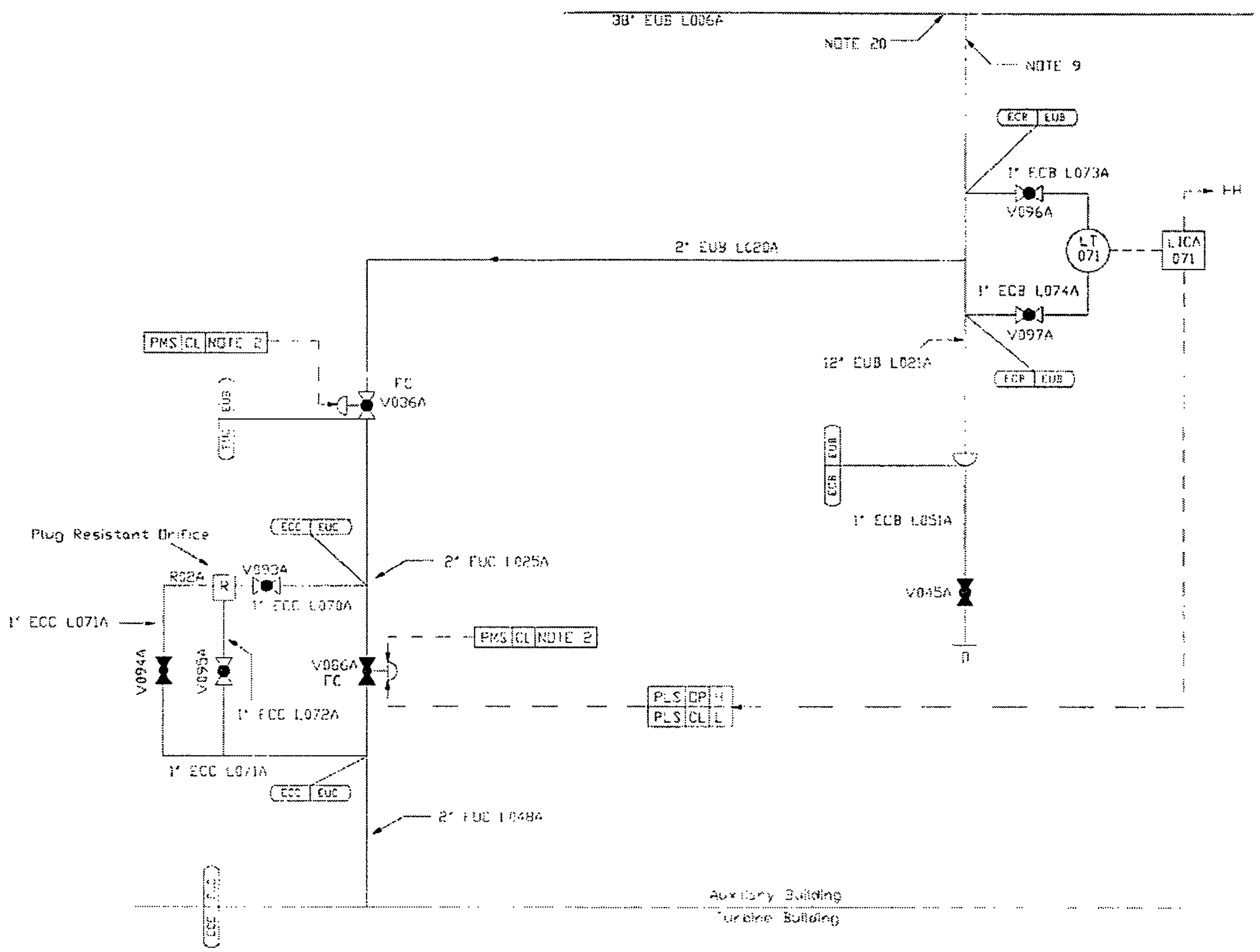


Figure 10.3.2-1 (Condensate Drain)
Main Steam Piping and Instrumentation
Diagram (Safety-Related System)
(REF) SGS 001

R15 Figure Mark-up

See Section II.B.16 on page 19 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

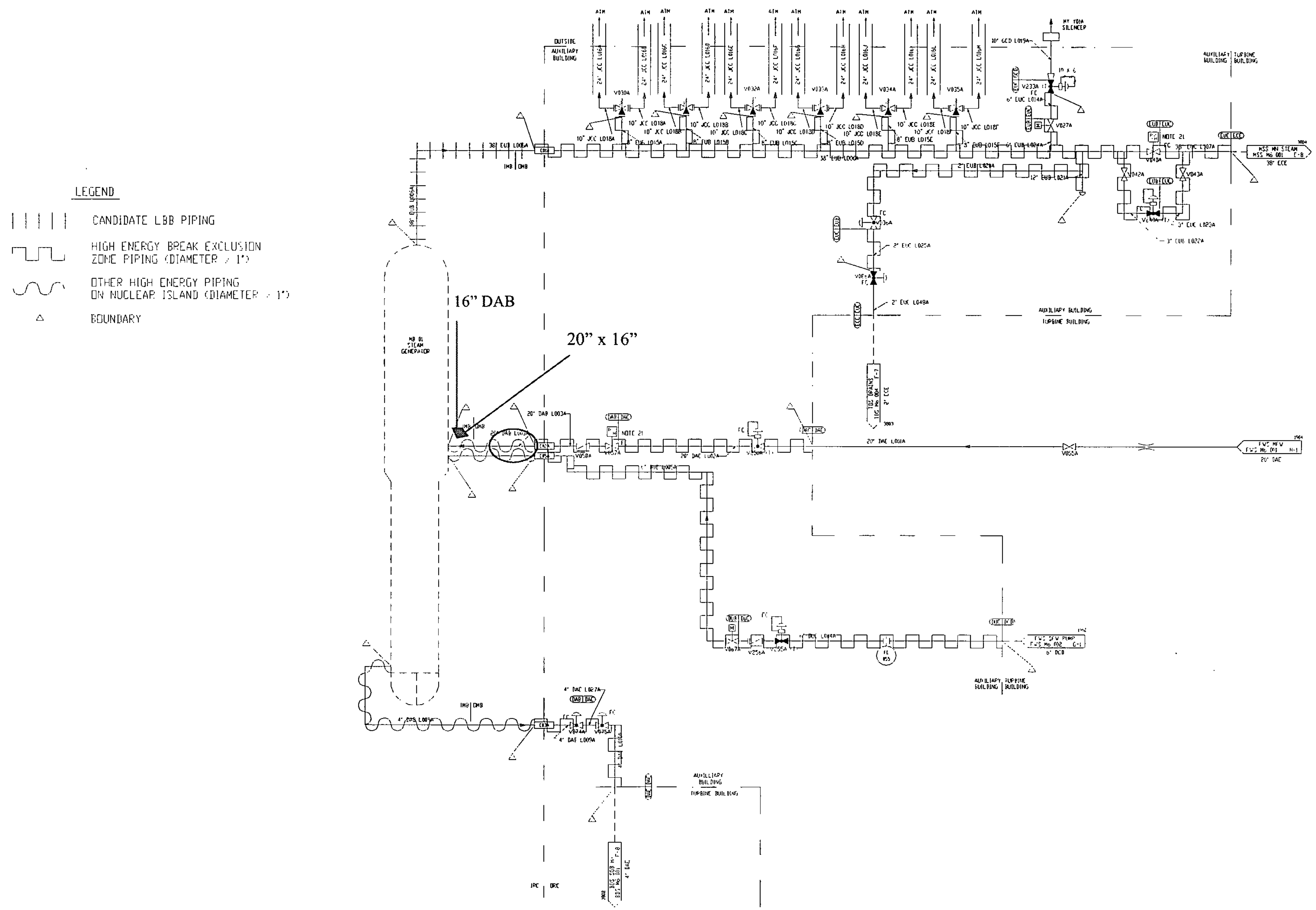


Figure 3E-1

R15 Figure Mark-up

See Section II.B.4 on page 11 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

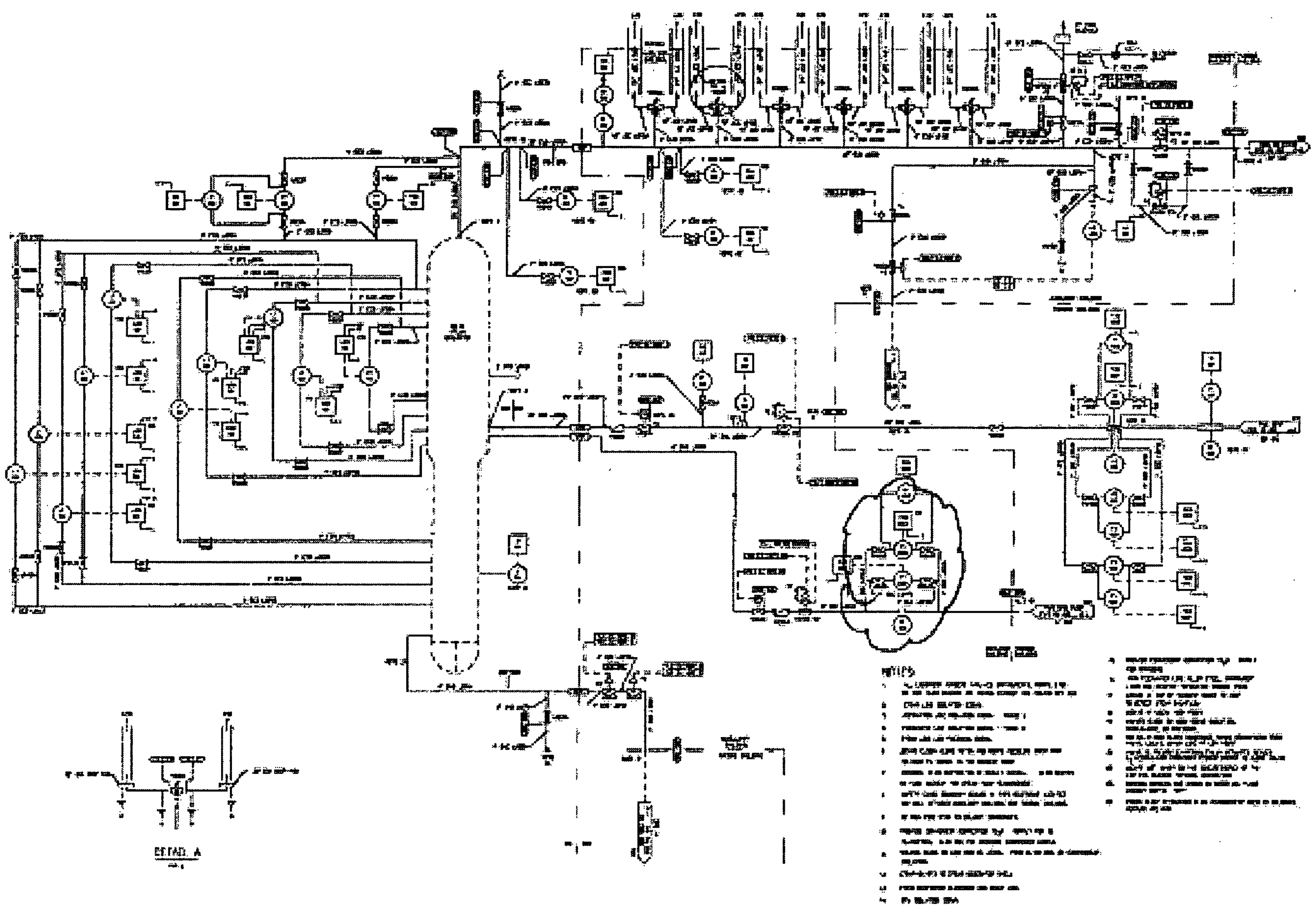


Figure 10.3.2-1 (Sheet 1 of 2)

Main Steam Piping and Instrumentation Diagram (Safety Related System) (REF) SGS 001

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

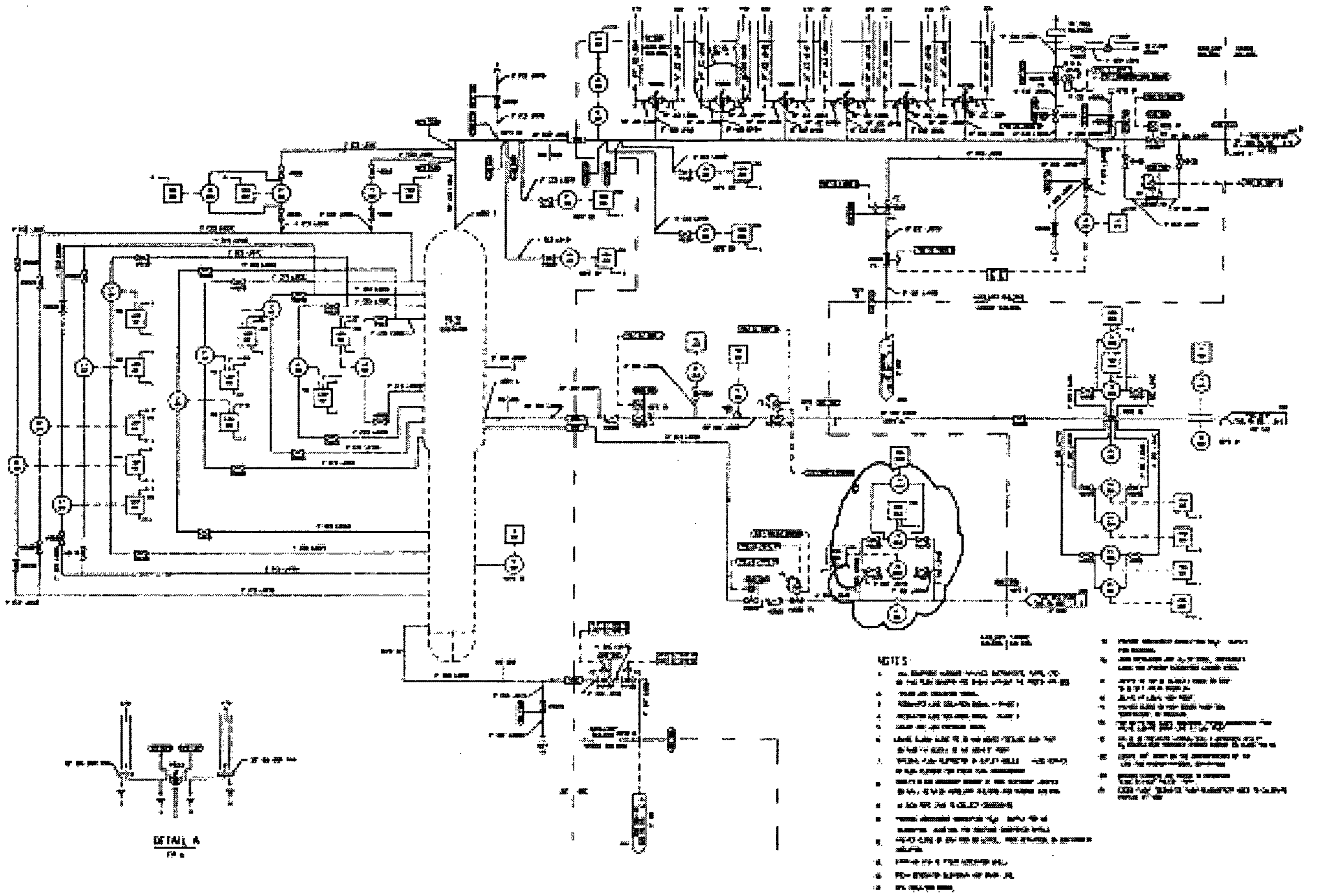
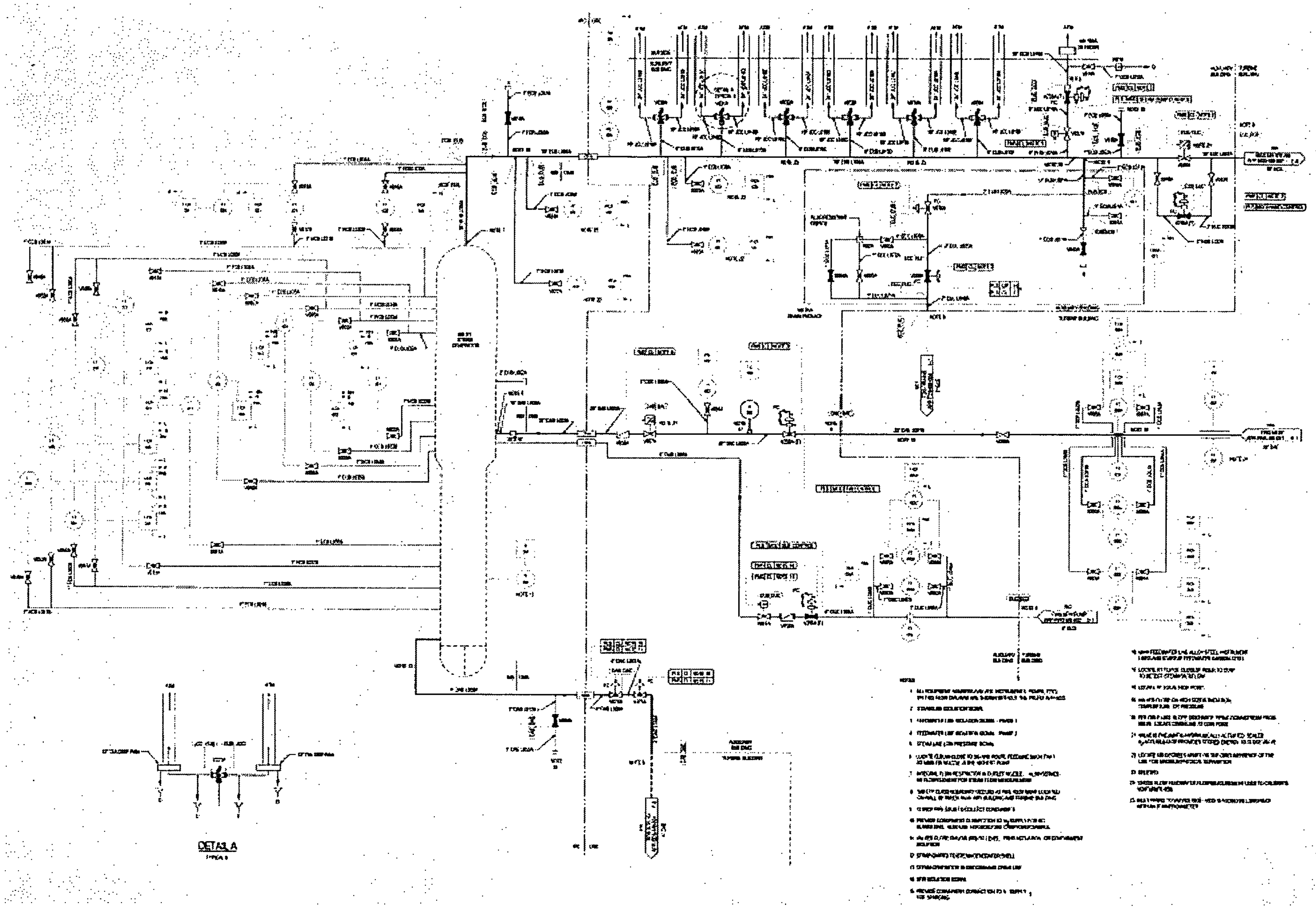


Figure 10.3.2-1 (Sheet 2 of 2)

Main Steam Piping and Instrumentation Diagram (Safety Related System) (REF) SGS 002

R15 Figure Mark-up

See Section II.C.1 on page 20 of TR 103 for the description and justification of this change.



Revised DCD Figure 10.3.2.1 (Sheet 1 of 2)
Main Steam Piping and Instrumentation
Diagram (Safety-Related System)
(REF) SGS 001

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

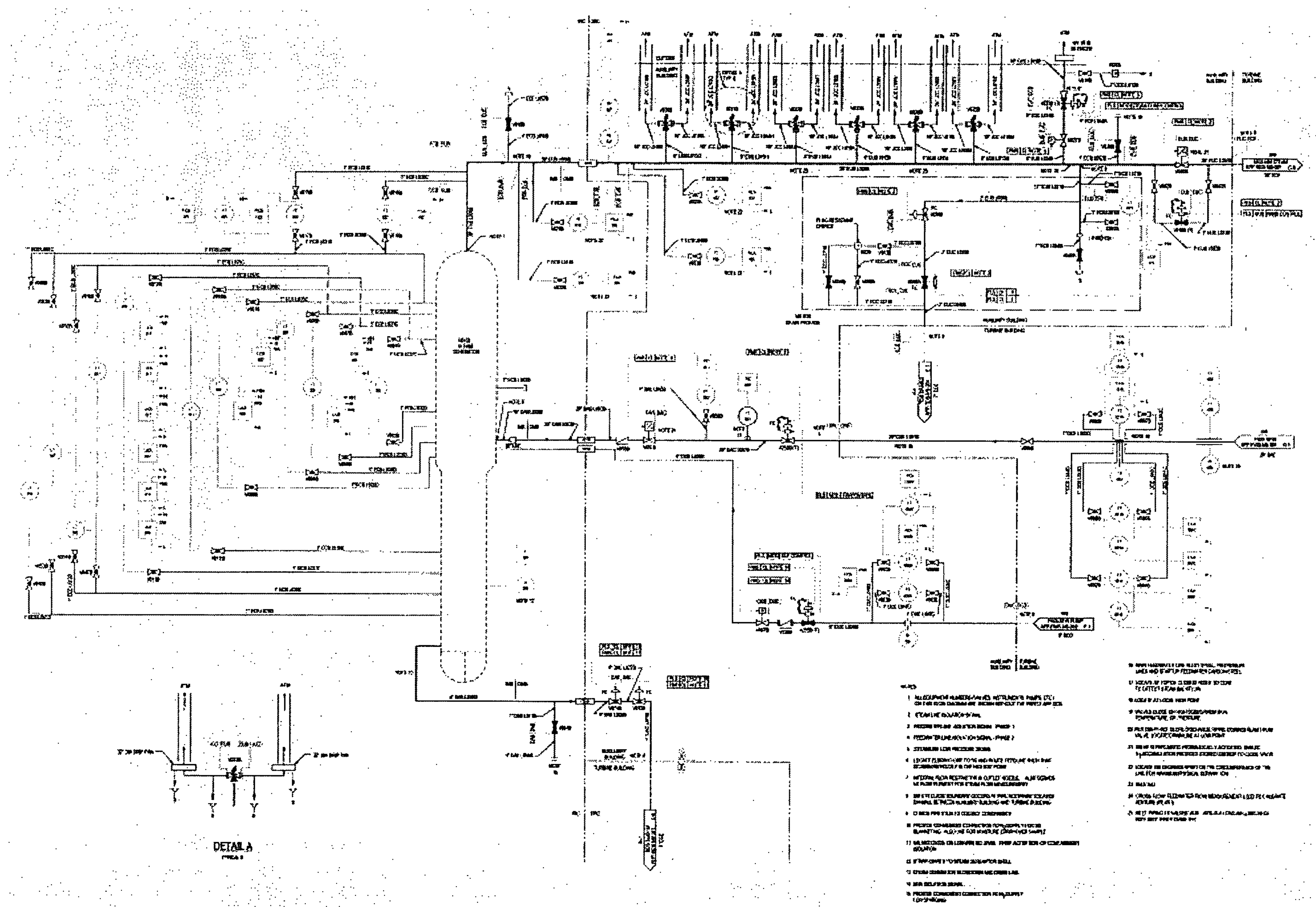


Figure 10.3.2-1 (Sheet 2 of 2)
Main Steam Piping and Instrumentation
Diagram (Safety-Related System)
(REF) SGS 002

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2
Title: Fluid System Changes

See Section II.B.2 on page 10 of TR 103 for the description and justification of this change.

Table 10.3.2-2

DESIGN DATA FOR MAIN STEAM SAFETY VALVES

Number per main steam line	6
Total number of valves required per steam line	6
Relieving capacity per valve at 110% of design pressure	~~1,390,000~~ 1,370,000 lb/hr
Relieving capacity per steam line at 110% of design pressure	~~8,340,000~~ 8,240,000 lb/hr
Total relieving capacity, 2 lines at 110% of design pressure	~~16,680,000~~ 16,480,000 lb/hr
Valve size	8 x 2(10)
Design code	ASME Code, Section III, Class 2, seismic Category I

Valve Number	Set Pressure (psig)	Relieving Capacity [(a)] (lb/hr)
SGS PL V030A(B)	1185	~~1,248,000~~ 1,307,000
SGS PL V031A(B)	~~1191~~ 1196	~~1,254,000~~ 1,319,000
SGS PL V032A(B)	~~1198~~ 1208	~~1,262,000~~ 1,333,000
SGS PL V033A(B)	~~1204~~ 1219	~~1,268,000~~ 1,344,000
SGS PL V034A(B)	~~1211~~ 1231	~~1,275,000~~ 1,357,000
SGS PL V035A(B)	~~1217~~ 1242	~~1,282,000~~ 1,369,000
Total capacity, 2 lines		~~15,178,000~~ 16,058,000

Note:

a. Based on system accumulation pressure of 3%, per Subsection NC-7512 of ASME Code, Section III, Division 1, 1989 Edition, Subsection NC, Class 2 components.

See Section II.D.4 on page 23 of TR 103 for the description and justification of this change.

10.4.2.2 System Description

10.4.2.2.1 General Description

Classification of equipment and components is given in Section 3.2.

The air removal system consists of four liquid ring vacuum pumps that remove air and noncondensable gases from the three condenser shells during normal operation and provide condenser hogging during startup. One vacuum pump is provided for each condenser shell, and one pump is provided as a standby. The noncondensable gases, together with a quantity of vapor, are drawn through the air cooler sections of condenser shells to the suction of the vacuum pumps. These noncondensables consist mainly of air, nitrogen, and ammonia. No hydrogen buildup is anticipated in the system (see subsection 10.4.1.3). Dissolved oxygen is present in the condensate and condenser hotwell inventory. Only trace amounts of this oxygen are released in the condenser, and the amounts are negligible compared to the amount of gas and vapor being evacuated by the system. Therefore, the potential for explosive mixtures within the condenser air removal system does not exist.

The [[circulating water system (CWS)]] provides the cooling water for the vacuum pump seal water heat exchangers. The seal water is kept cooler than the saturation temperature in the condenser to maintain satisfactory vacuum pump performance.

The noncondensable gases and vapor mixture discharged to the atmosphere are not normally radioactive. However, it is possible for the mixture to become contaminated in the event of primary-to-secondary system leakage. Air inleakage and noncondensable gases removed from the condenser and discharged by the vacuum pumps are routed to the turbine island vents, drains, and relief system (TDS) and monitored for radioactivity. Upon detection of unacceptable levels of radiation, operating procedures are implemented. A discussion of the radiological aspects of primary-to-secondary leakage, including anticipated release from the system, is included in Chapter 11.

The discharge from the condenser air removal system has a connection for taking local grab samples. Connections also allow the installation of portable, continuous sampling equipment.

Should the condenser air removal system become inoperable, a gradual increase in condenser back pressure would result from the buildup of noncondensable gases. This increase in backpressure would cause a decrease in the turbine cycle efficiency. If the condenser air removal system remains inoperable, condenser backpressure increases to the turbine trip setpoint, and a turbine trip is initiated. Loss of the main condenser vacuum causes a turbine trip but does not close the main steam isolation valves. A loss of condenser vacuum incident is described in subsection 15.2.5.

10.4.2.2.2 Component Description

The liquid ring vacuum pumps are supplied as packaged units. Major components in each package include a vacuum pump, seal water heat exchanger, seal water pump, air/water separator, and exhaust silencer. Seal water is supplied to seal the clearances in the pump and also to condense vapor at the inlet to the pump. Seal water flows through the shell side of the seal water heat exchanger and [[circulating water]] flows through the tube side. Seal water make up is provided by the condensate system (CDS).

Piping and valves are carbon steel. The piping is designed to ANSI B31.1.

10.4.2.2.3 System Operation

During startup operation, air is removed from the condenser by operating three liquid ring vacuum pumps. The fourth pump is on standby.

During normal plant operation, noncondensable gases are removed from the condenser by three vacuum pumps. If one pump trips, the condition is alarmed in the main control room, and the standby pump is started.

10.4.5 Circulating Water System

10.4.5.1 Design Basis

10.4.5.1.1 Safety Design Basis

The circulating water system (CWS) serves no safety-related function and therefore has no nuclear safety design basis.

10.4.5.1.2 Power Generation Design Basis

[[The circulating water system and/or make-up water from the raw water system]] supplies cooling water to remove heat from the main condensers, the turbine building closed cooling water system (TCS) heat exchangers, and the condenser vacuum pump seal water heat exchangers under varying conditions of power plant loading and design weather conditions.

10.4.5.2System Description

10.4.5.2.1 General Description

Classification of components and equipment in the circulating water system is given in Section 3.2. The circulating water system and cooling tower are subject to site specific modification or optimization. The system described here is applicable to a broad range of sites. The Combined License applicant will determine the final system configuration. Table 10.4.5-1 provides circulating water system design data based on a conceptual design.

[[The circulating water system consists of three 33-1/3-percent-capacity circulating water pumps, one hyperbolic natural draft cooling tower, and associated piping, valves, and instrumentation.]]

Makeup water to the CWS is provided by the raw water system (RWS). In addition, water chemistry is controlled by the turbine island chemical feed system (CFS).

10.4.5.2.2 Component Description

Circulating Water Pumps

[[The three circulating water pumps are vertical, wet pit, single-stage, mixed-flow pumps driven by electric motors. The pumps are mounted in an intake structure, which is connected to the cooling tower by a canal. The three pump discharge lines connect to a]] common header which connects to the two inlet water boxes of the condenser [as well as supplies cooling water to the TCS and condenser vacuum pump seal water heat exchangers]. [[Each pump discharge line has a motor-operated butterfly valve located between the pump discharge and the main header. This permits isolation of one pump for maintenance and allows two-pump operation.]]

[[Cooling Tower]]

[[The cooling tower is site specific with this description provided as a reference design using a hyperbolic natural draft structure. Operation of the cooling tower during conditions that are more restrictive than design conditions may result in higher condenser back pressure.]]

[[The cooling tower has a basin which serves as storage for the circulating water inventory and allows bypassing of the cooling tower during cold weather operations. This basin is connected to the intake of the circulating water pumps by a canal.]]

[[Cooling Tower Makeup and Blowdown]]

The circulating water system makeup is provided by the raw water system. [[Makeup to and blowdown from the circulating water system is controlled by the makeup and blowdown control valves. These valves, along with the turbine island chemical feed system provide chemistry control in the circulating water in order to maintain a noncorrosive, nonscale-forming condition and limit biological growth in circulating water system components.]]

Piping and Valves

[[The underground portions of the circulating water system piping are constructed of concrete pressure piping. The remainder is carbon steel, with an internal coating of a corrosion- resistant compound.]] Motor-operated butterfly valves are provided in each of the circulating water lines at their inlet to and exit from the condenser shell to allow isolation of portions of the condenser. [[Control valves provide regulation of cooling tower blowdown and makeup.]]

The circulating water system is designed to withstand the maximum operating discharge pressure of the circulating water pumps. [[Piping includes the expansion joints, butterfly valves, condenser water boxes, and tube bundles. The piping design pressure is site specific and therefore will be provided by the Combined License applicant (subsection 10.4.12.1).]]

~~A TCS heat exchanger can be taken out of service by closing the inlet isolation valve. Water chemistry in the isolated heat exchanger train is maintained by a continuous flow of circulating water through a small bypass valve around the inlet isolation valve.~~

~~Backwashable strainers are provided upstream of each TCS heat exchanger. They are actuated by a timer and have a backup starting sequence initiated by a high differential pressure across each individual strainer. The backwash can be manually activated.~~

Circulating Water Chemical Injection

Circulating water chemistry is maintained by the turbine island chemical feed system. Turbine island chemical equipment injects the required chemicals into the circulating water [[downstream of the CWS pumps.]] This maintains a noncorrosive, nonscale-forming condition and limits the biological film formation that reduces the heat transfer rate in the condenser and the heat exchangers supplied by the circulating water system.

The specific chemicals used within the system are determined by the site water conditions and therefore will be provided by the Combined License applicant (subsection 10.4.12). The chemicals can be divided into six categories based upon function: biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor, and a silt dispersant. The pH adjuster, corrosion inhibitor, scale inhibitor, and dispersant are metered into the system continuously or as required to maintain proper concentrations. The biocide application frequency may vary with seasons. [[The algaecide is applied, as necessary, to control algae formation on the cooling tower.]]

Addition of biocide and water treatment chemicals is performed by turbine island chemical feed injection metering pumps and is adjusted as required. [[Chemical concentrations are measured through analysis of grab samples from the CWS.]] Residual chlorine is measured to monitor the effectiveness of the biocide treatment.

[[Chemical injections are interlocked with each circulating water pump to prevent chemical injection when the circulating water pumps are not running.]]

10.4.5.2.3 System Operation

[[The three circulating water pumps take suction from the circulating water intake structure and circulate the water through the TCS, the condenser vacuum pump seal water heat exchangers, and the tube side of the main condenser and back through the piping discharge network to the cooling tower. The natural draft cooling tower cools the circulating water by discharging the water over a network of baffles in the tower. The water then falls through fill material to the basin beneath the tower and, in the process, rejects heat to the atmosphere. Provision is made during cold weather to direct a portion of the circulating water flow into freeze-prevention spray headers on the periphery of the cooling tower. Air flowing through the peripheral spray is thus heated and allows deicing in the central cooling tower spray baffles.]]

[[The flow to the cooling tower can be diverted directly to the basin, bypassing the cooling tower internals. This is accomplished by opening the bypass valve while operating one of the circulating water pumps. The bypass is normally used only during plant startup in cold weather or to maintain circulating water system temperature above 40°F while operating at partial load during periods of cold weather.]]

The raw water system supplies makeup water [[to the cooling tower basin to replace water losses due to evaporation, wind drift, and blowdown. A separate connection is provided between the RWS and CWS to initially fill the CWS piping. This line connects to the CWS downstream of the CWS pump isolation valves.]]

A condenser tube cleaning system is installed to clean the circulating water side of the main condenser tubes. [[Blowdown from the circulating water system is taken from the discharge of the circulating water system pumps and is discharged to the plant outfall.]]

The circulating water system is used to supply cooling water to the main condenser to condense the steam exhausted from the main turbine. If the [[circulating water pumps, the cooling tower, or the circulating water piping malfunctions such that]] condenser backpressure rises above the maximum allowable value, the main condenser will no longer be able to adequately support unit operation. Cooldown of the reactor may be accomplished by using the power-operated atmospheric steam relief valves or safety valves rather than the turbine bypass system when the condenser is not available.

Passage of condensate from the main condenser into the circulating water system through a condenser tube leak is not possible during power generation operation, since the circulating water system operates at a greater pressure than the condenser.

Turbine building closed cooling water in the TCS heat exchangers is maintained at a higher pressure than the [[circulating water]] to prevent leakage of the [[circulating water]] into the closed cooling water system.

Cooling water to the condenser vacuum pump seal water heat exchangers is supplied from the [[circulating water]] system. Cooling water flow from the [[circulating water]] system is normally maintained through all four heat exchangers to facilitate placing the spare condenser vacuum pump in service. Isolation valves are provided for the condenser vacuum pump seal water heat exchanger cooling water supply lines to facilitate maintenance.

Small circulating water system leaks in the turbine building will drain into the waste water system. Large circulating water system leaks due to pipe failures will be indicated in the control room by a loss of vacuum in the condenser shell. The effects of flooding due to a circulating water system failure, such as the rupture of an expansion joint, will not result in detrimental effects on safety-related equipment since there is no safety-related equipment in the turbine building and the base slab of the turbine building is located at grade elevation. Water from a system rupture will run out of the building through a relief panel in the turbine building west wall before the level could rise high enough to cause damage. Site grading will carry the water away from safety-related buildings.

[[The cooling tower is located so that collapse of the tower has no potential to damage equipment, components, or structures required for safe shutdown of the plant.]]

10.4.5.5Instrumentation Applications

[[Instrumentation provided indicates the open and closed positions of motor-operated butterfly valves in the circulating water piping. The motor-operated valve at each pump discharge is interlocked with the pump so that the pump trips if the discharge valve fails to reach the full-open position shortly after starting the pump.]]

[[Local grab samples are used to periodically test the circulating water quality to limit harmful effects to the system piping and valves due to improper water chemistry.]]

[[Pressure indication is provided on the circulating water pump discharge lines.]] A differential pressure transmitter is provided between one inlet and outlet branch to the condenser. This differential pressure transmitter is used to determine the frequency of operating the condenser tube cleaning system (CES).

Temperature indication is supplied [[on the common CWS inlet header to the TCS heat exchanger trains]]. This temperature is also representative of the inlet cooling water temperature to the main condenser.

A flow element is provided [[on the common discharge line from the TCS heat exchangers to allow monitoring of the total flow through the TCS heat exchangers]]. Flow measurement for the raw water makeup [[to the cooling tower and for the cooling tower blowdown]] is also provided.

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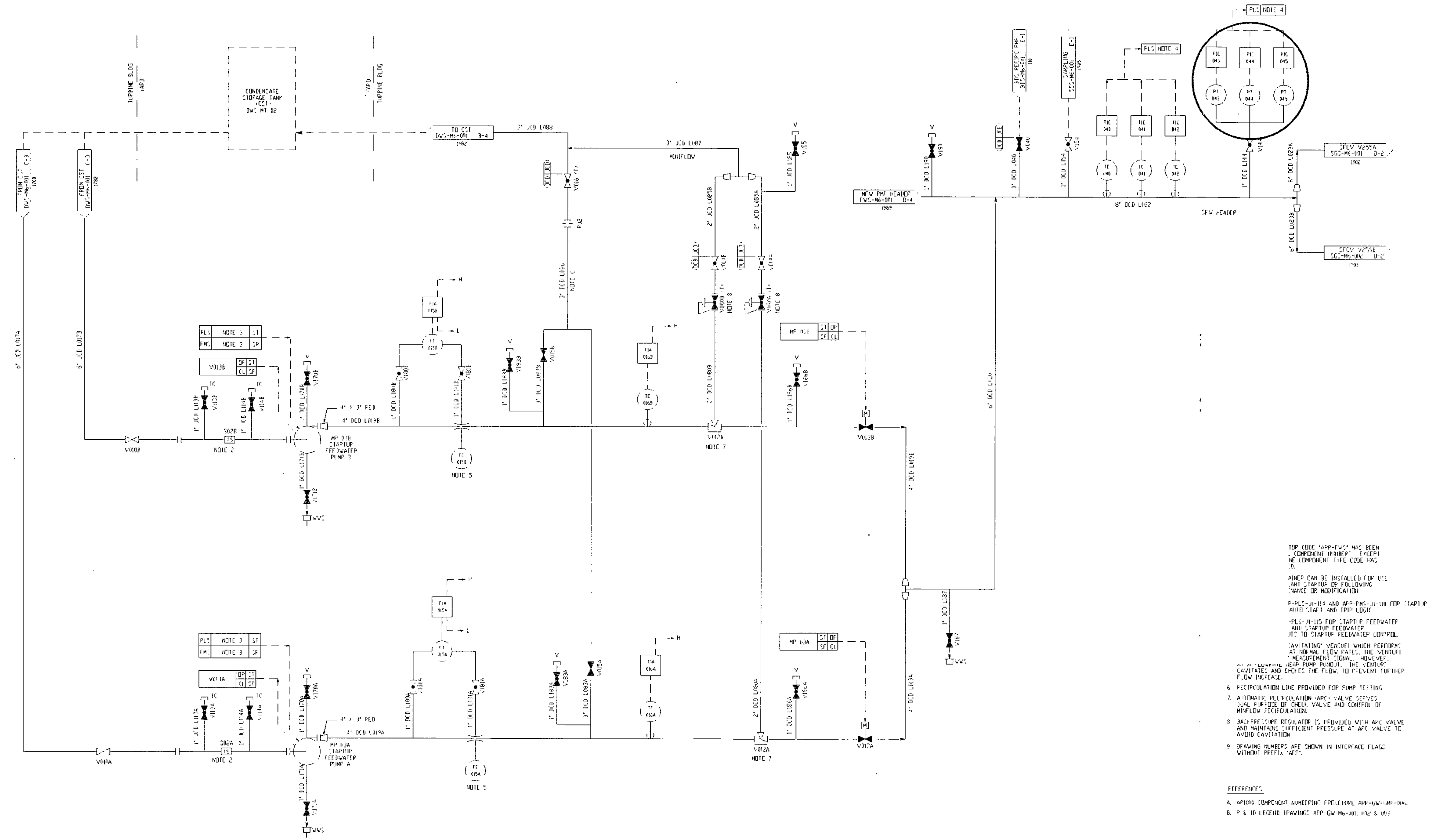
Title: Fluid System Changes



DCD Figure 10.4.7-1 (Sheet 4 of 4)
Startup Feedwater P&ID Changes

R15 Figure Mark-up

See Section II.A.6 on page 7 of TR 103 for the description and justification of this change.

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

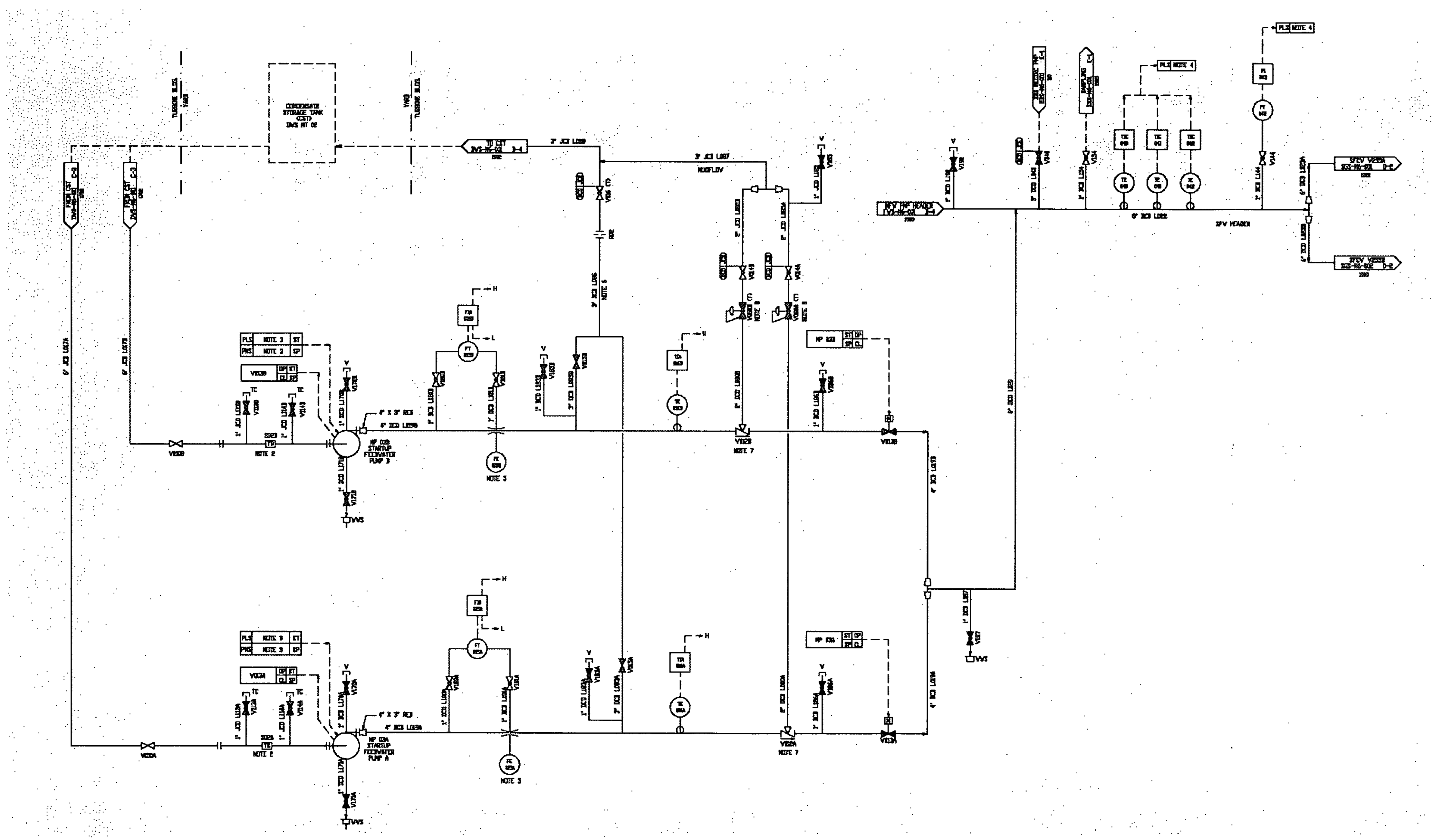


Figure 10.4.7-1 (Sheet 4 of 4)
Condensate and Feedwater System
Piping and Instrumental Diagram

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

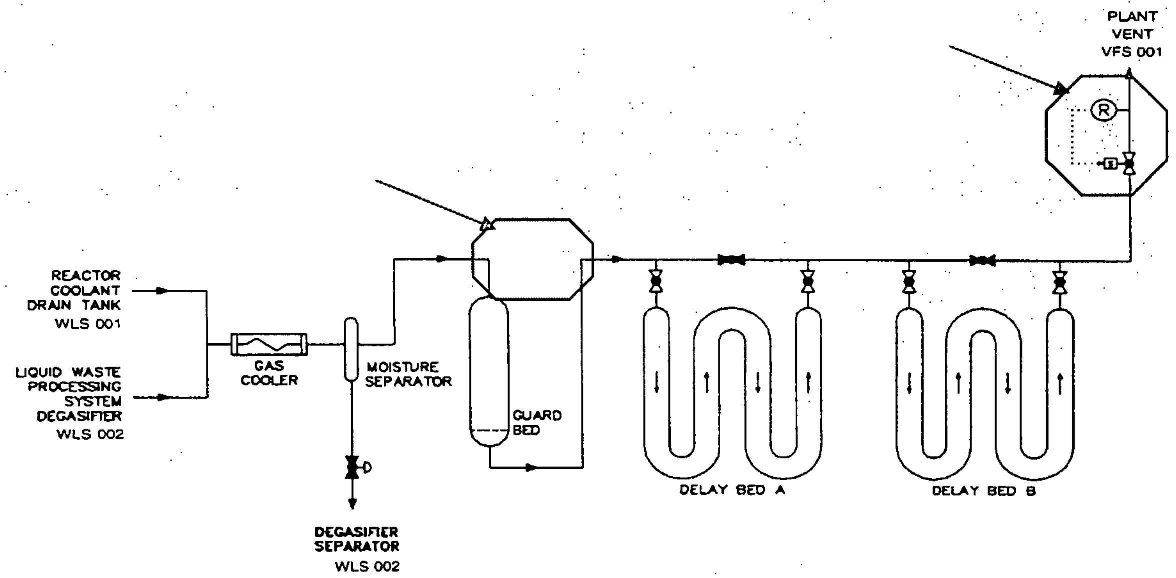


Figure 11.3-1
Gaseous Radwaste System
Piping and Instrumentation Diagram

R15 Figure Mark-up

See Section II.A.4 on page 6 of TR 103 for the description and justification of this change.

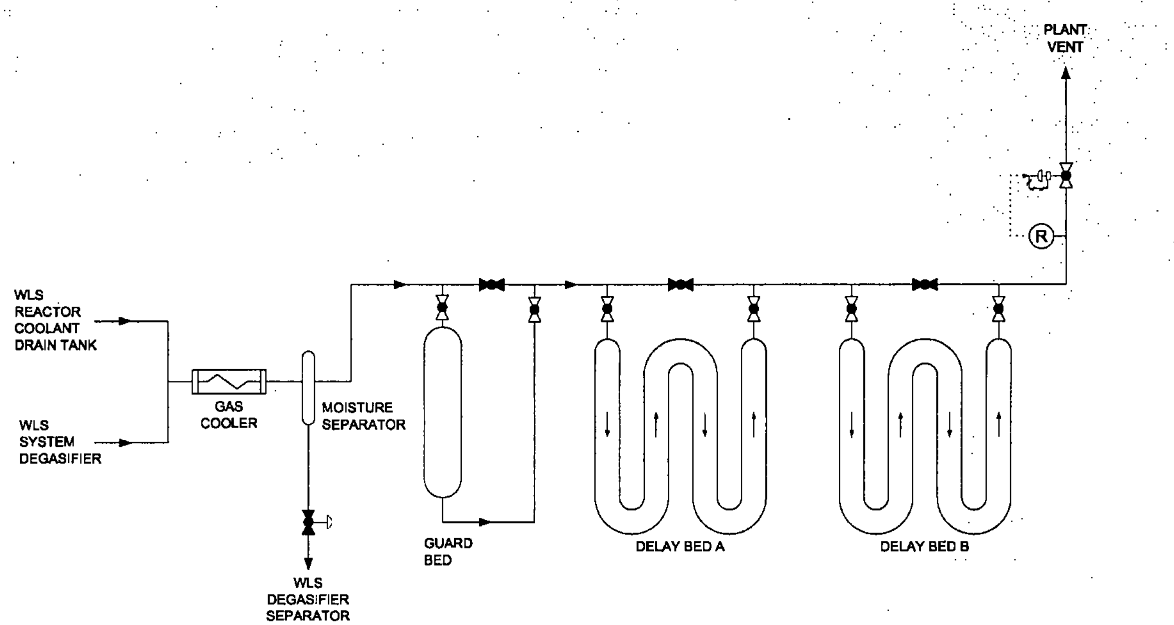


Figure 11.3-1
Gaseous Radwaste System
Piping and Instrumentation Diagram

R16 Figure with R15 changes incorporated

Document Number: APP-GW-GLN-019 **Revision Number:** 2

Title: Fluid System Changes

See Section II.D.3 on page 22 of TR 103 for the description and justification of this change.

Table 11.4-10 (Sheet 1 of 2)

COMPONENT DATA – SOLID WASTE MANAGEMENT SYSTEM (NOMINAL)

Tanks

Spent resin tank

Number	2
Total volume (ft^3)	300
Type	Vertical, conical bottom, dished top
Design pressure (psig)	15
Design temperature (°F)	150
Material	Stainless steel

Pumps

Resin mixing pump

Number	1
Type	Pneumatic diaphragm
Design pressure (psig)	125
Design temperature (°F)	150
Design flow rate (gpm)	120
Design head (ft)	160
Air supply pressure (psig)	100
Air consumption (scfm)	130
Material	Stainless steel housing, Buna N diaphragms

Resin transfer pump

Number	1
Type	Material Handling Positive Displacement ~~Progressing cavity~~
Design pressure (psig)	125 ~~150~~
Design temperature (°F)	150
Design flow rate (gpm)	100
Material	Stainless steel housing, ~~internals and rotor,~~ Buna N flexible parts ~~stator liner~~

DCD R16 Corrections

The following markups have not been incorporated into the DCD. The justifications can be found in Section II.

See Section II.A.7 on page 8 of TR 103 for the description and justification of this change.

4.4.6.4 Digital Metal Impact Monitoring System

The digital metal impact monitoring system is a nonsafety-related system that monitors the reactor coolant system for metallic loose parts. It consists of several active instrumentation channels, each comprising a piezoelectric accelerometer (sensor), signal conditioning, and diagnostic equipment. The digital impact monitoring system conforms with Regulatory Guide 1.133.

The digital metal impact monitoring system is designed to detect loose parts that weigh from 0.25 to 30 pounds, and can also detect impact with a kinetic energy of 0.5 foot-pounds on the inside surface of the reactor coolant system pressure boundary within three feet of a sensor.

The digital impact monitoring system consists of several ~~redundant~~ instrumentation channels, each comprised of a piezoelectric accelerometer (sensor), preamplifier, and signal conditioning equipment. The output signal from each accelerometer is amplified by the preamplifier and signal conditioning equipment before it is processed by a discriminator to eliminate noise and signals which are not indicative of loose part impacts. The system starts up and operates automatically.

The system facilitates performance tests, hardware integrity tests, and the recognition, location, replacement, repair and adjustment of malfunctioning components. System startup baseline performance tests are made using various size objects ~~a~~ (hammers) as ~~a~~ tools to ~~simulate an~~ generate calibrated impacts. Additional system online performance testing is performed using special signal injection test modules. These modules simulate impacts and test performance of the signal processing equipment. Hardware integrity tests are also performed to verify equipment operation.

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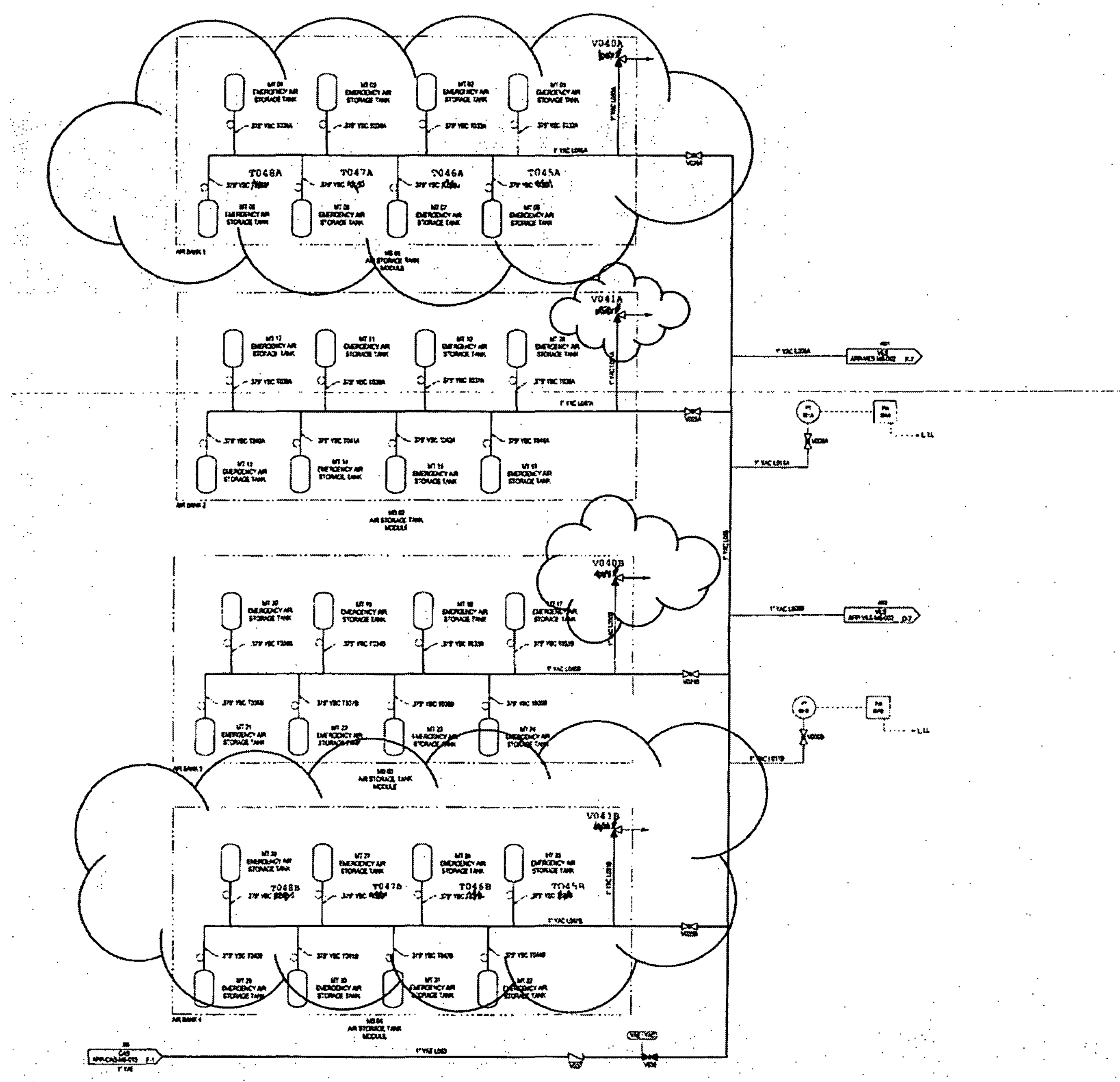

Figure 6.4-2

Piping and Instrumentation Diagram Main Control Room Emergency Habitability System

DCD R15 Mark-up

See Section II.A.2 on page 5 of TR 103 for the description and justification of this change.

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See Section II.A.5 on page 7 of TR 103 for the description and justification of this change.

Table 7.5-1 (Sheet 10 of 12)

POST-ACCIDENT MONITORING SYSTEM

Variable	Range/ Status	Type/ Category	Qualification		Number of Instruments Required	Power Supply	QDPS Indication (Note 2)	Remarks
			Environmental	Seismic				
IRWST to RNS suction valve status	Open/ Closed	B1, F3	Harsh	Yes	1 (Note 7)	1E	Yes	
RNS discharge to IRWST valve status	Open/ Closed	F3	None	None	1/valve	Non-1E	No	
RNS pump status	On/Off	F3	None	None	1/pump	Non-1E	No	
Reactor vessel head vent valve status	Open/ Closed	D2	Harsh	Yes	1/valve	1E	Yes	
MCR return air isolation valve status	Open/ Closed	D2, F3	Mild	Yes	1/valve	1E	Yes	
MCR toilet exhaust isolation valve status	Open/ Closed	D2	Mild	Yes	1/valve	1E	Yes	
MCR supply air isolation valve status	Open/ Closed	D2, F3	Mild	Yes	1/valve	1E	Yes	
MCR differential pressure	-1" to +1" wg	D2	Mild	Yes	2	1E	Yes	
MCR air delivery flowrate	0-80 cfm	D2	Mild	Yes	2	1E	Yes	
MCR pressure relief valve status	Open/ Closed	D2	Mild	Yes	1/valve	1E	Yes	

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See Section II.B.17 on page 19 of TR 103 for the description and justification of this change.

Table 9.1-4

STATION BLACKOUT/SEISMIC EVENT TIMES(1)

Event	Time to Saturation(1) (hours)	Height of Water Above Fuel at 72 Hours(4) (feet)	Height of Water Above Fuel at 7 Days(4) (feet)
Seismic Event(2) –Refueling Power Operation Immediately Following a Refueling(7)	~~7.8~~ 6.50	~~2.4~~ 1.6	~~2.4~~ 1.6(6)
Seismic Event(8) – Refueling, Immediately Following Spent Fuel Region Offload(3)(7)	~~5.6~~ 4.68	8.3(5)	8.3(5)
Seismic Event(8) – Refueling, Emergency Full Core Off-Load(3) Immediately Following Refueling(7)	~~3.1~~ 1.37	8.3(5)	8.3(6)

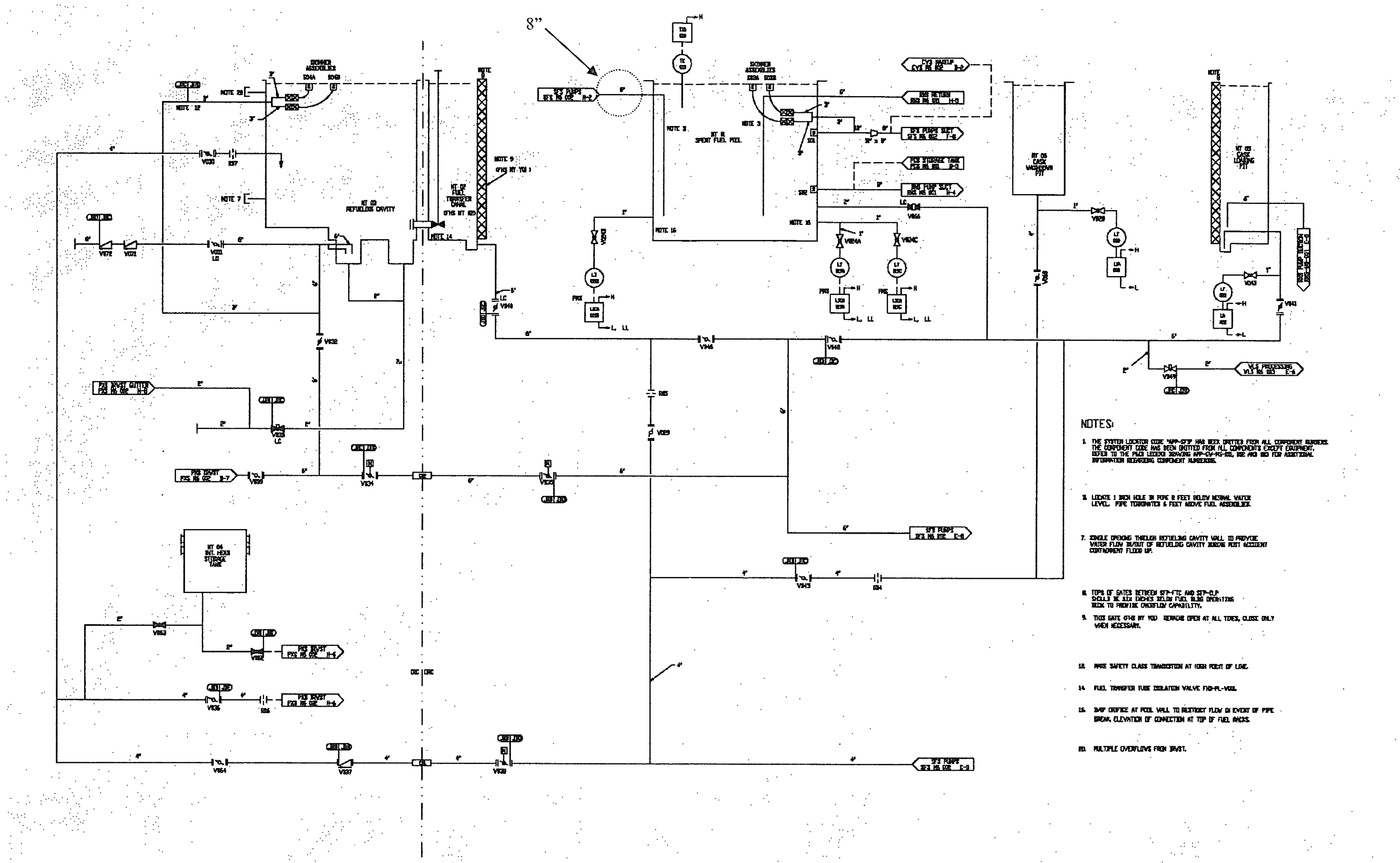

Figure 9.1.6 (Sheet 1 of 2)
SFS Pump Common Suction Pipe (L050) and RCS Engineering Flow Diagram

R16 Figure Mark-up

See Section II.B.6 on page 12 of TR 103 for the description and justification of this change

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IV. REGULATORY IMPACT

A. FSER IMPACT

These changes have no impact on the text or conclusions of the AP1000 FSER.

B. SCREENING QUESTIONS (Check correct response and provide justification for that determination under each response)

1. Does the proposed change involve a change to an SSC that adversely affects a DCD described design function? ☐ YES ☒ NO

   The proposed changes do not involve a change to an SSC that adversely affects a DCD described design function.

2. Does the proposed change involve a change to a procedure that adversely affects how DCD described SSC design functions are performed or controlled? ☐ YES ☒ NO

   The proposed changes do not involve a change to a procedure that adversely affects how DCD described SSC design functions are performed or controlled.

3. Does the proposed activity involve revising or replacing a DCD described evaluation methodology that is used in establishing the design bases or used in the safety analyses? ☐ YES ☒ NO

   The proposed changes do not involve revising or replacing a DCD described evaluation methodology that is used in establishing the design bases or used in the safety analyses.

4. Does the proposed activity involve a test or experiment not described in the DCD, where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the DCD? ☐ YES ☒ NO

   The proposed changes do not involve a test or experiment not described in the DCD.

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C. EVALUATION OF DEPARTURE FROM TIER 2 INFORMATION (Check correct response and provide justification for that determination under each response)

10 CFR Part 52, Appendix D, Section VIII. B.5.a. provides that an applicant for a combined licensee who references the AP1000 design certification may depart from Tier 2 information, without prior NRC approval, if it does not require a license amendment under paragraph B.5.b. The questions below address the criteria of B.5.b.

1. Does the proposed departure result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   The changes described will not increase the frequency of occurrence of an accident because there is no significant increase in the probability of failure of the safety functions due to the changes.

2. Does the proposed departure result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety and previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   There are no changes which will cause an increase in the probability of an occurrence of a malfunction of any SSC important to the safety and previously evaluated in the plant specific DCD.

3. Does the proposed departure Result in more than a minimal increase in the consequences of an accident previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   There is no increase in the calculated release of radioactive material during postulated accident conditions.

4. Does the proposed departure result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   There is no increase in the calculated release of radioactive material due to a malfunction of an SSC.

5. Does the proposed departure create a possibility for an accident of a different type than any evaluated previously in the plant-specific DCD? ☐ YES ☒ NO

   The changes have no effect on the operation, performance and pressure boundary integrity of the containment vessel. The changes do not introduce any additional failure modes. Therefore, these changes will not result in an accident of a type different than what has already been evaluated in the DCD.

6. Does the proposed departure create a possibility for a malfunction of an SSC important to safety with a different result than any evaluated previously in the plant-specific DCD? ☐ YES ☒ NO

   There are no additional failure modes or the possibility for a malfunction of an SSC important to safety with a different result than evaluated previously.

7. Does the proposed departure result in a design basis limit for a fission product barrier as ☐ YES ☒ NO

described in the plant-specific DCD being exceeded or altered?

The proposed departure does not result in a design basis limit for a fission product barrier as described in the plant-specific DCD being exceeded.

8. Does the proposed departure result in a departure from a method of evaluation described in the plant-specific DCD used in establishing the design bases or in the safety analyses? ☐ YES ☒ NO

The methods of evaluation for the SSCs described in the plant-specific DCD are not altered by the proposed departure.

☒ The answers to the evaluation questions above are "NO" and the proposed departure from Tier 2 does not require prior NRC review to be included in plant specific FSARs as provided in 10 CFR Part 52, Appendix D, Section VIII. B.5.b

☐ One or more of the answers to the evaluation questions above are "YES" and the proposed change requires NRC review.

D. IMPACT ON RESOLUTION OF A SEVERE ACCIDENT ISSUE

10 CFR Part 52, Appendix D, Section VIII. B.5.a. provides that an applicant for a combined licensee who references the AP1000 design certification may depart from Tier 2 information, without prior NRC approval, if it does not require a license amendment under paragraph B.5.c. The questions below address the criteria of B.5.c.

1. Does the proposed activity result in an impact to features that mitigate severe accidents. If the answer is Yes answer Questions 2 and 3 below. ☐ YES ☒ NO

2. Is there is a substantial increase in the probability of a severe accident such that a particular severe accident previously reviewed and determined to be not credible could become credible? ☐ YES ☐ NO ☒ N/A

3. Is there is a substantial increase in the consequences to the public of a particular severe accident previously reviewed? ☐ YES ☐ NO ☒ N/A

☒ The answers to the evaluation questions above are "NO" or are not applicable and the proposed departure from Tier 2 does not require prior NRC review to be included in plant specific FSARs as provided in 10 CFR

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Part 52, Appendix D, Section VIII. B.5.c

☐ One or more of the he answers to the evaluation questions above are "YES" and the proposed change requires NRC review.

E. SECURITY ASSESSMENT

1. Does the proposed change have an adverse impact on the security assessment of the AP1000? ☐ YES ☒ NO

The design changes will not alter barriers or alarms that control access to protected areas of the plant. The changes will not alter requirements for security personnel.

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Westinghouse performed a regulatory assessment of the information contained in this technical report (TR) against the regulatory basis for the original AP1000 certified design, which is described in DCD Revision 15, Sections 3.1, 1.9 and Appendix 1A. The results of the regulatory assessment appear below. Unless specifically noted, the changes described in the TR are not intended to change the regulatory basis for the design, but are instead meant to be incremental changes that are necessary to properly describe standard aspects of the AP1000 and to allow successful construction of the plant. The regulatory requirements of DCD Revision 15, Sections 3.1, 1.9 and Appendix 1A, therefore remain valid.

- Regulatory requirements and guidance are defined in AP1000 DCD Section 1.9 and Appendix 1A. This technical report does not affect the conformance to these requirements and guidance where applicable.
- Nuclear Regulatory Commission General Design Criteria (GDC) are defined in AP1000 DCD section 3.1. This technical report does not affect the conformance of the AP1000 to the GDCs, where applicable.
- The technical report was reviewed against WCAP-15799 Rev. 1 (SRP Conformance) and WCAP-15800 Rev. 3 (AP1000 Operational Assessment). This technical report does not affect the AP1000 conformance as described in these WCAPs. This includes the commitments to any applicable Branch Technical Positions.
- The report was reviewed against the AP1000 Probabilistic Risk Assessment (PRA). This technical report does not negatively impact the AP1000 PRA results as documented in Westinghouse documents APP-PRA-GER-001.
- This technical report was reviewed against the AP1000 DCD Chapter 15 Accident Analyses. It has been concluded that the safety analyses results documented in DCD Chapter 15 remain bounding..
- This technical report was reviewed against the AP1000 Technical Specifications (AP1000 DCD Chapter 16.1). This technical report does not affect the AP1000 Technical Specifications.
- This technical report was reviewed against barriers and alarms that control access to protected areas of the plant, as well as requirements for security personnel. This technical report does not have an adverse impact on the security assessment of the AP1000.
- This technical report was reviewed against design features that mitigate severe accidents. This technical report does not have an adverse affect on the AP1000's ability to mitigate severe accidents.