

**Nine Mile Point Unit 2
Alternative Source Term**

Calculation H21C-093

**“LOCA Bypass Piping Models for
Alternative Source Term Methodology (AST)”**

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The purpose of this calculation is to document the physical characteristics associated with primary containment piping which may serve as bypass leakage pathways during a design basis Loss of Coolant Accident (LOCA) in NMP Unit 2. This calculation documents piping lengths, internal areas, volumes, and degrees of bend that are appropriate for use in fission product deposition removal methodologies associated with Alternative Source Term (AST) guidance set forth in R. G. 1.183 and implemented in the RADTRAD computer code and/or other applicable deposition models.

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1. Objective

The purpose of this calculation is to document the physical characteristics associated with primary containment piping which may serve as bypass leakage pathways during a design basis Loss of Coolant Accident (LOCA) in NMP Unit 2. This calculation documents piping lengths, internal areas, volumes, and degrees of bend that are appropriate for use in fission product deposition removal methodologies associated with Alternative Source Term (AST) guidance set forth in Regulatory Guide 1.183 (Reference 8.1) and implemented in the RADTRAD (Reference 8.7) computer code. Additionally, the results developed herein may be used for the analysis of fission product deposition in main steam lines according to the methodology provided in NRC SER AEB-98-03 (Reference 8.2).

2. Background

Guidance for modeling the removal of radioactive fission products due to various physical mechanisms is provided in the Alternative Source Term methodology per RG 1.183. The following guidance from RG 1.183 Appendix A, as directed by Regulatory Positions 1.2.1 and 1.3.2, provide acceptable criteria regarding the deposition credit for fission product removal in bypass leakage.

4.5. Primary containment leakage that bypasses the secondary containment should be evaluated at the bypass leak rate incorporated in the technical specifications. If the bypass leakage is through water, e.g., via a filled piping run that is maintained full, credit for the retention of iodine and aerosols may be considered on a case-by-case basis. Similarly, deposition of aerosol radioactivity in gas-filled lines may be considered on a case-by-case basis.

6.3. Reduction of the amount of released radioactivity by deposition and plateout on steam system piping upstream of the outboard MSIVs may be credited, but the amount of reduction in concentration allowed will be evaluated on an individual case basis. Generally, the model should be based on the assumption of well-mixed volumes, but other models such as slug flow may be used if justified.

6.5 A reduction in MSIV releases that is due to holdup and deposition in main steam piping downstream of the MSIVs and in the main condenser, including the treatment of air ejector effluent by offgas systems, may be credited if the components and piping systems used in the release path are capable of performing their safety function during and following a safe shutdown earthquake (SSE). The amount of reduction allowed will be evaluated on an individual case basis.

3. Method

The piping which comprises the current Nine Mile Point Unit 2 (NMP2) LOCA bypass releases (References 8.3 through 8.6) and which includes main steam isolation valve (MSIV) leakage is reviewed to determine the following design information: horizontal and vertical lengths and total degrees of bends. Reference piping specifications and drawings are then used in conjunction with the gathered design information to calculate the internal volume and deposition areas. The portion of each line that is acceptable for deposition credit is determined using guidance set forth in RG 1.183 (Reference 8.1).

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Table 3-1 provides a matrix of criteria utilized in determining which line portions are credited for bypass holdup and deposition. A more detailed explanation of the table and the assumptions taken are provided in the Section 4 Data/Assumptions.

Table 3-1 Deposition/Holdup Criteria for Bypass Lines

Criteria	MSIV	Other
All piping Seismic Category I and QA CAT 1	X	X
Deposition credit for piping upstream of inboard isolation valve ^[1]	X	X
Holdup credit for piping upstream of inboard isolation valve	X	X
Deposition credit for piping between isolation valves ^[1]	X	X
Holdup credit for piping between isolation valves ^[1]		X
Deposition credit for piping downstream of outboard isolation valve ^[2]	X	
Holdup credit for piping downstream of outboard isolation valve ^[2]	X	

[1] In accordance with Section 6.3 of R. G. 1.183 Appendix A, credit for deposition in main steam piping upstream of the outboard MSIV may be taken and is implemented for appropriate line (unfailed) conditions. Credit for iodine deposition not taken for portions of lines which are assumed to be failed or assumed open to the atmosphere.. The majority of the main steam horizontal piping is from the reactor to the inboard MSIV.

[2] The majority of non-MSIV bypass lines do not have Seismic Category I/QA CAT 1 piping beyond the outboard isolation valve. Therefore, this piping is conservatively neglected.

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4. Data/Assumptions

RG 1.183 provides positions in regards to holdup and pipe deposition for MSIV and primary containment bypass leakage lines as delineated above in Sections 2 & 3. In light of the positions set forth in RG 1.183, the following assumptions are taken regarding the portion of piping acceptable for credit.

Assumption (1) - In accordance with RG 1.183, credit for deposition in main steam piping upstream of the outboard MSIV may be taken and is implemented. The majority of the main steam horizontal piping is from the reactor to the inboard MSIV. Deposition credit is applied to horizontal piping only.

Assumption (2) - Transport time or 'holdup' is a physical characteristic of any flow process. Credit for decay of radionuclides during the flow process is taken. This is referred to as 'holdup'. Holdup credit for piping volumes is taken and is applied to total (horizontal plus vertical) piping volume for unfailed lines. Holdup is not credited for portions of lines which are assumed to be failed.

In the tables below, the raw data extracted from plant piping diagrams as referenced in Section 8 is shown.

4.1. Main Steam Lines (MSL)**Table 4.1-1 Main Steam Line A Inboard Pipe Data**

MSL "A" Piping Leading Up To Inboard IV								
Starting Location: Reactor								
Stopping Location: MSIV 2MSS*AOV6A								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-MSS-026-43-1		8.11, 8.12, 8.19		2	9	1/4		
2-MSS-026-43-1		8.11, 8.12, 8.19	90	3	3			
2-MSS-026-43-1		8.11, 8.12, 8.19					3	3
2-MSS-026-43-1		8.11, 8.12, 8.19					3	11
2-MSS-026-43-1		8.11, 8.12, 8.19					3	3 3/4
2-MSS-026-43-1		8.11, 8.12, 8.19					2	11
2-MSS-026-43-1		8.11, 8.12, 8.19					1	2 1/4
2-MSS-026-43-1		8.11, 8.12, 8.19					10	4 3/4
2-MSS-026-43-1		8.11, 8.12, 8.19	90				3	3
2-MSS-026-43-1		8.11, 8.12, 8.19		3	3			
2-MSS-026-43-1		8.11, 8.12, 8.19		6	4	3/4		
2-MSS-026-43-1	1	8.11, 8.12, 8.19			11			
2-MSS-026-43-1		8.11, 8.12, 8.19		1	1	3/8		
2-MSS-026-43-1		8.11, 8.12, 8.19		2	10			
2-MSS-026-43-1		8.11, 8.12, 8.19		1	3	3/4		
2-MSS-026-43-1		8.11, 8.12, 8.19			11	3/4		

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MSL "A" Piping Leading Up To Inboard IV

Starting Location: Reactor

Stopping Location: MSIV 2MSS*AOV6A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-026-43-1		8.11, 8.12, 8.19			6	1/4			
2-MSS-026-43-1		8.11, 8.12, 8.19		2	10				
2-MSS-026-43-1		8.11, 8.12, 8.19		1	3	7/8			
2-MSS-026-43-1		8.11, 8.12, 8.19	90	3	3				
2-MSS-026-43-1		8.11, 8.12, 8.19					3	3	
2-MSS-026-43-1		8.11, 8.12, 8.19						9	1/4
2-MSS-026-43-1		8.11, 8.12, 8.19						10	1/4
2-MSS-026-43-1		8.11, 8.12, 8.19					7	2	1/8
2-MSS-026-43-1		8.11, 8.12, 8.19						11	3/4
2-MSS-026-43-1		8.11, 8.12, 8.19					1	10	1/2
2-MSS-026-43-1		8.11, 8.12, 8.19						9	1/8
2-MSS-026-43-1		8.11, 8.12, 8.19					21	10	3/4
2-MSS-026-43-1		8.11, 8.12, 8.19					1	3	3/8
2-MSS-026-43-1		8.11, 8.12, 8.19	90				3	3	
2-MSS-026-43-1		8.11, 8.12, 8.19		3	3				
2-MSS-026-43-1		8.11, 8.12, 8.19		1	2	3/4			
2-MSS-026-43-1		8.11, 8.12, 8.19		3	8	1/4			
2-MSS-026-43-1		8.11, 8.12, 8.19			11	1/8			

1. Gradual bend (~21 deg.) neglected.

Table 4.1-2 Main Steam Line A Interstitial Pipe Data**MSL "A" Interstitial Piping Between IVs**

Starting Location: MSIV 2MSS*AOV6A

Stopping Location: MSIV 2MSS*AOV7A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-MSS-026-152-1		8.12, 8.20, 8.28		1	6	1/2		
2-MSS-026-152-1		8.12, 8.20, 8.28		13	3	1/4		
2-MSS-026-152-1		8.12, 8.20, 8.28		3	11	1/4		
2-MSS-026-152-1		8.12, 8.20, 8.28		1				

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Table 4.1-3 Main Steam Line A Outboard Pipe Data

MSL "A" Piping After Outboard IV

Starting Location: MSIV 2MSS*AOV7A

Stopping Location: 4' 0" before 2MSS-MSV1A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-028-1-4		8.28, 8.21	90	32	8				
2-MSS-028-1-4		8.28, 8.31					3	6	
2-MSS-028-1-4		8.28, 8.31					3	11	
2-MSS-028-1-4		8.28, 8.31					4	5	1/2
2-MSS-028-1-4		8.28, 8.31					1	1	5/8
2-MSS-028-1-4		8.28, 8.31					14	8	
2-MSS-028-1-4		8.28, 8.31					8	6	5/8
2-MSS-028-1-4		8.28, 8.31						11	1/2
2-MSS-028-1-4		8.28, 8.31					4	6	1/2
2-MSS-028-1-4		8.28, 8.31	90				3	6	
2-MSS-028-1-4		8.28, 8.31		3	6				
2-MSS-028-1-4		8.28, 8.31		2	1	7/8			
2-MSS-028-1-4		8.28, 8.31		9	2	1/8			
2-MSS-028-1-4	2	8.28, 8.31		2	2				
2-MSS-028-2-4	2	8.30, 8.32		28	6				

2. Includes length through 48" main steam header.

Table 4.1-4 Main Steam Line B Inboard Pipe Data

MSL "B" Piping Leading Up To Inboard IV

Starting Location: Reactor

Stopping Location: MSIV 2MSS*AOV6B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-026-44-1		8.13, 8.14, 8.19		2	9	9/16			
2-MSS-026-44-1		8.13, 8.14, 8.19	90	3	3				
2-MSS-026-44-1		8.13, 8.14, 8.19					3	3	
2-MSS-026-44-1		8.13, 8.14, 8.19					7	4	1/8
2-MSS-026-44-1		8.13, 8.14, 8.19					4	2	3/8
2-MSS-026-44-1		8.13, 8.14, 8.19					1	0	1/2
2-MSS-026-44-1		8.13, 8.14, 8.19					3	11	7/8
2-MSS-026-44-1		8.13, 8.14, 8.19					2	4	3/8
2-MSS-026-44-1		8.13, 8.14, 8.19	45				1	4	3/16
2-MSS-026-44-1		8.13, 8.14, 8.19					1	4	3/16
2-MSS-026-44-1		8.13, 8.14, 8.19					1	10	
2-MSS-026-44-1		8.13, 8.14, 8.19	90				3	3	

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MSL "B" Piping Leading Up To Inboard IV

Starting Location: Reactor

Stopping Location: MSIV 2MSS*AOV6B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-MSS-026-44-1		8.13, 8.14, 8.19		3	3		
2-MSS-026-44-1		8.13, 8.14, 8.19		1	11 1/2		
2-MSS-026-44-1		8.13, 8.14, 8.19		2	8 7/8		
2-MSS-026-44-1		8.13, 8.14, 8.19		1	8		
2-MSS-026-44-1		8.13, 8.14, 8.19			8 3/8		
2-MSS-026-44-1		8.13, 8.14, 8.19		1	1 7/8		
2-MSS-026-44-1		8.13, 8.14, 8.19		1	2 1/2		
2-MSS-026-44-1		8.13, 8.14, 8.19			7 7/8		
2-MSS-026-44-1		8.13, 8.14, 8.19		1	7 3/4		
2-MSS-026-44-1		8.13, 8.14, 8.19			0 3/4		
2-MSS-026-44-1		8.13, 8.14, 8.19		8	11		
2-MSS-026-44-1		8.13, 8.14, 8.19		1	3 1/8		
2-MSS-026-44-1		8.13, 8.14, 8.19		8	0 1/2		
2-MSS-026-44-1		8.13, 8.14, 8.19	90	3	3		
2-MSS-026-44-1		8.13, 8.14, 8.19				3	3
2-MSS-026-44-1		8.13, 8.14, 8.19					7
2-MSS-026-44-1		8.13, 8.14, 8.19					10 1/8
2-MSS-026-44-1		8.13, 8.14, 8.19				7	4 5/8
2-MSS-026-44-1		8.13, 8.14, 8.19				1	5 3/4
2-MSS-026-44-1		8.13, 8.14, 8.19				2	1 3/8
2-MSS-026-44-1		8.13, 8.14, 8.19				3	11
2-MSS-026-44-1		8.13, 8.14, 8.19				18	1
2-MSS-026-44-1		8.13, 8.14, 8.19				1	4
2-MSS-026-44-1		8.13, 8.14, 8.19	90			3	3
2-MSS-026-44-1		8.13, 8.14, 8.19		2	11 1/2		
2-MSS-026-44-1		8.13, 8.14, 8.19			3 1/2		
2-MSS-026-44-1		8.13, 8.14, 8.19			11 5/8		
2-MSS-026-44-1		8.13, 8.14, 8.19			7		

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Table 4.1-5 Main Steam Line B Interstitial Pipe Data

MSL "B" Interstitial Piping Between IVs

Starting Location: MSIV 2MSS*AOV6B

Stopping Location: MSIV 2MSS*AOV7B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-MSS-026-151-1		8.14, 8.20, 8.28		1	5	3/4		
2-MSS-026-151-1		8.14, 8.20, 8.28		15	4	9/16		
2-MSS-026-151-1		8.14, 8.20, 8.28		3	10	7/8		
2-MSS-026-151-1		8.14, 8.20, 8.28		1	0			

Table 4.1-6 Main Steam Line B Outboard Pipe Data

MSL "B" Piping After Outboard IV

Starting Location: MSIV 2MSS*AOV7B

Stopping Location: 4'0" before 2MSS-MSV1B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-MSS-028-3-4		8.28, 8.21	90	32	8			
2-MSS-028-3-4		8.28, 8.31					3	6
2-MSS-028-3-4		8.28, 8.31					3	11 1/8
2-MSS-028-3-4		8.28, 8.31					4	5 5/8
2-MSS-028-3-4		8.28, 8.31					1	1 7/8
2-MSS-028-3-4		8.28, 8.31					14	9 5/8
2-MSS-028-3-4		8.28, 8.31					9	9 5/8
2-MSS-028-3-4		8.28, 8.31					3	11 1/2
2-MSS-028-3-4		8.28, 8.31	90				3	6
2-MSS-028-3-4		8.28, 8.31		3	6			
2-MSS-028-3-4		8.28, 8.31		2	2	3/8		
2-MSS-028-3-4		8.28, 8.31		6	4	1/4		
2-MSS-028-3-4		8.28, 8.31		2	9	5/8		
2-MSS-028-3-4	1	8.28, 8.31		2	2	1/4		
2-MSS-028-4-4	1	8.30, 8.32		28	6			

1. Includes length through 48" main steam header.

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Table 4.1-7 Main Steam Line C Inboard Pipe Data

MSL "C" Piping Leading Up To Inboard IV

Starting Location: Reactor

Stopping Location: MSIV 2MSS*AOV6C

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-026-45-1		8.15, 8.16, 8.19		2	10	1/4			
2-MSS-026-45-1		8.15, 8.16, 8.19	90	3	3				
2-MSS-026-45-1		8.15, 8.16, 8.19					3	3	
2-MSS-026-45-1		8.15, 8.16, 8.19					4	9	1/2
2-MSS-026-45-1		8.15, 8.16, 8.19					3	6	3/4
2-MSS-026-45-1		8.15, 8.16, 8.19					10	1	3/8
2-MSS-026-45-1		8.15, 8.16, 8.19						6	1/2
2-MSS-026-45-1		8.15, 8.16, 8.19	45				1	4	3/16
2-MSS-026-45-1		8.15, 8.16, 8.19					1	4	3/16
2-MSS-026-45-1		8.15, 8.16, 8.19					1	10	1/4
2-MSS-026-45-1		8.15, 8.16, 8.19	90				3	3	
2-MSS-026-45-1		8.15, 8.16, 8.19		3	3				
2-MSS-026-45-1		8.15, 8.16, 8.19		1	11	1/4			
2-MSS-026-45-1		8.15, 8.16, 8.19			7	7/8			
2-MSS-026-45-1		8.15, 8.16, 8.19		2	0	3/4			
2-MSS-026-45-1		8.15, 8.16, 8.19				3/8			
2-MSS-026-45-1		8.15, 8.16, 8.19		2	3	5/8			
2-MSS-026-45-1		8.15, 8.16, 8.19				7/8			
2-MSS-026-45-1		8.15, 8.16, 8.19		1	3	3/8			
2-MSS-026-45-1		8.15, 8.16, 8.19			2				
2-MSS-026-45-1		8.15, 8.16, 8.19			11	1/8			
2-MSS-026-45-1		8.15, 8.16, 8.19		2	4	1/2			
2-MSS-026-45-1		8.15, 8.16, 8.19		9					
2-MSS-026-45-1		8.15, 8.16, 8.19			10	1/2			
2-MSS-026-45-1		8.15, 8.16, 8.19		8	4	3/4			
2-MSS-026-45-1		8.15, 8.16, 8.19	90	3	3				
2-MSS-026-45-1		8.15, 8.16, 8.19					3	3	
2-MSS-026-45-1		8.15, 8.16, 8.19					1	3	5/8
2-MSS-026-45-1		8.15, 8.16, 8.19						3	
2-MSS-026-45-1		8.15, 8.16, 8.19					7	2	1/2
2-MSS-026-45-1		8.15, 8.16, 8.19					2	7	3/4
2-MSS-026-45-1		8.15, 8.16, 8.19						11	5/8
2-MSS-026-45-1		8.15, 8.16, 8.19					1	5	3/4
2-MSS-026-45-1		8.15, 8.16, 8.19					20	6	1/2
2-MSS-026-45-1		8.15, 8.16, 8.19					1	3	1/2
2-MSS-026-45-1		8.15, 8.16, 8.19	90				3	3	
2-MSS-026-45-1		8.15, 8.16, 8.19		2	11	1/2			
2-MSS-026-45-1		8.15, 8.16, 8.19			3	1/2			

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MSL "C" Piping Leading Up To Inboard IV

Starting Location: Reactor
Stopping Location: MSIV 2MSS*AOV6C

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-MSS-026-45-1		8.15, 8.16, 8.19			11 3/4		
2-MSS-026-45-1		8.15, 8.16, 8.19			6 3/8		

Table 4.1-8 Main Steam Line C Interstitial Pipe Data

MSL "C" Interstitial Piping Between IVs

Starting Location: MSIV 2MSS*AOV6C
Stopping Location: MSIV 2MSS*AOV7C

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-MSS-026-154-1		8.16, 8.20, 8.28		1	7		
2-MSS-026-154-1		8.16, 8.20, 8.28		15	4 5/8		
2-MSS-026-154-1		8.16, 8.20, 8.28		3	10 1/2		
2-MSS-026-154-1		8.16, 8.20, 8.28		1			

Table 4.1-9 Main Steam Line C Outboard Pipe Data

MSL "C" Piping After Outboard IV

Starting Location: MSIV 2MSS*AOV7C
Stopping Location: 4'0" before 2MSS-MSV1C

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-MSS-028-5-4		8.28, 8.21	90	32	8		
2-MSS-028-5-4		8.28, 8.31				3	6
2-MSS-028-5-4		8.28, 8.31				1	0 1/2
2-MSS-028-5-4		8.28, 8.31				3	
2-MSS-028-5-4		8.28, 8.31				4	4
2-MSS-028-5-4		8.28, 8.31				1	0 1/2
2-MSS-028-5-4		8.28, 8.31				14	11
2-MSS-028-5-4		8.28, 8.31				9	10 1/2
2-MSS-028-5-4		8.28, 8.31				3	11 1/8
2-MSS-028-5-4		8.28, 8.31	90			3	6
2-MSS-028-5-4		8.28, 8.31		3	6		
2-MSS-028-5-4		8.28, 8.31		2	1		

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MSL "C" Piping After Outboard IV

Starting Location: MSIV 2MSS*AOV7C

Stopping Location: 4'0" before 2MSS-MSV1C

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-028-5-4		8.28, 8.31		6	4	3/4			
2-MSS-028-5-4		8.28, 8.31		2	10	1/8			
2-MSS-028-5-4	1	8.28, 8.31		2	2				
2-MSS-028-6-4	1	8.30, 8.32		28	6				

1. Includes length through 48" main steam header.

Table 4.1-10 Main Steam Line C Inboard Pipe Data

MSL "D" Piping Leading Up To Inboard IV

Starting Location: Reactor

Stopping Location: MSIV 2MSS*AOV6D

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-026-46-1		8.17, 8.18, 8.19		2	10	1/16			
2-MSS-026-46-1		8.17, 8.18, 8.19	90	3	3				
2-MSS-026-46-1		8.17, 8.18, 8.19					3	3	
2-MSS-026-46-1		8.17, 8.18, 8.19					5	1	1/2
2-MSS-026-46-1		8.17, 8.18, 8.19					1	7	
2-MSS-026-46-1		8.17, 8.18, 8.19					5	4	
2-MSS-026-46-1		8.17, 8.18, 8.19					9	9	1/4
2-MSS-026-46-1		8.17, 8.18, 8.19	90				3	3	
2-MSS-026-46-1		8.17, 8.18, 8.19		3	3				
2-MSS-026-46-1		8.17, 8.18, 8.19		2	10	1/2			
2-MSS-026-46-1		8.17, 8.18, 8.19			5	1/8			
2-MSS-026-46-1	1	8.17, 8.18, 8.19		5	1	1/2			
2-MSS-026-46-1		8.17, 8.18, 8.19		2	4	1/4			
2-MSS-026-46-1		8.17, 8.18, 8.19			5	3/4			
2-MSS-026-46-1		8.17, 8.18, 8.19		1	7	1/4			
2-MSS-026-46-1		8.17, 8.18, 8.19		1	1				
2-MSS-026-46-1		8.17, 8.18, 8.19			2	1/8			
2-MSS-026-46-1		8.17, 8.18, 8.19		2	10				
2-MSS-026-46-1		8.17, 8.18, 8.19		1	3	3/4			
2-MSS-026-46-1		8.17, 8.18, 8.19	90	3	3				
2-MSS-026-46-1		8.17, 8.18, 8.19					3	3	
2-MSS-026-46-1		8.17, 8.18, 8.19					3	8	
2-MSS-026-46-1		8.17, 8.18, 8.19					2	4	5/8
2-MSS-026-46-1		8.17, 8.18, 8.19					2	9	

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MSL "D" Piping Leading Up To Inboard IV

Starting Location: Reactor

Stopping Location: MSIV 2MSS*AOV6D

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length		
				Feet	Inches	Feet	Inches	
2-MSS-026-46-1		8.17, 8.18, 8.19				1	5	1/4
2-MSS-026-46-1		8.17, 8.18, 8.19				2	1	7/8
2-MSS-026-46-1		8.17, 8.18, 8.19					9	3/4
2-MSS-026-46-1		8.17, 8.18, 8.19				21	0	3/4
2-MSS-026-46-1		8.17, 8.18, 8.19				1	4	1/4
2-MSS-026-46-1		8.17, 8.18, 8.19	90			3	3	
2-MSS-026-46-1		8.17, 8.18, 8.19		3	3			
2-MSS-026-46-1		8.17, 8.18, 8.19		1	2			
2-MSS-026-46-1		8.17, 8.18, 8.19		3	8	1/2		
2-MSS-026-46-1		8.17, 8.18, 8.19			11			

Table 4.1-11 Main Steam Line D Interstitial Pipe Data

MSL "D" Interstitial Piping Between IVs

Starting Location: MSIV 2MSS*AOV6D

Stopping Location: MSIV 2MSS*AOV7D

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length		
				Feet	Inches	Feet	Inches	
2-MSS-026-153-1		8.18, 8.20, 8.28		1	6	1/2		
2-MSS-026-153-1		8.18, 8.20, 8.28		13	3			
2-MSS-026-153-1		8.18, 8.20, 8.28		3	10	3/4		
2-MSS-026-153-1		8.18, 8.20, 8.28		1	0	1/4		

Table 4.1-12 Main Steam Line D Outboard Pipe Data

MSL "D" Piping After Outboard IV

Starting Location: MSIV 2MSS*AOV7D

Stopping Location: 4'0" before 2MSS-MSV1D

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length		
				Feet	Inches	Feet	Inches	
2-MSS-028-7-4		8.28, 8.21	90	32	8			
2-MSS-028-7-4		8.28, 8.31				3	6	
2-MSS-028-7-4		8.28, 8.31				3	11	1/2
2-MSS-028-7-4		8.28, 8.31				4	5	

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MSL "D" Piping After Outboard IV

Starting Location: MSIV 2MSS*AOV7D

Stopping Location: 4'0" before 2MSS-MSV1D

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-MSS-028-7-4		8.28, 8.31					3/4
2-MSS-028-7-4		8.28, 8.31				1	1 5/8
2-MSS-028-7-4		8.28, 8.31				14	7 1/4
2-MSS-028-7-4		8.28, 8.31				8	5 3/8
2-MSS-028-7-4		8.28, 8.31					11 1/2
2-MSS-028-7-4		8.28, 8.31				4	5 3/4
2-MSS-028-7-4		8.28, 8.31	90			3	6
2-MSS-028-7-4		8.28, 8.31		3	6		
2-MSS-028-7-4		8.28, 8.31		2	1 3/4		
2-MSS-028-7-4		8.28, 8.31		9	1 3/4		
2-MSS-028-7-4	2	8.28, 8.31		2	2 1/4		
2-MSS-028-8-4	2	8.30, 8.32		28	6		

2. Includes length through 48" main steam header.

4.2. Main Steam Drain Lines

Table 4.2-1 Inboard Main Steam Line Drain Inboard Pipe Data

MSL Inboard Drain Piping Leading Up To Inboard IV

Starting Location: 2-MSS-002-048-1/1-MSS-006-150-1 tee

Stopping Location: 2MSS*MOV111

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-MSS-006-150-1		8.20, 8.24			9		
2-MSS-006-150-1	1	8.20, 8.24			9		
2-MSS-006-150-1		8.20, 8.24		2			
2-MSS-006-150-1		8.20, 8.24	90	3	11		
2-MSS-006-150-1		8.20, 8.24		11	4		

1. Neglects valve 2MSS*V207 length.

Table 4.2-2 Inboard Main Steam Line Drain Interstitial Pipe Data

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MSL Inboard Drain Interstitial Piping Between IVs

Starting Location: 2MSS*MOV111

Stopping Location: 2MSS*MOV112

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-006-150-1		8.20, 8.24	90	1	4				
2-MSS-006-150-1		8.20, 8.24	90	9	6				
2-MSS-006-150-1		8.20, 8.24	90				2	1	7/8
2-MSS-006-150-1		8.20, 8.24		14	7	5/16			
2-MSS-006-150-1	2	8.20, 8.25		2	8				

2. To downstream side of valve.

Table 4.2-3 Outboard Main Steam Line Drain Inboard Pipe Data**MSL Outboard Drain Piping Leading Up To Inboard IV**

Starting Location: 2-MSS-750-168-1/2-MSS-002-175-2 tee

Stopping Location: 2MSS*MOV208

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-MSS-002-175-2		8.20, 8.28, 8.29		4	8				
2-MSS-002-175-2		8.20, 8.28, 8.29	90	5	5				
2-MSS-002-175-2	1	8.20, 8.28, 8.29		5	11	1/2			

1. To center of valve

4.3. Drywell Drains**Table 4.3-1 Drywell Floor Drain Inboard Pipe Data****Drywell Floor Drain Piping Leading Up To Inboard IV**

Starting Location: 2-DFR-006-65-2/2-DFR-004-66-2 tee

Stopping Location: 2DFR*MOV121

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-DFR-006-65-2		8.47, 8.54, 8.55 8.58					6	9	9/16
2-DFR-006-65-2	1	8.47, 8.54, 8.55, 8.58	90	2	4	3/4			
2-DFR-006-65-2		8.47, 8.54, 8.55 8.58			4	1/8			
2-DFR-006-65-2	2	8.47, 8.54, 8.55, 8.55, 8.58		1	1	1/8			

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1. Neglects 2DFR*V114 valve length.
2. To valve edge.

Table 4.3-2 Drywell Floor Drain Interstitial Pipe Data

Drywell Floor Drain Interstitial Piping Between IVs							
Starting Location: 2DFR*MOV121							
Stopping Location: 2DFR*MOV120							
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-DFR-006-25-2	2	8.54, 8.58		7	3		
2-DFR-006-25-2	2	8.54, 8.58		1	2	5/16	

2. To valve edge.

Table 4.3-3 Drywell Floor Drain Tank Vent Interstitial Pipe Data

Drywell Floor Drain Tank Vent Interstitial Piping Between IVs							
Starting Location: 2DFR*MOV140							
Stopping Location: 2DFR*MOV139							
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-DFR-003-52-2		8.54, 8.57		1	5 7/8		
2-DFR-003-52-2		8.54, 8.57			1 5/8		
2-DFR-003-52-2		8.54, 8.57	90		4 1/2		
2-DFR-003-52-2		8.54, 8.57				4	1/2
2-DFR-003-52-2		8.54, 8.57				6	1/4
2-DFR-003-52-2		8.54, 8.57	90			4	1/2
2-DFR-003-52-2		8.54, 8.57			4 1/2		
2-DFR-003-52-2		8.54, 8.57		1	3/4		
2-DFR-003-52-2		8.54, 8.57		8	6		
2-DFR-003-56-2		8.54, 8.57		4	3		
2-DFR-003-56-2		8.54, 8.57	8		2		
2-DFR-003-56-2		8.54, 8.57			2		
2-DFR-003-56-2		8.54, 8.57	90		4 1/2		
2-DFR-003-56-2		8.54, 8.57				4	1/2
2-DFR-003-56-2		8.54, 8.57				1	
2-DFR-003-56-2		8.54, 8.57				8	1/4
2-DFR-003-56-2		8.54, 8.57				8	7/8
2-DFR-003-56-2		8.54, 8.57				4	3 5/8
2-DFR-003-56-2		8.54, 8.57	90			4	1/2
2-DFR-003-56-2		8.54, 8.57			4 1/2		
2-DFR-003-56-2		8.54, 8.57			8 7/8		
2-DFR-003-56-2		8.54, 8.57		1	2 1/2		

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Table 4.3-4 Drywell Equipment Drain Inboard Pipe Data**Drywell Equipment Drain Piping Leading Up To Inboard IV**

Starting Location: 2-DER-004-18-2/2-DER-004-17-2 tee

Stopping Location: 2DER*MOV119

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-DER-004-18-2		8.47, 8.53	90				8	2	13/16
2-DER-004-18-2		8.47, 8.53	90	19	11	3/8			
2-DER-004-18-2		8.47, 8.53	90				4	3	7/8
2-DER-004-18-2	1	8.47, 8.53		3	6				
2-DER-004-18-2		8.47, 8.53		2	6	1/2			

1. Neglects 2DER*V300 valve length

Table 4.3-5 Drywell Equipment Drain Interstitial Pipe Data**Drywell Equipment Drain Interstitial Piping Between IVs**

Starting Location: 2DER*MOV119

Stopping Location: 2DER*MOV120

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-DER-004-13-2		8.47, 8.53		9	8	1/2			
2-DER-004-14-2		8.47, 8.53		4	2	1/2			

Table 4.3-6 Drywell Equipment Drain Tank Vent Inboard Pipe Data**Drywell Equipment Drain Tank Vent Piping Leading Up To Inboard IV**

Starting Location: Drywell Atmosphere

Stopping Location: 2DER*MOV130

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-DER-002-34-2		8.47, 8.48			6				
2-DER-002-34-2	1	8.47, 8.48	135	1	2	9/16			

1. To center of valve.

Table 4.3-7 Drywell Equipment Drain Tank Vent Interstitial Pipe Data

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Drywell Equipment Drain Tank Vent Interstitial Piping Between IVs

Starting Location: 2DER*MOV130

Stopping Location: 2DER*MOV131 (QA CAT 1 Boundary)

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-DER-002-34-2		8.47, 8.48			7	13/16		
2-DER-002-34-2		8.47, 8.48	21	1	4	5/8		
2-DER-002-34-2		8.47, 8.49		6	4	3/16		

4.4. Feedwater Lines**Table 4.4-1 Feedwater Line A Inboard Pipe Data****Feedwater Line A Piping Leading Up To Inboard IV**

Starting Location: 24"x18" reducer on 2-FWS-024-61-1

Stopping Location: 2FWS*V12A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-FWS-024-61-1		8.40, 8.42		1	4	3/4		
2-FWS-024-61-1		8.40, 8.42		1	5			
2-FWS-024-61-1		8.40, 8.42			7	1/8		
2-FWS-024-61-1	1	8.40, 8.42	16	9		5/8		
2-FWS-024-61-1		8.40, 8.42			10	1/8		
2-FWS-024-61-1		8.40, 8.42		4	8	1/2		
2-FWS-024-61-1		8.40, 8.42		1	3	3/8		
2-FWS-024-61-1		8.40, 8.42			9	1/4		
2-FWS-024-61-1	1	8.40, 8.42	47	1	3			
2-FWS-024-61-1		8.40, 8.42		1	3			
2-FWS-024-61-1	1, 2	8.40, 8.42	90	1	6	3/4		
2-FWS-024-31-1		8.40, 8.42					7	1/2
2-FWS-024-31-1		8.40, 8.42					1	3/8
2-FWS-024-31-1		8.40, 8.42					11	3
2-FWS-024-31-1		8.40, 8.42					2	1
2-FWS-024-31-1		8.40, 8.42					7	5
2-FWS-024-31-1		8.40, 8.42					2	4
2-FWS-024-31-1		8.40, 8.42					5	10
2-FWS-024-31-1		8.40, 8.42	90				2	
2-FWS-024-31-1		8.40, 8.42		2				
2-FWS-024-31-1		8.40, 8.42		1	2	1/8		
2-FWS-024-31-1		8.40, 8.42		1	9	7/8		

1. Conservative angle approximation.

2. 2FWS*HCV54A valve length neglected.

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Table 4.4-2 Feedwater Line A Interstitial Pipe Data

Interstitial Piping Between IVs								
Starting Location: 2FWS*V12A								
Stopping Location: 2FWS*AOV23A								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-FWS-024-31-1	3	8.40, 8.42		11	10	5/16		
2-FWS-024-31-1		8.40, 8.42			11	1/2		
2-FWS-024-31-1		8.40, 8.42		1		1/4		

3. Assumes the length of Z-4B on Feedwater line B.

Table 4.4-3 Feedwater Line A Outboard Pipe Data

Piping After Outboard IV								
Starting Location: 2FWS*AOV23A								
Stopping Location: 2FWS*MOV21A								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-FWS-024-50-1		8.40, 8.42		1	10	1/4		
2-FWS-024-50-1		8.40, 8.42		3	9	3/4		
2-FWS-024-50-1		8.40, 8.42		3	10			
2-FWS-024-50-1		8.40, 8.42		1	1	1/2		
2-FWS-024-50-1		8.40, 8.42			11	3/8		
2-FWS-024-50-1		8.40, 8.42			8	1/4		

Table 4.4-4 Feedwater Line B Inboard Pipe Data

Feedwater Line B Piping Leading Up To Inboard IV	
Starting Location:	24"x18" reducer on 2-FWS-024-60-1
Stopping Location:	2FWS*V12B

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Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-FWS-024-60-1		8.40, 8.45		1	5	5/8			
2-FWS-024-60-1	1	8.40, 8.45	16	1	6	5/8			
2-FWS-024-60-1		8.40, 8.45		5	5				
2-FWS-024-60-1		8.40, 8.45		1	1	3/8			
2-FWS-024-60-1		8.40, 8.45		8	8				
2-FWS-024-60-1		8.40, 8.45			10				
2-FWS-024-60-1		8.40, 8.45		1	1	1/2			
2-FWS-024-60-1	1	8.40, 8.45	47	1	3				
2-FWS-024-60-1		8.40, 8.45		1	3				
2-FWS-024-60-1	1, 2	8.40, 8.45	90	1	6	3/8			
2-FWS-024-32-1		8.40, 8.45						6	1/4
2-FWS-024-32-1		8.40, 8.45					1		
2-FWS-024-32-1		8.40, 8.45					11	4	1/8
2-FWS-024-32-1		8.40, 8.45					2	1	1/8
2-FWS-024-32-1		8.40, 8.45					7	6	
2-FWS-024-32-1		8.40, 8.45					2	4	3/4
2-FWS-024-32-1		8.40, 8.45					5	9	1/4
2-FWS-024-32-1		8.40, 8.45	90				2		
2-FWS-024-32-1		8.40, 8.45		2					
2-FWS-024-32-1		8.40, 8.45		1	1	3/4			
2-FWS-024-32-1		8.40, 8.45		1	10	3/8			

1. Conservative angle approximation.
2. 2FWS*HCV54A valve length neglected.

Table 4.4-5 Feedwater Line B Interstitial Pipe Data

Feedwater Line B Interstitial Piping Between IVs									
Starting Location: 2FWS*V12B									
Stopping Location: 2FWS*AOV23B									
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-FWS-024-32-1		8.40, 8.45		11	10	5/16			
2-FWS-024-32-1		8.40, 8.45			11				
2-FWS-024-32-1		8.40, 8.45		1		1/2			

Table 4.4-6 Feedwater Line B Outboard Pipe Data

Feedwater Line B Piping After Outboard IV									
Starting Location: 2FWS*AOV23B									
Stopping Location: 2FWS*MOV21B									
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-FWS-024-51-1		8.40, 8.45		1	10				

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Feedwater Line B Piping After Outboard IV								
Starting Location: 2FWS*AOV23B								
Stopping Location: 2FWS*MOV21B								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-FWS-024-51-1		8.40, 8.45		3	10	1/4		
2-FWS-024-51-1		8.40, 8.45		5	10			
2-FWS-024-51-1		8.40, 8.45		1	1	1/4		
2-FWS-024-51-1		8.40, 8.45		1	1	1/2		
2-FWS-024-51-1		8.40, 8.45			6	1/8		

4.5. Primary Containment Purge (CPS) Lines in Drywell/Wetwell

Table 4.5-1 2" CPS Line in Drywell Inboard Pipe Data

2" CPS Line in Drywell Piping Leading Up To Inboard IV							
Starting Location: Drywell Atmosphere 2CPS*S03							
Stopping Location: 2CPS*SOV122							
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-002-30-2		8.60, 8.61			4		
2-CPS-002-30-2	1	8.60, 8.61			8		

1. To center of valve.

Table 4.5-2 2" CPS Line in Drywell Interstitial Pipe Data

2" CPS Line in Drywell Interstitial Piping Between IVs								
Starting Location: 2CPS*SOV122								
Stopping Location: 2CPS*SOV120								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-CPS-002-30-2		8.60, 8.61		2	6			
2-CPS-002-30-2		8.60, 8.61		5	4	1/16		
2-CPS-002-19-2		8.60, 8.61			5	1/2		
2-CPS-002-19-2	1	8.60, 8.61			8	1/2		

1. To center of valve.

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Table 4.5-3 14" CPS Line in Drywell Inboard Pipe Data**14" CPS Line in Drywell Piping Leading Up To Inboard IV**

Starting Location: Drywell Atmosphere (2CPS*S01A)

Stopping Location: 2CPS*AOV106

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-14-35-2		8.60, 8.62		1	2		

Table 4.5-4 14" CPS Line in Drywell Interstitial Pipe Data**14" CPS Line in Drywell Interstitial Piping Between IVs**

Starting Location: 2CPS*AOV106

Stopping Location: 2CPS*AOV104

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-14-16-2		8.60, 8.62			4 7/8		
2-CPS-14-16-2		8.60, 8.62		8	6		
2-CPS-14-2-2		8.60, 8.62		1			
2-CPS-14-2-2		8.60, 8.62		1	8 7/8		

Table 4.5-5 12" CPS Line in Wetwell Inboard Pipe Data**12" CPS Line in Wetwell Piping Leading Up To Inboard IV**

Starting Location: Wetwell Atmosphere (2CPS*S02A)

Stopping Location: 2CPS*AOV107

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-012-36-2		8.60, 8.63				5	9 1/8
2-CPS-012-36-2		8.60, 8.63				1	
2-CPS-012-36-2		8.60, 8.63	90	1			
2-CPS-012-36-2		8.60, 8.63		3	8 5/8		

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Table 4.5-6 12" CPS Line in Wetwell Interstitial Pipe Data**12" CPS Line in Wetwell Interstitial Piping Between IVs**

Starting Location: 2CPS*AOV107

Stopping Location: 2CPS*AOV105

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-012-15-2		8.60, 8.63			4 1/4		
2-CPS-012-15-2		8.60, 8.63		7	3		
2-CPS-012-3-2		8.60, 8.63		2	6		
2-CPS-012-3-2		8.60, 8.63			10 1/4		

Table 4.5-7 2" CPS Line in Wetwell Inboard Pipe Data**2" CPS Line in Wetwell Piping Leading Up To Inboard IV**

Starting Location: Wetwell Atmosphere (2CPS*SO4)

Stopping Location: 2CPS*SOV121

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-002-16-2	1	8.60, 8.64		1	9 1/2		

1. To center of valve

Table 4.5-8 2" CPS Line in Wetwell Interstitial Pipe Data**2" CPS Line in Wetwell Interstitial Piping Between IVs**

Starting Location: 2CPS*SOV121

Stopping Location: 2CPS*SOV119

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-002-16-2		8.60, 8.64		2	5 1/2		
2-CPS-002-10-2	2	8.60, 8.64	90	5			
2-CPS-002-10-2		8.60, 8.64	90			4	6
2-CPS-002-10-2		8.60, 8.64	90	3	9		
2-CPS-002-10-2	1	8.60, 8.64	90	6	2		

1. To center of valve

2. Conservatively assumes 5 ft. length through penetration

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4.6. Reactor Water Cleanup (RWCU) Line**Table 4.6-1 RWCU Line Inboard Pipe Data**

RWCU Piping Leading Up To Inboard IV								
Starting Location: 2-WCS-008-86-1/2-WCS-004-3-1 tee								
Stopping Location: 2WCS*MOV102								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-WCS-008-86-1		8.34, 8.37			6			
2-WCS-008-86-1		8.34, 8.37		6	4	3/8		
2-WCS-008-86-1		8.34, 8.37		1	1			
2-WCS-008-86-1		8.34, 8.37		3	2	1/2		

Table 4.6-2 RWCU Line Interstitial Pipe Data

RWCU Interstitial Piping Between IVs								
Starting Location: 2WCS*MOV102								
Stopping Location: 2WCS*MOV112								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-WCS-008-86-1		8.34, 8.37		1	3			
2-WCS-008-86-1		8.34, 8.37		10	8			
2-WCS-008-87-1		8.34, 8.37		1	3			

4.7. Post Accident Sampling System (PASS) Lines**Table 4.7-1 PASS Sample Line A Inboard Pipe Data**

Piping Leading Up To Inboard IV								
Starting Location: Penetration Z60B								
Stopping Location: 2CMS*SOV74A								
Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-CMS-750-61-2	1, 2	8.89, 8.91		0	16	1/2		
2-CMS-750-61-2	2	8.89, 8.91	45	1	8	0		
2-CMS-750-61-2		8.89, 8.91	45					8 1/2
2-CMS-750-61-2		8.89, 8.91	90				5	3
2-CMS-750-61-2		8.89, 8.91	90	3	8	5/8		
2-CMS-750-61-2		8.89, 8.91	90				5	6 7/8

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Piping Leading Up To Inboard IV

Starting Location: Penetration Z60B

Stopping Location: 2CMS*SOV74A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-61-2		8.89, 8.91	90	5	5		
2-CMS-750-61-2		8.89, 8.91	90			21	11 1/8
2-CMS-750-61-2		8.89, 8.91	90	4	6 1/2		
2-CMS-750-61-2		8.89, 8.91, 8.92	30			4	5 3/16
2-CMS-750-61-2		8.89, 8.92	120			2	
2-CMS-750-61-2		8.89, 8.92		4	7 13/16		
2-CMS-750-61-2		8.89, 8.92		2	6		
2-CMS-750-61-2		8.89, 8.92	90		6		
2-CMS-750-77-2		8.89, 8.100			6		
2-CMS-750-77-2		8.89, 8.100		3	1		
2-CMS-750-77-2	2	8.89, 8.100		1	10		

1. Includes piping in penetration.
2. Includes length through SOV(s).

Table 4.7-2 PASS Sample Line A Interstitial Pipe Data**Interstitial Piping Between IVs**

Starting Location: 2CMS*SOV74A

Stopping Location: 2CMS*SOV76A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-77-2	2	8.89, 8.100		1			

2. Includes length through SOV(s).

Table 4.7-3 PASS Sample Line B Inboard Pipe Data**Piping Leading Up To Inboard IV**

Starting Location: Penetration Z60F

Stopping Location: 2CMS*SOV74B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-69-2	1	8.89, 8.93			8 9/16		
2-CMS-750-69-2		8.89, 8.93			3/4		
2-CMS-750-69-2	2	8.89, 8.93			6 1/2		

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Piping Leading Up To Inboard IV

Starting Location: Penetration Z60F
Stopping Location: 2CMS*SOV74B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-CMS-750-69-2		8.89, 8.93	90	1	3	15/16			
2-CMS-750-69-2		8.89, 8.93	90	2	10	3/8			
2-CMS-750-69-2		8.89, 8.93	90	6	1	1/4			
2-CMS-750-69-2		8.89, 8.93	90	3					
2-CMS-750-69-2		8.89, 8.93	90				3	3	1/2
2-CMS-750-69-2		8.89, 8.93	90	3	4	1/2			
2-CMS-750-69-2		8.89, 8.93	45				2		1/16
2-CMS-750-69-2		8.89, 8.93	90	6	7	3/8			
2-CMS-750-69-2		8.89, 8.93	90				1	8	
2-CMS-750-69-2		8.89, 8.93	45		7	1/16			
2-CMS-750-69-2		8.89, 8.93	90	8	5				
2-CMS-750-69-2		8.89, 8.93	45					11	5/16
2-CMS-750-69-2		8.89, 8.93	90				5	2	
2-CMS-750-69-2		8.89, 8.93	90	1	3				
2-CMS-750-69-2		8.89, 8.93	90	10	7	1/2			
2-CMS-750-69-2		8.89, 8.93					5	5	
2-CMS-750-69-2		8.89, 8.94	45				5	3	
2-CMS-750-69-2		8.89, 8.94	45				1	9	3/16
2-CMS-750-69-2		8.89, 8.94	57	8	4				
2-CMS-750-69-2		8.89, 8.94		11	6				
2-CMS-750-69-2		8.89, 8.94	45	1	6				
2-CMS-750-69-2		8.89, 8.94	45				1		3/4
2-CMS-750-69-2		8.89, 8.94	45	5	1				
2-CMS-750-69-2		8.89, 8.94	45				2	7	1/8
2-CMS-750-69-2		8.89, 8.94	90	3	4				
2-CMS-750-69-2		8.89, 8.94	45				6	11	
2-CMS-750-69-2		8.89, 8.94	45					6	15/16
2-CMS-750-69-2		8.89, 8.94	45				4	4	7/8
2-CMS-750-69-2		8.89, 8.94	45					4	1/4
2-CMS-750-69-2		8.89, 8.94					9	6	
2-CMS-750-69-2		8.89, 8.95	45					11	3/4
2-CMS-750-69-2		8.89, 8.95	45				1	5	5/16
2-CMS-750-69-2		8.89, 8.95	90					6	
2-CMS-750-69-2		8.89, 8.95			5	3/4			
2-CMS-750-69-2		8.89, 8.96	90		3				
2-CMS-750-79-2		8.89, 8.96, 8.100	90				1	4	0.4898
2-CMS-750-79-2		8.89, 8.100	90	5	11	3/4			
2-CMS-750-79-2	2	8.89, 8.100		2	10				

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Piping Leading Up To Inboard IV

Starting Location: Penetration Z60F

Stopping Location: 2CMS*SOV74B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches

1. Includes piping in penetration.
2. Includes length through SOV(s).

Table 4.7-4 PASS Sample Line B Interstitial Pipe Data**Interstitial Piping Between IVs**

Starting Location: 2CMS*SOV74B

Stopping Location: 2CMS*SOV76B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-79-2	2	8.89, 8.100			6		
2-CMS-750-79-2	2	8.89, 8.100			6		

2. Includes length through SOV(s).

Table 4.7-5 PASS Return Line A Inboard Pipe Data**Piping Leading Up To Inboard IV**

Starting Location: Penetration Z60D

Stopping Location: 2CMS*SOV75A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-CMS-750-2-2	1	8.89, 8.97		1	1				
2-CMS-750-2-2		8.89, 8.97	45		6				
2-CMS-750-2-2		8.89, 8.97	45	2	1				
2-CMS-750-2-2		8.89, 8.97	90	5	1	1/4			
2-CMS-750-2-2		8.89, 8.97	90	4	10	9/16			
2-CMS-750-2-2		8.89, 8.97	90				13	9	11/16
2-CMS-750-2-2		8.89, 8.97	90	6	2				
2-CMS-750-2-2		8.89, 8.97	90				2	6	
2-CMS-750-2-2		8.89, 8.97	90	13	10	1/8			
2-CMS-750-2-2		8.89, 8.97	90				2	5	3/8
2-CMS-750-2-2		8.89, 8.97	29	21	11	1/2			
2-CMS-750-2-2		8.89, 8.97	90		8	9/16			
2-CMS-750-2-2		8.89, 8.97	36				20	10	7/16
2-CMS-750-2-2		8.89, 8.97	36				1	5	15/16
2-CMS-750-2-2		8.89, 8.97					1	2	15/16
2-CMS-750-2-2		8.89, 8.98	13				4	9	

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Piping Leading Up To Inboard IV

Starting Location: Penetration Z60D

Stopping Location: 2CMS*SOV75A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-2-2		8.89, 8.98	90				9 0.2622
2-CMS-750-63-2		8.89, 8.98			2 13/16		
2-CMS-750-63-2		8.89, 8.99	90		3 5/8		
2-CMS-750-78-2		8.89, 8.99			2		
2-CMS-750-78-2		8.89, 8.100	90		9		
2-CMS-750-78-2		8.89, 8.100	90	6	8 1/8		
2-CMS-750-78-2	2	8.89, 8.100		1	9		

1. From outer edge of penetration.
2. Includes length through SOV(s).

Table 4.7-6 PASS Return Line A Interstitial Pipe Data

Interstitial Piping Between IVs

Starting Location: 2CMS*SOV75A

Stopping Location: 2CMS*SOV77A

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-78-2	2	8.89, 8.100			6		
2-CMS-750-78-2	2	8.89, 8.100			6		

2. Includes length through SOV(s).

Table 4.7-7 PASS Return Line B Inboard Pipe Data

Piping Leading Up To Inboard IV

Starting Location: Penetration Z60H

Stopping Location: 2CMS*SOV75B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-71-2	1	8.89, 8.101			3/4		
2-CMS-750-71-2		8.89, 8.101		1			
2-CMS-750-71-2		8.89, 8.101	45	1	3/4		
2-CMS-750-71-2		8.89, 8.101	45	1	11		
2-CMS-750-71-2		8.89, 8.101	90	4	2		
2-CMS-750-71-2		8.89, 8.101				8	6 1/4
2-CMS-750-71-2		8.89, 8.102	90			9	4 5/8

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Piping Leading Up To Inboard IV

Starting Location: Penetration Z60H

Stopping Location: 2CMS*SOV75B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length		
				Feet	Inches	Feet	Inches	
2-CMS-750-71-2		8.89, 8.102	90	1				
2-CMS-750-71-2		8.89, 8.102	90	1	7			
2-CMS-750-71-2		8.89, 8.102	90	3				
2-CMS-750-71-2		8.89, 8.102	90			5	1	1/4
2-CMS-750-71-2		8.89, 8.102	30	3	6			
2-CMS-750-71-2		8.89, 8.102	30	3	10			
2-CMS-750-71-2		8.89, 8.102	90	12	11	3/16		
2-CMS-750-80-2		8.89, 8.102	45				6	
2-CMS-750-80-2		8.89, 8.91	45				8	1/2
2-CMS-750-80-2		8.89, 8.91	90			1	5	
2-CMS-750-80-2	2	8.89, 8.91		1	5			

1. From outer edge of penetration.

2. Includes length through SOV(s).

Table 4.7-8 PASS Return Line B Interstitial Pipe Data**Interstitial Piping Between IVs**

Starting Location: 2CMS*SOV75B

Stopping Location: 2CMS*SOV77B

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CMS-750-80-2	2	8.89, 8.91			7		
2-CMS-750-80-2	2	8.89, 8.91			7		

2. Includes length through SOV(s).

4.8. Instrument Air (IAS) Lines**Table 4.8-1 IAS Line 1 Inboard Pipe Data****Piping Leading Up To Inboard IV**

Starting Location: 2IAS*V179

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Stopping Location: 2IAS*V448

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-IAS-150-982-3	2	8.84, 8.87	90					10	5/8
2-IAS-150-982-3		8.84, 8.87	90	2	5	3/8			
2-IAS-150-982-3		8.84, 8.87	90				3	6	
2-IAS-150-982-3	2	8.84, 8.87		1					

1. Through valve 2IAS*V181.
2. To center of valve

Table 4.8-2 IAS Line 1 Interstitial Pipe Data

Interstitial Piping Between IVs

Starting Location: 2IAS*V448

Stopping Location: 2IAS*SOV164

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-IAS-150-991-2		8.84, 8.87	61	3	7	1/2			
2-IAS-150-991-2		8.84, 8.87	61				2	10	5/16
2-IAS-150-991-2		8.84, 8.87			1	1/4			
2-IAS-150-898-2		8.84, 8.85			2	1/4			
2-IAS-150-898-2	2	8.84, 8.85			9	1/2			

2. To center of SOV.

Table 4.8-3 IAS Line 2 Inboard Pipe Data

Piping Leading Up To Inboard IV

Starting Location: 2IAS*V180

Stopping Location: 2IAS*V449

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length		
				Feet	Inches		Feet	Inches	
2-IAS-150-780-3	1	8.74, 8.76		3	11	5/8			
2-IAS-150-780-3		8.74, 8.76	90			1/2			
2-IAS-150-780-3		8.74, 8.76	90				3		
2-IAS-150-780-3		8.74, 8.76	75	3		9/16			
2-IAS-150-780-3		8.74, 8.76	90	1	4				
2-IAS-150-780-3		8.74, 8.76	90	2	9				
2-IAS-150-780-3		8.74, 8.76	90				2	9	

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Piping Leading Up To Inboard IV

Starting Location: 2IAS*V180

Stopping Location: 2IAS*V449

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-IAS-150-780-3		8.74, 8.76		1	1/4		

1. To center of valve.

Table 4.8-4 IAS Line 2 Interstitial Pipe Data**Interstitial Piping Between IVs**

Starting Location: 2IAS*V449

Stopping Location: 2IAS*SOV165

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-IAS-150-779-2		8.74, 8.76	90	1	8		
2-IAS-150-779-2		8.74, 8.76	45			1	5 5/8
2-IAS-150-779-2		8.74, 8.76	90			1	5
2-IAS-150-779-2		8.74, 8.76			1 3/8		
2-IAS-150-837-2	1	8.74, 8.75			11 1/4		

1. To center of SOV.

Table 4.8-5 IAS Line 3 Inboard Pipe Data**Piping Leading Up To Inboard IV**

Starting Location: 2IAS*V181

Stopping Location: 2IAS*SOV180

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-IAS-150-714-3	1	8.77, 8.82	90	4	9 7/16		
2-IAS-150-714-3		8.77, 8.82	90			2	8
2-IAS-150-714-3	2	8.77, 8.82		3	6 3/16		

1. Termination at valve center.

2. To center of SOV.

Table 4.8-6 IAS Line 3 Interstitial Pipe Data**Interstitial Piping Between IVs**

Starting Location: 2IAS*SOV180

Stopping Location: 2IAS*SOV168

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches

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Pipe Segment	Note	Reference	(deg)	Feet	Inches	Feet	Inches
2-IAS-150-527-2		8.77, 8.82	90	1	7 1/4		
2-IAS-150-527-2		8.77, 8.82	90		6 5/8		
2-IAS-150-527-2		8.77, 8.82	45			2	5 9/16
2-IAS-150-527-2		8.77, 8.82	45			3	6 1/2
2-IAS-150-527-2		8.77, 8.82			4 3/4		
2-IAS-150-526-2	2	8.77, 8.79			10		

2. To center of SOV.

Table 4.8-7 IAS Line 4 Inboard Pipe Data

Piping Leading Up To Inboard IV

Starting Location: 2IAS*V182

Stopping Location: 2IAS*SOV185

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-IAS-150-521-3		8.77, 8.83		1	4 5/8		
2-IAS-150-521-3	1	8.77, 8.83		1	5 1/4		

1. To centerline of SOV.

Table 4.8-8 IAS Line 4 Interstitial Pipe Data

Interstitial Piping Between IVs

Starting Location: 2IAS*SOV185

Stopping Location: 2IAS*SOV167

			Bends	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches

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Pipe Segment	Note	Reference	(deg)	Feet	Inches	Feet	Inches
2-IAS-150-525-3		8.77, 8.83		1	2 1/4		
2-IAS-150-524-3		8.77, 8.78		7	6		
2-IAS-150-524-3		8.77, 8.78	90	1	7 1/16		
2-IAS-150-524-3		8.77, 8.78	90			2	7 1/4
2-IAS-150-524-3		8.77, 8.78	90	6	9 5/8		
2-IAS-150-524-3		8.77, 8.78	90			4	6
2-IAS-150-524-3		8.77, 8.78		2	3		
2-IAS-150-524-3	1	8.77, 8.78		1	6		

1. To centerline of SOV.

Table 4.8-9 IAS Line 5 Inboard Pipe Data

Piping Leading Up To Inboard IV

Starting Location: 2IAS*V178

Stopping Location: 2IAS*SOV184

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-IAS-150-807-3		8.84, 8.88	45			7	8 5/8
2-IAS-150-807-3		8.84, 8.88	45				8 1/2
2-IAS-150-807-3	1	8.84, 8.88		4	10 13/16		

1. To center of SOV.

Table 4.8-10 IAS Line 5 Interstitial Pipe Data

Interstitial Piping Between IVs

Starting Location: 2IAS*SOV184

Stopping Location: 2IAS*SOV166

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-IAS-150-990-2		8.84, 8.88	90	2	9 1/2		
2-IAS-150-990-2		8.84, 8.88	180			4	9 3/8
2-IAS-150-990-2		8.84, 8.88		1			
2-IAS-150-897-2	1	8.84, 8.86			11 1/4		

1. To center of SOV.

4.9. Nitrogen System (GSN) Line

Table 4.9-1 GSN Line Interstitial Pipe Data

Interstitial Piping Between IVs

Starting Location: 2GSN*V170

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Stopping Location: 2GSN*SOV166

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-GSN-500-152-2	3	8.71, 8.73			4			
2-GSN-500-152-2		8.71, 8.73		7	5			
2-GSN-500-152-2	1	8.71, 8.72	180				10	
2-GSN-500-152-2	1	8.71, 8.72	90	3	11	3/16		
2-GSN-500-151-2		8.71, 8.72	90				10	7/16
2-GSN-500-151-2	2	8.71, 8.72			4	1/4		

1. 3/4" Flex hose
2. Inboard of SOV
3. Outboard of check valve.

4.10. 1" Primary Containment Purge (CPS) Lines**Table 4.10-1 1" CPS Line 1 Interstitial Pipe Data****Interstitial Piping Between IVs**

Starting Location: Z-96 Penetration

Stopping Location: 2CPS*SOV132

Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length			Vertical Length	
				Feet	Inches		Feet	Inches
2-CPS-001-41-2		8.60, 8.68	90		6	1/16		
2-CPS-001-41-2		8.60, 8.68	90				4	2
2-CPS-001-41-2		8.60, 8.68		3		5/8		
2-CPS-001-41-2		8.60, 8.68		8	2	9/16		
2-CPS-001-41-2		8.60, 8.68		3	5			

Table 4.10-2 1" CPS Line 2 Interstitial Pipe Data**Interstitial Piping Between IVs**

Starting Location: Z92 Penetration

Stopping Location: 2CPS*SOV133

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Pipe Segment	Note	Reference	Bends (deg)	Horizontal Length		Vertical Length	
				Feet	Inches	Feet	Inches
2-CPS-001-45-2		8.60, 8.65	90		1		
2-CPS-001-45-2		8.60, 8.65	90			4	6
2-CPS-001-45-2		8.60, 8.65		2	5		
2-CPS-001-45-2		8.60, 8.65		2	8		

4.11. Pipe Data for Bypass Lines Evaluated

The following table provides a summary of piping class data for the piping systems evaluated in this calculation. This data was collected from a variety of sources. All the data except the pipe inside diameters were taken from the NMP MEL (Ref. 8.105). This confirms the nominal size of the pipe, the schedule and the quality classification. For the MSLs, the pipe inner diameter was taken from the "Tabulation of Specific Pipe" listed in the NMP pipe specification (Ref. 8.106). This was due to the special pipe schedule. For the rest of the pipes, the inner diameter was taken from the Crane manual (Ref. 8.107).

Table 4.11-1 Bypass Line QA Classification and Size Data Summary

Pipe Line	SAFETY	QUAL GRP	SEIS (SSE)	QA CAT.	NOM SIZE/ RATING (in.)	PIPE CLASS	PIPE SCHEDULE	SERVICE CODE	PIPE ID (in.)
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Pipe Line	SAFETY	QUAL GRP	SEIS (SSE)	QA CAT.	NOM SIZE/ RATING (in.)	PIPE CLASS	PIPE SCHEDULE	SERVICE CODE	PIPE ID (in.)
Inboard MSLs	SR	A	I	1	26.00	901	SPW	STM	23.481
Interstitial MSLs	SR	A	I	1	26.00	901	SPW	STM	23.481
Outboard MSLs	Q9	D	I	1	28.00	901	SPW	STM	25.23
MS Header	Q9	D	I	1	48.00	901	SPW	STM	41
MSL Up To TSV	Q9	D	I	1	28.00	901	SPW	STM	25.23
2 in. Inboard/Outboard MSL Drain Lines	SR	A/B	I	1	2.00	901/901C	160	STM	1.687
6 in. Inboard MSL Drain Line	SR	A	I	1	6.00	901	80	STM	5.761
1 in. Outboard MSL Drain Lines	SR	B	I	1	1.00	901	160	STM	0.815
3/4 in. Outboard MSL Drain Lines	SR	B	I	1	0.75	901/901C	160	STM	0.612
1 1/2 in. IAS Lines	SR	B/C	I	1	1.50	602/302	40S/STD	N2	1.61
GSN Lines	SR	B	I	1	0.50	153	STD	N2	0.622
1 in. CPS Line to Suppression Pool SOVs	SR	B	I	1	1.00	302	STD	N2	1.049
2 in. CPS Line in Drywell	SR	B	I	1	2.00	151	80	AIR	1.939
14 in. CPS Line in Drywell	SR	B	I	1	14.00	151	STD	AIR	13.25
2 in. CPS Line in Wetwell	SR	B	I	1	2.00	153	STD	AIR	2.067
12 in. CPS Line in Wetwell	SR	B	I	1	12.00	151	STD	AIR	12
6 in. Drywell Floor Drain Line	SR	B	I	1	6.00	153	STD	WTR	6.065
3 in. Drywell Floor Drain Tank Vent Line	SR	B	I	1	3.00	153	STD	WTR	3.068
4 in. Drywell Equipment Drain Line	SR	B	I	1	4.00	153	STD	WTR	4.026

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Pipe Line	SAFETY	QUAL GRP	SEIS (SSE)	QA CAT.	NOM SIZE/ RATING (in.)	PIPE CLASS	PIPE SCHEDULE	SERVICE CODE	PIPE ID (in.)
2 in. Drywell Equipment Drain Tank Vent Line	SR	B	I	1	2.00	153	STD	AIR	2.067
24 in. SCH 80 Feedwater Lines	SR	A	I	1	24.00	901	80	WTR	21.562
24 in. SCH 140 Feedwater Lines	SR	A	I	1	24.00	1511	140	WTR	19.876
RWCU Lines	SR/Q7	A/C	I	1	8.00	901	80	WTR	7.625
PASS Lines	SR	B	I	1	0.75	153	STD	AIR	0.824

5. Calculations

Using the raw data in Section 4, Excel spreadsheets were prepared to compute the piping line volumes and areas. The area determined in these evaluations is the total inside surface area of the piping system. The internal area of piping, which is oriented in a vertical position is computed separately from horizontally aligned piping. This is because aerosol deposition, which is a gravimetric process, would not occur on vertical pipe surfaces. The general equations which are used in the Excel spread sheets are:

$$\begin{aligned}\text{Internal Area} &= 2 \pi R L \\ \text{Internal Volume} &= L \pi R^2\end{aligned}$$

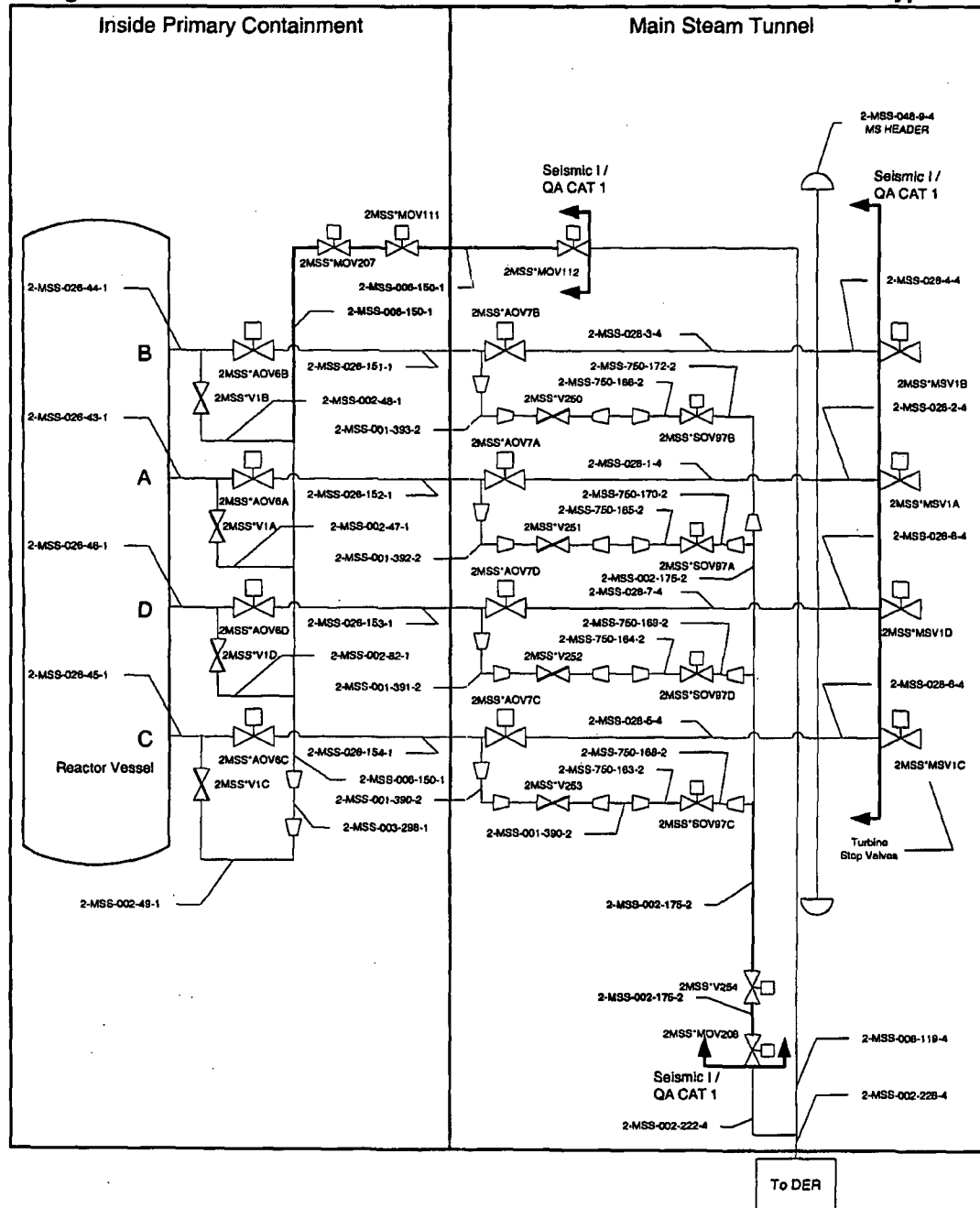
R is the piping run internal radius and L length at that radius. The individual results of these computations are shown in Section 6 below, and summarized in Tables 6.11.

Figures 5-1 through 5-8 are provided as a visual aid to depict the piping considered for this analysis. The pipelines indicated in bold, along with the QA CAT 1 boundaries, show the portion of the bypass lines that were analyzed. The data provided in Section 4 above corresponds directly to these figures.

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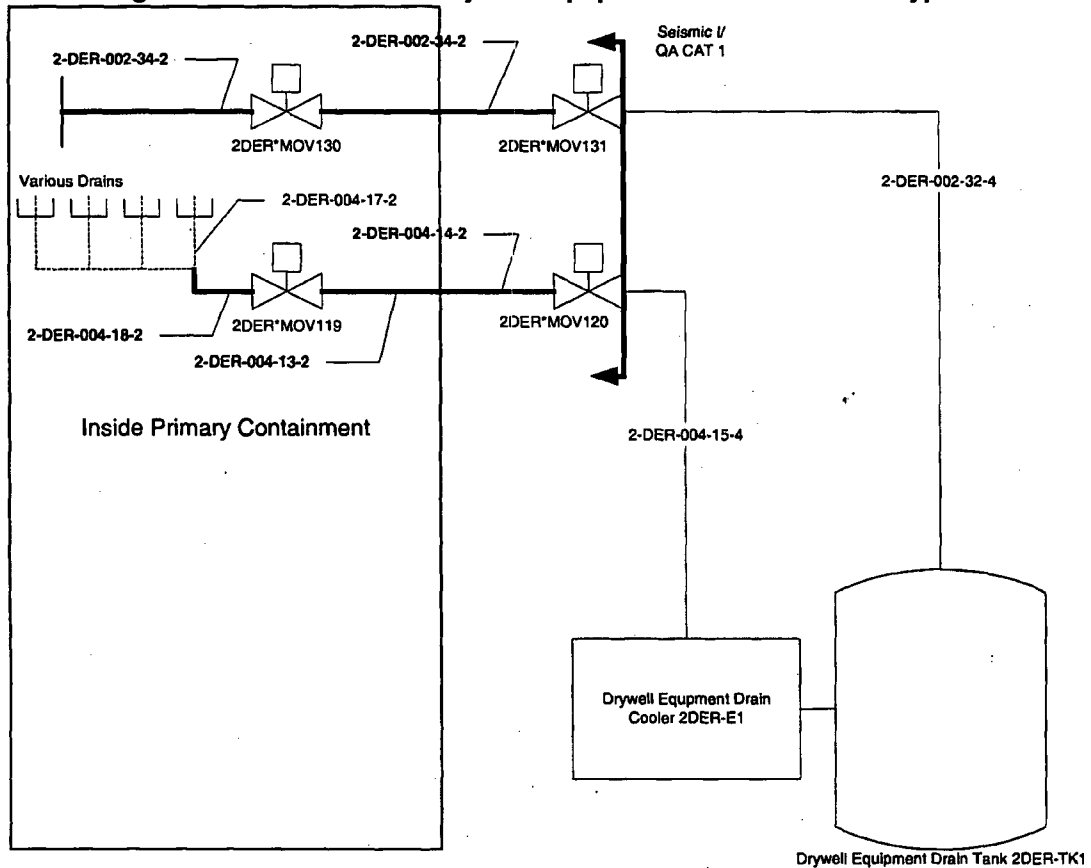
Figure 5-1 Schematic of Main Steam Line and Main Steam Drain Line Bypass



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Figure 5-2 Schematic of Drywell Equipment Drain and Vent Bypass



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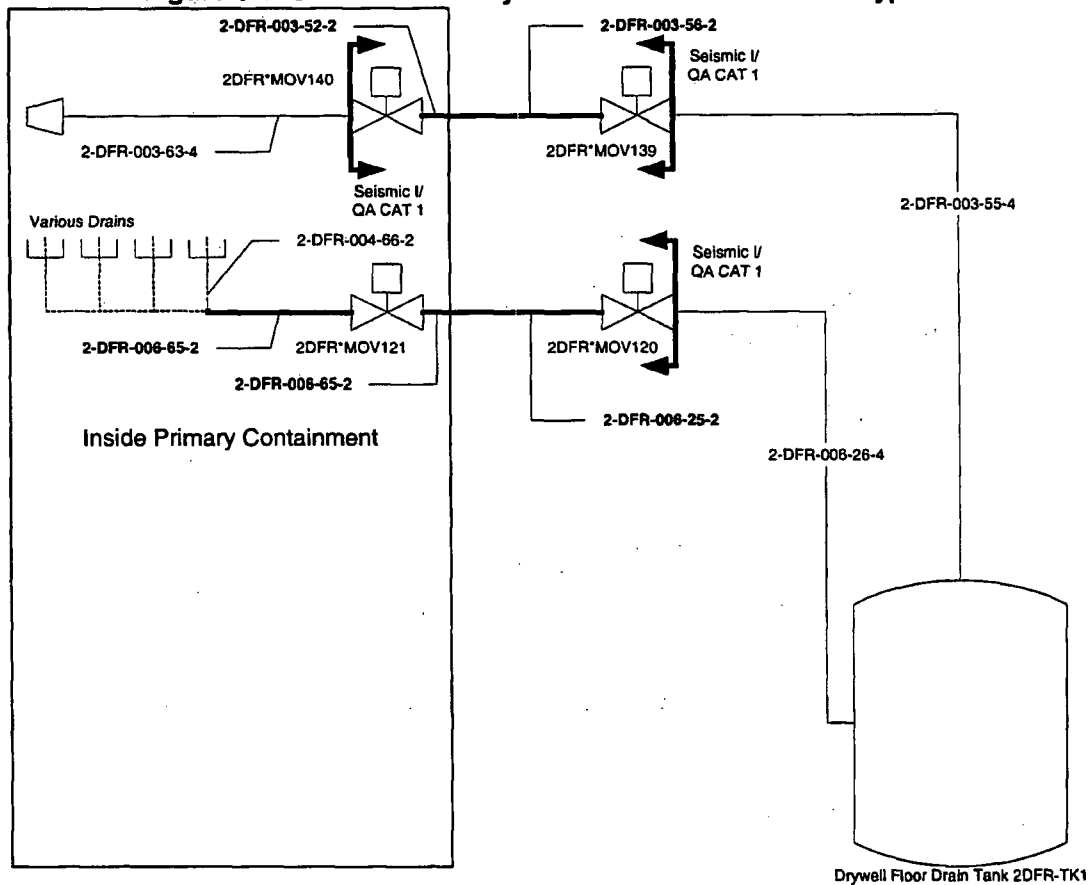
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Ref.	Year	Country	Sample Size	Age Range	Gender	Study Design	Findings
1	2018	USA	1,200	18-65	Male	Quantitative	High levels of stress and anxiety reported.
2	2019	UK	800	25-55	Female	Qualitative	Focus on mental health challenges.
3	2020	Canada	1,500	18-75	Both	Quantitative	Increased rates of depression and isolation.
4	2021	Australia	900	30-60	Male	Quantitative	Significant impact on work-life balance.
5	2022	Germany	1,100	20-70	Both	Qualitative	Emphasis on social support networks.

Figure 5-3 Schematic of Drywell Floor Drain and Vent Bypass

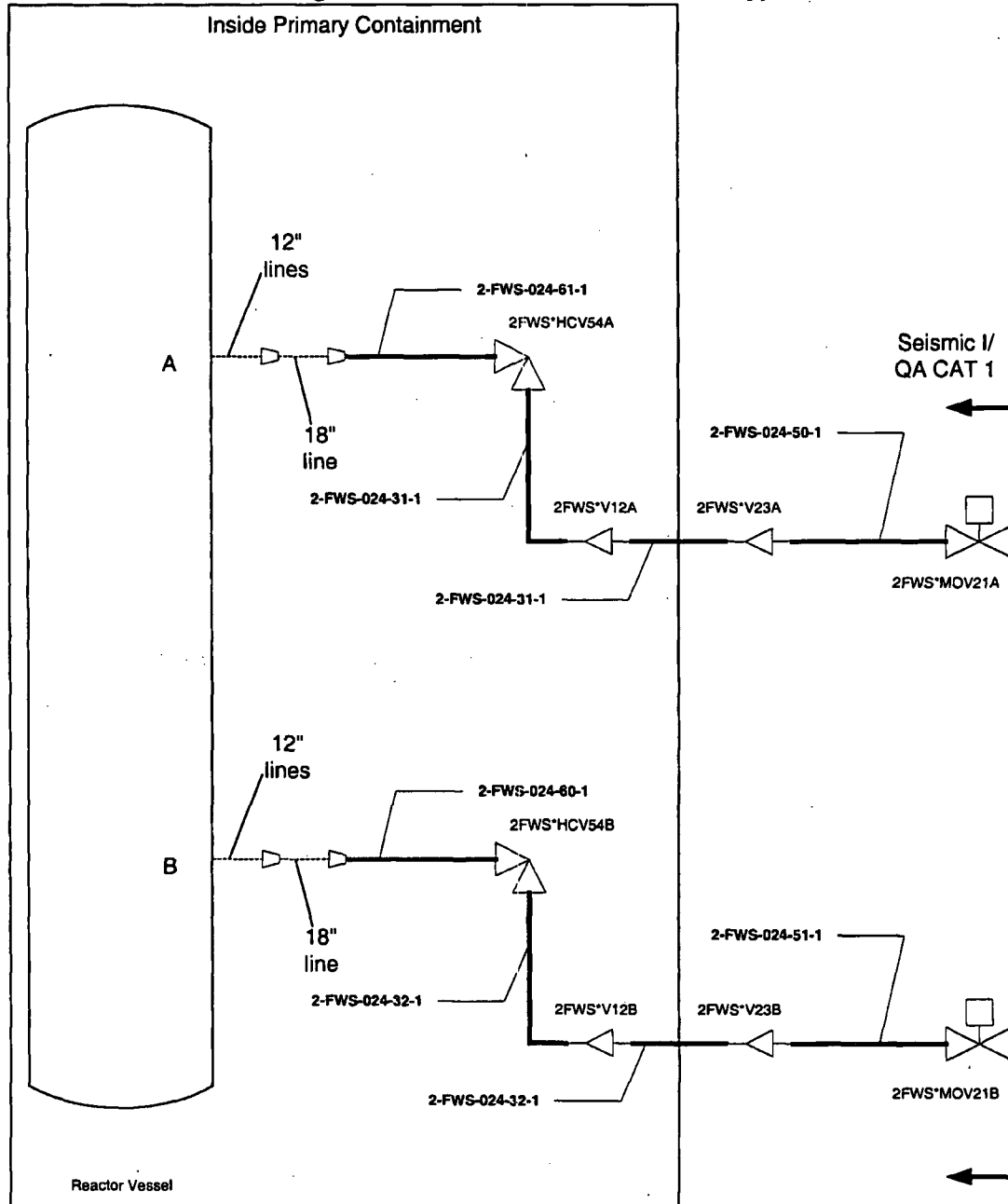


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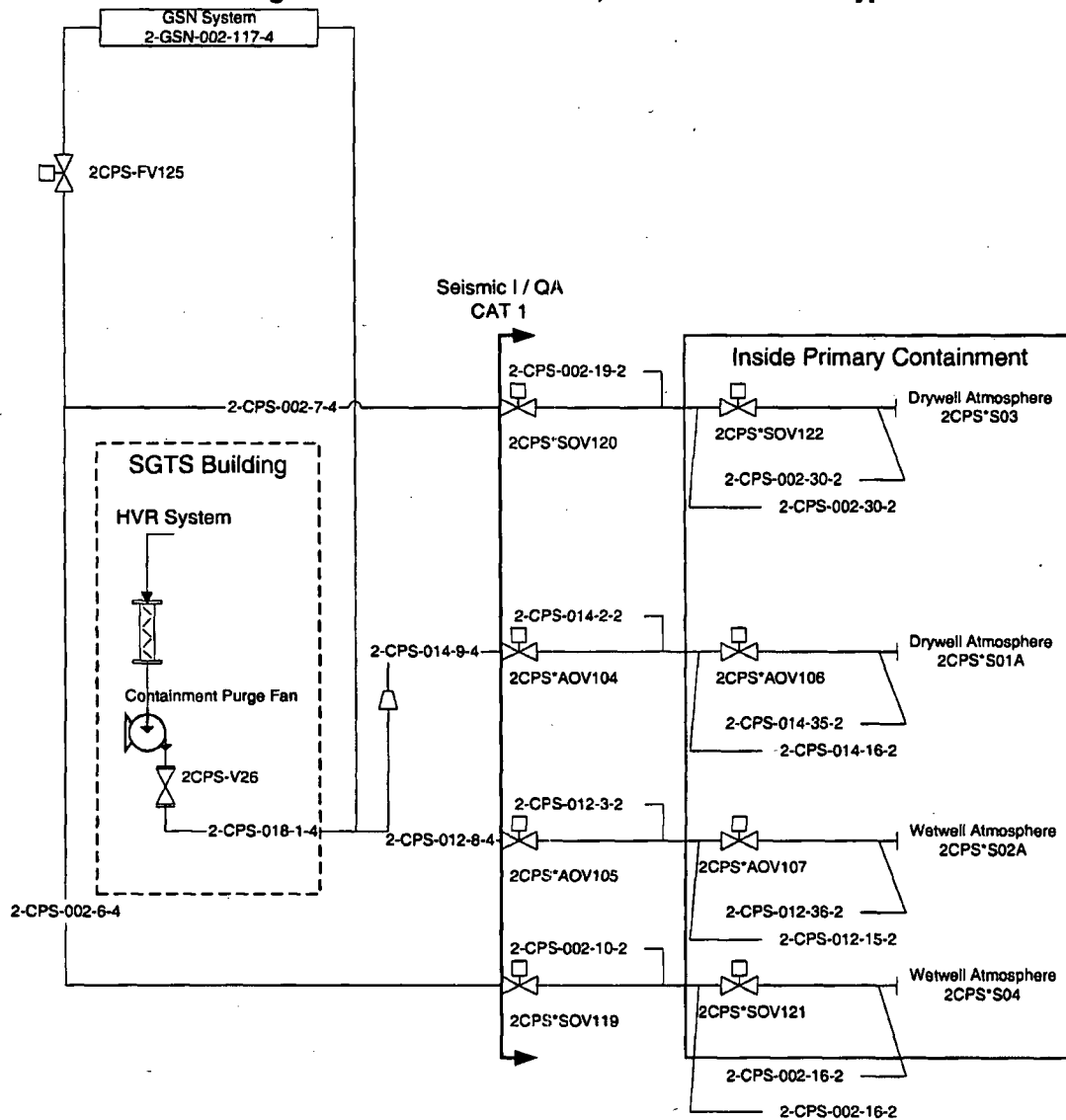
Figure 5-4 Schematic of Feedwater Bypass



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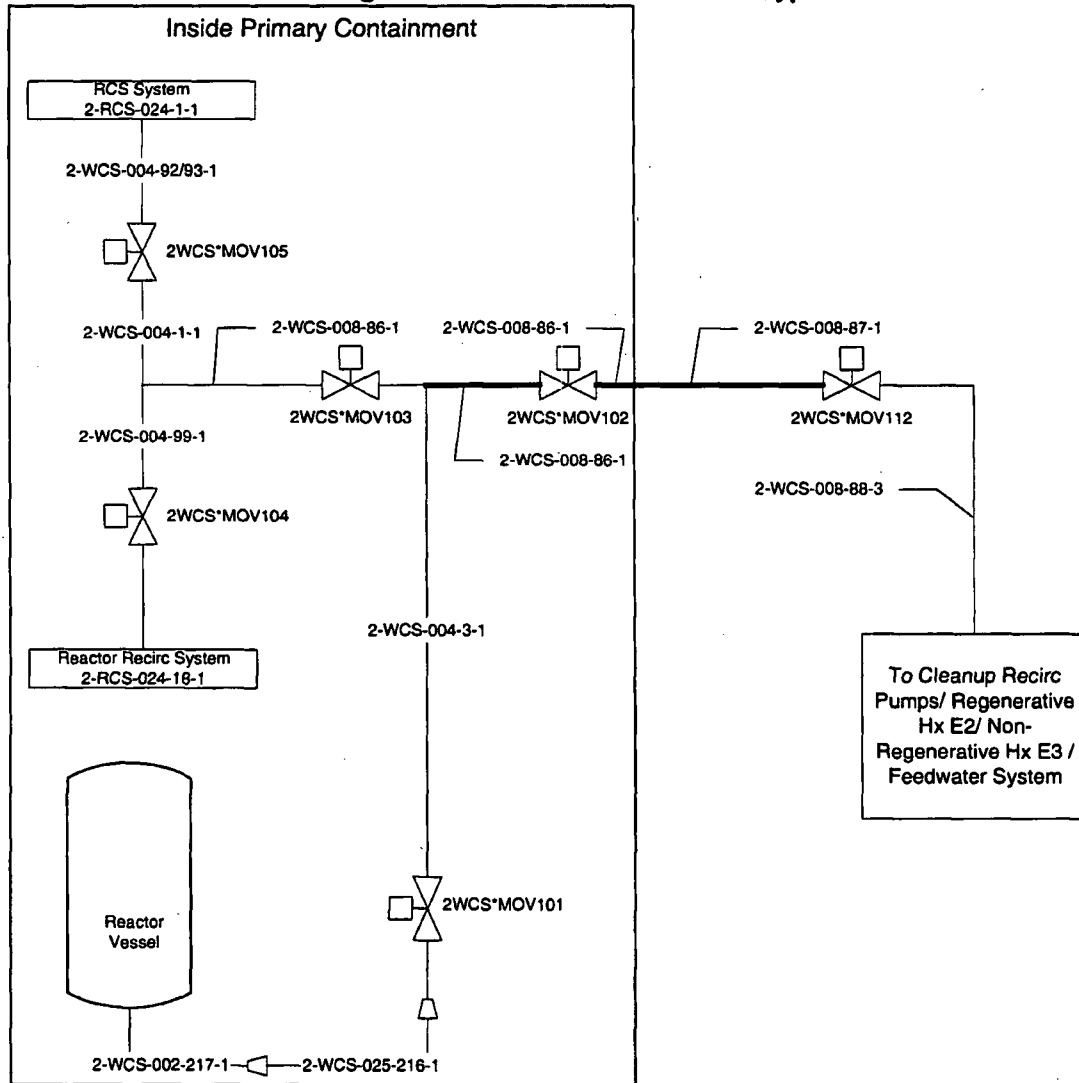
Figure 5-5 Schematic of 2", 12" and 14" CPS Bypass



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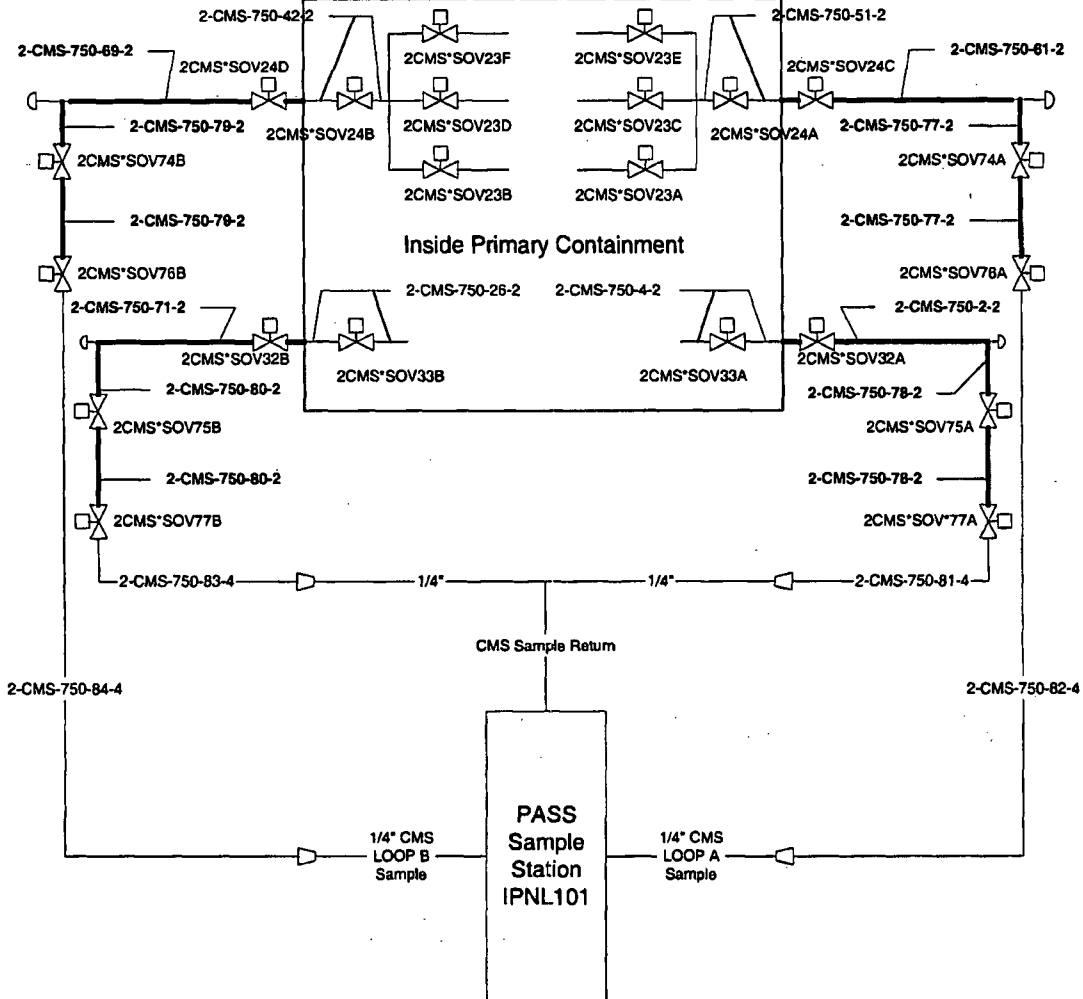
Figure 5-6 Schematic of RWCU Bypass



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Figure 5-7 Schematic of PASS Bypass



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6. Results

This section summarizes the results of the Excel spreadsheets. Tables 6.11-1 through -3 provide an overall summary of the output data.

6.1. Main Steam Lines (MSL)**Table 6.1-1 Main Steam Line A Results**

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	244.93	119.82	432.30	211.47
Interstitial Between IVs	121.41	59.39	0.00	0.00
Outboard IV to CAT 1	516.31	271.38	298.75	157.03

Table 6.1-2 Main Steam Line B Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	291.13	142.42	443.89	217.14
Interstitial Between IVs	133.80	65.45	0.00	0.00
Outboard IV to CAT 1	516.58	271.53	297.99	156.63

Table 6.1-3 Main Steam Line C Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	291.68	142.68	444.14	217.27
Interstitial Between IVs	134.28	65.69	0.00	0.00
Outboard IV to CAT 1	516.24	271.35	298.13	156.70

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Table 6.1-4 Main Steam Line D Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	245.28	119.99	433.00	211.82
Interstitial Between IVs	121.15	59.27	0.00	0.00
Outboard IV to CAT 1	516.17	271.31	297.65	156.45

6.2. Main Steam Drain Lines

Table 6.2-1 Inboard Main Steam Line Drain Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	28.28	3.39	0.00	0.00
Interstitial Between IVs	42.40	5.09	3.25	0.39
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.2-2 Outboard Main Steam Line Drain Inboard Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	7.08	0.25	0.00	0.00
Interstitial Between IVs	0.00	0.00	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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6.3. Drywell Drains**Table 6.3-1 Drywell Floor Drain Results**

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	6.09	0.77	10.79	1.36
Interstitial Between IVs	13.41	1.69	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.3-2 Drywell Floor Drain Tank Vent Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.00	0.00	0.00	0.00
Interstitial Between IVs	15.44	0.99	12.18	0.78
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.3-3 Drywell Equipment Drain Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	27.39	2.30	13.24	1.11
Interstitial Between IVs	14.67	1.23	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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Table 6.3-4 Drywell Equipment Drain Tank Vent Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.93	0.04	0.00	0.00
Interstitial Between IVs	4.54	0.20	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

6.4. Feedwater Lines

Table 6.4-1 Feedwater Line A Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	162.20	71.95	170.04	70.41
Interstitial Between IVs	72.01	29.82	0.00	0.00
Outboard IV to CAT 1	63.80	26.42	0.00	0.00

Table 6.4-2 Feedwater Line B Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	162.73	72.18	169.76	70.30
Interstitial Between IVs	71.90	29.77	0.00	0.00
Outboard IV to CAT 1	74.20	30.73	0.00	0.00

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6.5. Primary Containment Purge (CPS) Lines in Drywell/Wetwell**Table 6.5-1 2" CPS Line in Drywell Results**

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.51	0.02	0.00	0.00
Interstitial Between IVs	4.57	0.18	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.5-2 14" CPS Line in Drywell Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	4.05	1.12	0.00	0.00
Interstitial Between IVs	40.40	11.15	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.5-3 12" CPS Line in Wetwell Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	14.82	3.71	21.24	5.31
Interstitial Between IVs	34.43	8.61	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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Table 6.5-4 2" CPS Line in Wetwell Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.97	0.04	0.00	0.00
Interstitial Between IVs	9.40	0.40	2.44	0.10
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

6.6. Reactor Water Cleanup (RWCU) Line

Table 6.6-1 RWCU Line Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	22.27	3.54	0.00	0.00
Interstitial Between IVs	26.28	4.18	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

6.7. Post Accident Sampling System (PASS) Lines

Table 6.7-1 PASS Sample Line A Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	6.43	0.11	8.61	0.15
Interstitial Between IVs	0.22	0.00	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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Table 6.7-2 PASS Sample Line B Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	18.29	0.31	11.91	0.20
Interstitial Between IVs	0.22	0.00	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.7-3 PASS Return Line A Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	14.28	0.25	10.33	0.18
Interstitial Between IVs	0.22	0.00	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.7-4 PASS Return Line B Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	7.65	0.13	5.53	0.09
Interstitial Between IVs	0.25	0.00	0.00	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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6.8. Instrument Air (IAS) Lines**Table 6.8-1 IAS Line 1 Results**

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	1.45	0.05	1.85	0.06
Interstitial Between IVs	1.98	0.07	1.21	0.04
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.8-2 IAS Line 2 Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	5.13	0.17	2.42	0.08
Interstitial Between IVs	1.15	0.04	1.22	0.04
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.8-3 IAS Line 3 Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	3.50	0.12	1.12	0.04
Interstitial Between IVs	1.43	0.05	2.53	0.08
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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Table 6.8-4 IAS Line 4 Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	1.19	0.04	0.00	0.00
Interstitial Between IVs	8.78	0.29	2.99	0.10
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.8-5 IAS Line 5 Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	2.07	0.07	3.55	0.12
Interstitial Between IVs	1.99	0.07	2.02	0.07
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

6.9. Nitrogen System (GSN) Line

Table 6.9-1 GSN Line Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.00	0.00	0.00	0.00
Interstitial Between IVs	1.96	0.03	0.28	0.00
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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6.10. 1" Primary Containment Purge (CPS) Lines**Table 6.10-1 1" CPS Line 1 Results**

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.00	0.00	0.00	0.00
Interstitial Between IVs	4.17	0.09	1.14	0.03
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

Table 6.10-2 1" CPS Line 2 Results

Segment	Horiz. Area (ft ²)	Horiz Vol (ft ³)	Vert. Area (ft ²)	Vert. Vol (ft ³)
Reactor to Inboard IV	0.00	0.00	0.00	0.00
Interstitial Between IVs	1.42	0.03	1.24	0.03
Outboard IV to CAT 1	0.00	0.00	0.00	0.00

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6.11. Summary of Results**Table 6.11-1 Summary of Pipe Data: Bends and Length**

Pipe Segment	Start to Inboard IV			Interstitial Between IVs			Outboard IV to CAT 1		
	Bends (deg)	Horiz. Length (ft)	Vertical Length (ft)	Bends (deg)	Horiz. Length (ft)	Vertical Length (ft)	Bends (deg)	Horiz. Length (ft)	Vertical Length (ft)
MSL A	360.00	39.84	70.32	0.00	19.75	0.00	180.00	78.17	45.23
MSL B	405.00	47.36	72.21	0.00	21.77	0.00	180.00	78.21	45.11
MSL C	405.00	47.45	72.25	0.00	21.84	0.00	180.00	78.16	45.14
MSL D	360.00	39.90	70.44	0.00	19.71	0.00	180.00	78.15	45.06
MSL Inboard Drains	90.00	18.75	0.00	270.00	28.11	2.16	0.00	0.00	0.00
MSL Outboard Drains	90.00	16.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drywell Floor Drain	90.00	3.83	6.80	0.00	8.44	0.00	0.00	0.00	0.00
Drywell Floor Drain Tank Vent	0.00	0.00	0.00	368.00	19.22	15.17	0.00	0.00	0.00
Drywell Equip. Drain	270.00	25.99	12.56	0.00	13.92	0.00	0.00	0.00	0.00
Drywell Equip. Drain Tank Vent	135.00	1.71	0.00	21.00	8.39	0.00	0.00	0.00	0.00
Feedwater Line A	243.00	29.13	32.68	0.00	13.84	0.00	0.00	12.26	0.00
Feedwater Line B	243.00	29.22	32.63	0.00	13.82	0.00	0.00	14.26	0.00
2 in. CPS Line in Drywell	0.00	1.00	0.00	0.00	9.01	0.00	0.00	0.00	0.00
14 in. CPS Line in Drywell	0.00	1.17	0.00	0.00	11.65	0.00	0.00	0.00	0.00
12 in. CPS Line in Wetwell	90.00	4.72	6.76	0.00	10.96	0.00	0.00	0.00	0.00
2 in. CPS Line in Wetwell	0.00	1.79	0.00	360.00	17.38	4.50	0.00	0.00	0.00
RWCU	0.00	11.16	0.00	0.00	13.17	0.00	0.00	0.00	0.00
PASS Sample A	870.00	29.79	39.89	0.00	1.00	0.00	0.00	0.00	0.00
PASS Sample B	2262.00	84.78	55.21	0.00	1.00	0.00	0.00	0.00	0.00
PASS Return A	1284.00	66.21	47.89	0.00	1.00	0.00	0.00	0.00	0.00
PASS Return B	960.00	35.47	25.64	0.00	1.17	0.00	0.00	0.00	0.00
IAS Line 1	270.00	3.45	4.39	122.00	4.71	2.86	0.00	0.00	0.00
IAS Line 2	525.00	12.16	5.75	225.00	2.72	2.89	0.00	0.00	0.00
IAS Line 3	180.00	8.30	2.67	270.00	3.39	6.01	0.00	0.00	0.00
IAS Line 4	0.00	2.82	0.00	360.00	20.83	7.10	0.00	0.00	0.00
IAS Line 5	90.00	4.90	8.43	270.00	4.73	4.78	0.00	0.00	0.00
GSN	0.00	0.00	0.00	360.00	12.04	1.70	0.00	0.00	0.00
1 in. CPS Line 1	0.00	0.00	0.00	180.00	15.19	4.17	0.00	0.00	0.00
1 in. CPS Line 2	0.00	0.00	0.00	180.00	5.17	4.50	0.00	0.00	0.00

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Table 6.11-2 Summary of Results: Internal Areas

Pipe Segment	Start to Inboard IV		Interstitial Between IVs		Outboard IV to CAT 1	
	Horizontal Area (ft ²)	Vertical Area (ft ²)	Horizontal Area (ft ²)	Vertical Area (ft ²)	Horizontal Area (ft ²)	Vertical Area (ft ²)
MSL A	244.93	432.30	121.41	0.00	516.31	298.75
MSL B	291.13	443.89	133.80	0.00	516.58	297.99
MSL C	291.68	444.14	134.28	0.00	516.24	298.13
MSL D	245.28	433.00	121.15	0.00	516.17	297.65
MSL Inboard Drains	28.28	0.00	42.40	3.25	0.00	0.00
MSL Outboard Drains	7.08	0.00	0.00	0.00	0.00	0.00
Drywell Floor Drain	6.09	10.79	13.41	0.00	0.00	0.00
Drywell Floor Drain Tank Vent	0.00	0.00	15.44	12.18	0.00	0.00
Drywell Equip. Drain	27.39	13.24	14.67	0.00	0.00	0.00
Drywell Equip. Drain Tank Vent	0.93	0.00	4.54	0.00	0.00	0.00
Feedwater Line A	162.20	170.04	72.01	0.00	63.80	0.00
Feedwater Line B	162.73	169.76	71.90	0.00	74.20	0.00
2 in. CPS Line in Drywell	0.51	0.00	4.57	0.00	0.00	0.00
14 in. CPS Line in Drywell	4.05	0.00	40.40	0.00	0.00	0.00
12 in. CPS Line in Wetwell	14.82	21.24	34.43	0.00	0.00	0.00
2 in. CPS Line in Wetwell	0.97	0.00	9.40	2.44	0.00	0.00
RWCU	22.27	0.00	26.28	0.00	0.00	0.00
PASS Sample A	6.43	8.61	0.22	0.00	0.00	0.00
PASS Sample B	18.29	11.91	0.22	0.00	0.00	0.00
PASS Return A	14.28	10.33	0.22	0.00	0.00	0.00
PASS Return B	7.65	5.53	0.25	0.00	0.00	0.00
IAS Line 1	1.45	1.85	1.98	1.21	0.00	0.00
IAS Line 2	5.13	2.42	1.15	1.22	0.00	0.00
IAS Line 3	3.50	1.12	1.43	2.53	0.00	0.00
IAS Line 4	1.19	0.00	8.78	2.99	0.00	0.00
IAS Line 5	2.07	3.55	1.99	2.02	0.00	0.00
GSN	0.00	0.00	1.96	0.28	0.00	0.00
1 in. CPS Line 1	0.00	0.00	4.17	1.14	0.00	0.00
1 in. CPS Line 2	0.00	0.00	1.42	1.24	0.00	0.00

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Table 6.11-3: Summary of Results: Internal Volumes

Pipe Segment	Start to Inboard IV		Interstitial Between IVs		Outboard IV to CAT 1	
	Horizontal Vol. (ft ³)	Vertical Vol. (ft ³)	Horizontal Vol. (ft ³)	Vertical Vol. (ft ³)	Horizontal Vol. (ft ³)	Vertical Vol. (ft ³)
MSL A	119.82	211.47	59.39	0.00	271.38	157.03
MSL B	142.42	217.14	65.45	0.00	271.53	156.63
MSL C	142.68	217.27	65.69	0.00	271.35	156.70
MSL D	119.99	211.82	59.27	0.00	271.31	156.45
MSL Inboard Drains	3.39	0.00	5.09	0.39	0.00	0.00
MSL Outboard Drains	0.25	0.00	0.00	0.00	0.00	0.00
Drywell Floor Drain	0.77	1.36	1.69	0.00	0.00	0.00
Drywell Floor Drain Tank Vent	0.00	0.00	0.99	0.78	0.00	0.00
Drywell Equip. Drain	2.30	1.11	1.23	0.00	0.00	0.00
Drywell Equip. Drain Tank Vent	0.04	0.00	0.20	0.00	0.00	0.00
Feedwater Line A	71.95	70.41	29.82	0.00	26.42	0.00
Feedwater Line B	72.18	70.30	29.77	0.00	30.73	0.00
2 in. CPS Line in Drywell	0.02	0.00	0.18	0.00	0.00	0.00
14 in. CPS Line in Drywell	1.12	0.00	11.15	0.00	0.00	0.00
12 in. CPS Line in Wetwell	3.71	5.31	8.61	0.00	0.00	0.00
2 in. CPS Line in Wetwell	0.04	0.00	0.40	0.10	0.00	0.00
RWCU	3.54	0.00	4.18	0.00	0.00	0.00
PASS Sample A	0.11	0.15	0.00	0.00	0.00	0.00
PASS Sample B	0.31	0.20	0.00	0.00	0.00	0.00
PASS Return A	0.25	0.18	0.00	0.00	0.00	0.00
PASS Return B	0.13	0.09	0.00	0.00	0.00	0.00
IAS Line 1	0.05	0.06	0.07	0.04	0.00	0.00
IAS Line 2	0.17	0.08	0.04	0.04	0.00	0.00
IAS Line 3	0.12	0.04	0.05	0.08	0.00	0.00
IAS Line 4	0.04	0.00	0.29	0.10	0.00	0.00
IAS Line 5	0.07	0.12	0.07	0.07	0.00	0.00
GSN	0.00	0.00	0.03	0.00	0.00	0.00
1 in. CPS Line 1	0.00	0.00	0.09	0.03	0.00	0.00
1 in. CPS Line 2	0.00	0.00	0.03	0.03	0.00	0.00

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7. Conclusions

The above calculation provides physical parameters for use in the evaluation of bypass leakage pathways for NMP U2. The data is summarized in its entirety in Tables 6.11-1 through -3.

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8. References

- 8.1. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," USNRC, July 2000.
- 8.2. AEB-98-03, "Assessment of Radiological Consequences for the Perry Pilot Plant Application using the Revised (NUREG-1465) Source Term, USNRC, December 8, 1998.
- 8.3. NMP Calculation PR-C-28-E-02C, 6-26-98, "Design Basis Loss of Coolant Accident Doses in the Control Room and at the EAB and the LPZ from All Sources Based on a 60 Minute Drawdown Time and Leakage of 24 scfh per MSIV."
- 8.4. Calculation ES-177-05, 10/22/86, "Secondary Containment Bypass Leakage", including:
 - a. Supplement 05-SPL-1, 11/22/88,
 - b. Supplement 05-SPL-2, 5/9/89,
 - c. Disposition ES-177-05A, 9/21/94,
 - d. Disposition ES-177-05B, 12/8/94,
 - e. Disposition ES-177-05C, 12/8/94
 - f. Disposition ES-177-05D, 3/7/95 and
 - g. Disposition ES-177-05E, 7/23/96.
- 8.5. Nine Mile Point Nuclear Station Unit 2 Updated Safety Analysis Report (UFSAR), Rev. 15, October 2002
- 8.6. NMP Unit 2 Technical Specifications.
- 8.7. NUREG/CR-6604, "RADTRAD: A Simplified Model for Radionuclide Transport and Removal And Dose Estimation," April 1998.
- 8.10. Drawing PID-001-02, SH1, "P&ID Main Steam Fundamental."
- 8.11. Drawing PID-001A-06, "P&ID Main Steam."
- 8.12. Vender Drawing 2MSS-001-013, "As-Built Drawing AX-2A", SWEC File No. 6.221-819-005E and/or "As-Built Drawing AX-2E", SWEC File No. 6.225-819-001B
- 8.13. Drawing PID-001B-07, "P&ID Main Steam."
- 8.14. Vender Drawing 2MSS-001-014, "As-Built Drawing AX-2B", SWEC File No. 6.222-819-006D and/or "As-Built Drawing AX-2E", SWEC File No. 6.225-819-002B
- 8.15. Drawing PID-001C-06, "P&ID Main Steam."
- 8.16. Vender Drawing 2MSS-001-015, "As-Built Drawing AX-2C", SWEC File No. 6.223-819-006C and/or "As-Built Drawing AX-2E", SWEC File No. 6.225-819-003B.
- 8.17. Drawing PID-001D-05, "P&ID Main Steam."

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Ref.	
8.18.	Vender Drawing 2MSS-001-016, "As-Built Drawing AX-2D", SWEC File No. 6.224-819-004D and/or "As-Built Drawing AX-2E", SWEC File No. 6.225-819-004B.
8.19.	Drawing PID-001J-06, "P&ID Main Steam."
8.20.	Drawing PID-001E-15, "P&ID Main Steam."
8.21.	Vender Drawing Iso No. 01-17 Rev. M, "MSS Piping", SWEC File No. 5.110-065-056D.
8.22.	Vender Drawing Iso No. 01- 19 Rev E, "MSS Piping", SWEC File No. 5.110-065-078C.
8.23.	Drawing DP-302B-05, "Isometric Drawing – Reactor Building Main Steam Piping (2MSS) Primary Containment Elevation 240'-9".
8.24.	Vender Drawing Iso No. 01-21 Rev K, "MSS Piping", SWEC File No. 5.110-065-080C.
8.25.	Vender Drawing Iso No. 01-20 Rev N, "MSS Piping", SWEC File No. 5.110-065-079C.
8.26.	Vender Drawing Iso No. 01-018 Rev H, "MSS Large Bore Piping", SWEC File No. 5.110-065-076E.
8.27.	Drawing EP-139A-06, "Main Steam Drain Piping"
8.28.	Drawing PID-001F-18, "P&ID Main Steam."
8.29.	Drawing DP-302R-10, "ISO DWG Reactor Bldg. Main Steam Piping (2MSS) Sec. Contmt EI 240'-0".
8.30.	Drawing PID-001G-16, "P&ID Main Steam."
8.31.	Vender Drawing 2MSS-001-004, "As-Built Drawing AX-2E", SWEC File No. 6.225-819-005B.
8.32.	Vender Drawing Iso No. 01-05 Rev M, "MSS Piping", SWEC File No. 5.110-065-010F.
8.33.	Drawing PID-037-02, SH1, "P&ID Reactor Water Cleanup System Fundamental."
8.34.	Drawing PID-037A-18, "P&ID Reactor Water Cleanup System."
8.35.	Vender Drawing Iso. No. 09-05 Rev Z, "WCS Piping", SWEC File No. 5.190-065-419D.
8.36.	Drawing DP-374AJ-04, "ISO DWG Reactor BLDG. Reactor WTR Cleanup PP (2WCS) PRI CONTMT EL. 261'-0"
8.37.	Vender Drawing 2WCS-009-06, Rev. AN, "WCS Piping", SWEC File No. 5.190-065-420D.
8.38.	Vender Drawing 2WCS-009-07, Rev. Y, "WCS Piping", SWEC File No. 5.190-065-421G.

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Ref.	
8.39.	Drawing PID-006-01, SH1, "P&ID Feedwater System Fundamental"
8.40.	Drawing PID-006B-24, "P&ID Feedwater System."
8.41.	Vender Drawing Iso. No. 47-008 Rev M, "FWS System Large Bore Piping", SWEC File No. 5.120-065-074E.
8.42.	Drawing 2FWS-47-013, Rev. 13, "Final As-Built Dwg AX-17B", SWEC File No. 6.122-819-001C.
8.43.	Vender Drawing Iso. No. 47-014 Rev M, "FWS Piping", SWEC File No. 5.120-065-081D.
8.44.	Vender Drawing Iso. No. 47-009 Rev Q, "FWS System Large Bore Piping", SWEC File No. 5.120-065-075E.
8.45.	Vender Drawing 47-016, Rev. 17, "Final As-Built Dwg AX-17A", SWEC File No. 6.121-819-001C.
8.46.	Vender Drawing Iso. No. 47-17 Rev N, "FWS Piping", SWEC File No. 5.120-065-084D.
8.47.	Drawing PID-067A-17, "P&ID Drywell Equipment Drains."
8.48.	Drawing DP-385B-05, "ISO DWG REACTOR BLDG NUCLEAR EQUIPT. VENT & DRAIN PP. (2DER) PRI. CONTMT. EL. 240'-9"
8.49.	Drawing DP-385AW-06, "ISO. DWG. REACTOR BLDG. NUC. EQPT. VENT & DRAIN PP (2DER) SEC. CONTMT. EL. 175'-0"
8.50.	Drawing DP-385AX-04, "ISO DWG-REACTOR BLDG NR EQUIPMENT VENT & DRAIN (2DER) SEC CONTMT EL 175'-0"
8.51.	Vender Drawing Iso. No. 28-1F Rev L, "DER Piping", SWEC File No. 5.190-065-336E.
8.52.	Vender Drawing Iso. No. 28-2F Rev K, "DER Piping", SWEC File No. 5.190-065-337E.
8.53.	Vender Drawing Iso. No. 28-3F Rev Q, "DER Piping", SWEC File No. 5.190-065-338F.
8.54.	Drawing PID-063E-16, "P&ID Reactor Building Equipment and Floor Drains."
8.55.	Drawing PID-063C-16, "P&ID Reactor Building Equipment and Floor Drains."
8.56.	Vender Drawing Iso. No. 31-09 Rev W, "R.B.FLR. & Equip. Drains", SWEC File No. 5.190-65-353F.
8.57.	Vender Drawing 31-009, Rev. 10, "As-Built Drawing of AX-85A", SWEC File No. 6.061-819-001C.

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- 8.58. Vender Drawing Iso. No. 31-5F Rev AD, "DFR Piping", SWEC File No. 5.190-065-335G.
- 8.59. Vender Drawing ITT Grinnel Ind. Piping Inc. Iso. No. 31-6F Rev D, "Drain From 240'-0" to Drywell Floor Drain Tank.
- 8.60. Drawing PID-061A-12, "P&ID Primary Containment Purge & Standby Gas Treatment."
- 8.61. Drawing DB-315F-09, "ISO DWG REACTOR BLDG AIR COOL AND PURGE PP (2CPS) SEC CONTMT EL 289'-0"
- 8.62. Vender Drawing 24-002. Rev. 11, "As-Built Drawing of AX-515E", SWEC File NO. 6.524-819-001B.
- 8.63. Vender Drawing 24-001. Rev. 24, "As-Built Drawing of AX-515A", SWEC File NO. 6.521-819-001D.
- 8.64. Drawing DB-315A-12, "ISO. DWG. REACTOR BLDG. AIR COOL AND PURGE PP. (2CPS) PRIM. & SEC. CONTMT. EL. 215'-0"
- 8.65. Drawing DB-315J-03, "ISO DWG. REACTOR BLDG. AIR COOL AND PURGE PP (2CPS) SEC CONTMT EL 215'-0"
- 8.66. Drawing DB-315K-02, "ISO DWG. REACTOR BLDG. AIR COOL AND PURGE PP (2CPS) SEC CONTMT EL 215'-0"
- 8.67. Drawing DB-315H-02, "ISO DWG. REACTOR BLDG. AIR COOL AND PURGE PP (2CPS) SEC CONTMT EL 215'-0"
- 8.68. Drawing DB-315L-03, "ISO DWG. REACTOR BLDG. AIR COOL AND PURGE PP (2CPS) SEC CONTMT EL 215'-0"
- 8.69. Drawing DB-315N-05, "ISO DWG REACTOR BLDG AIR COOL AND PURGE PP (2CPS) PRI CONTMT EL 222'-6"
- 8.70. Drawing DB-315M-07, "ISOMETRIC DRAWING REACTOR BUILDING AIR COOL & PURGE PIPING 2CPS PRIMARY CONTAINMENT ELEVATION 222 FEET - 6 INCH"
- 8.71. Drawing PID-105B-20, "P&ID Nitrogen System."
- 8.72. Drawing DP-453W-05, "ISOMETRIC DRAWING REACTOR BUILDING NITROGEN SYSTEM PP. (GSN) SEC. CONTAINMENT EL. 250'-0"
- 8.73. Drawing DP-453X-4, "ISO DWG REACTOR BLDG NITROGEN SYSTEM PP. (2-GSN) PRIMARY CONTMT. EL. 247' -6"
- 8.74. Drawing PID-019F-15, "P&ID Instrument & Service Air."

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Ref.	
8.75.	Drawing DP-340QR-06, "ISO DRAWING REACTOR BUILDING INSTRUMENT AIR PIPING (2IAS) SECONDARY CONTAINMENT EL. 289'-0"
8.76.	Drawing DP-340QL-7, "ISO DRAWING REACTOR BUILDING INSTRUMENT AIR (2IAS) PRIMARY CONTAINMENT EL. 288' 3"
8.77.	Drawing PID-019G-25, "P&ID Instrument & Service Air."
8.78.	Drawing DP-340JR-06, "ISO DWG REACTOR BLDG INSTRUMENT AIR PIPING (2IAS) SEC CONTMT EL. 240' 0"
8.79.	Drawing DP-340SA-06, "ISO DWG REACTOR BLDG INSTRUMENT AIR PIPING (2IAS) SEC CONTMT EL. 289'-0"
8.80.	Drawing DP-340JW-5, "ISO DWG REACTOR BLDG INSTRUMENT AIR PIPING (2IAS) PRI CONTMT EL. 288' -3"
8.81.	Drawing DP-340JX-10, "ISO DWG REACTOR BLDG INSTRUMENT AIR PIPING (2IAS) PRI CONTMT EL. 305' -9"
8.82.	Drawing DP-340JV-6, "ISO. DWG. REACTOR BLDG. INSTRUMENT AIR P.P. (2IAS) PRI. CONTMT. EL. 288' -3"
8.83.	Drawing DP-340V-6, "ISO DWG. REACTOR BUILDING INSTRUMENT AIR PIPING (2IAS) PRIMARY CONTAINMENT EL. 240' -9"
8.84.	Drawing PID-019D-20, "P&ID Instrument & Service Air."
8.85.	Drawing DP-340SF-07, "ISO DWG REACTOR BLDG INSTRUMENT AIR PIPING (2IAS) SEC CONTMT EL. 289'-0"
8.86.	Drawing DP-340SD-07, "ISO DWG REACTOR BLDG INSTRUMENT AIR PIPING (2IAS) SEC. CONTMT. EL. 289'-0"
8.87.	Drawing DP-340QW-5, "ISO DRAWING REACTOR BUILDING INSTRUMENT AIR PIPING (2IAS) PRIMARY CONTAINMENT EL. 288' -3"
8.88.	Drawing DP-340QM-8, "ISO DRAWING REACTOR BUILDING INSTRUMENT AIR PIPING (2IAS) PRIMARY CONTAINMENT EL. 288' -3"
8.89.	Drawing PID-082A-16, "P&ID Containment Atmosphere Monitoring System."
8.90.	Drawing PID-106A-13, "P&ID Post Accident Sampling."
8.91.	Drawing DP-384BF-13, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT EL. 261'-0"

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Ref.	
8.92.	Drawing DP-384AG-09, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 240'-0"
8.93.	Drawing DP-384BW-07, "ISO DWG REACTOR BLDG CONTMT. ATM. MONT. SYS. (2CSM) SEC CONTMT EL. 289'-0"
8.94.	Drawing DP-384AU-07, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 261'-0"
8.95.	Drawing DP-384AF-09, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 240'-0"
8.96.	Drawing DP-384AR-11, "ISO DWG REACTOR BLDG CONTMT ATM MONTG (2CMS) AUX. BAY SOUTH EL. 240'-0"
8.97.	Drawing DP-384AM-13, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 261'-0"
8.98.	Drawing DP-384AJ-10, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 240'-0"
8.99.	Drawing DP-384B-10, "ISO. DWG. REACTOR BLDG. CONTMT. ATM. MONTG. (2CMS) AUX. BAY NORTH EL. 240'-0"
8.100.	Drawing DP-384AK-08, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 240'-0"
8.101.	Drawing DP-384AN-09, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 261'-0"
8.102.	Drawing DP-384AE-06, "ISO DWG REACTOR BLDG CONTMT ATM MONTG PP (2CMS) SEC. CONTMT. EL. 240'-0"
8.103.	Drawing EK-431J-02, "Sample Piping Reactor Building Part Plan EL 240'-0"
8.104.	Drawing EK-32D-01, "Sample Piping Radwaste Tunnel & Sample Room Part Plan EL 244'-0" & 261'-0"
8.105.	Nine Mile Point Unit 2 Master Equipment List (MEL)
8.106.	NMP2-P301A, "Specification for Piping Engineering and Design, ASME III, Code Class 1, 2, and 3 and ANSI B31.1," Nine Mile Point Nuclear Station Unit 2, Revision 2, November 24, 1986.
8.107.	Crane Engineering Data Catalog, Copyright 1976.

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9. Appendices

This appendix provides a listing of Excel Spreadsheets on CD-ROM.

Figure 9-1 Directory Listing of Excel Spreadsheets

DATE	TIME	BYTES	FILE NAME
08/02/2004	03:04 PM	77,312	12 Inch CPS Line in Wetwell.xls
08/02/2004	03:00 PM	76,800	14 Inch CPS Line in Drywell.xls
03/25/2004	11:42 AM	76,800	2 Inch CPS Line in Drywell.xls
03/25/2004	11:43 AM	76,800	2 Inch CPS Line in Wetwell.xls
03/25/2004	11:44 AM	77,312	Drywell Equip Drain Lines.xls
03/25/2004	11:44 AM	76,800	Drywell Equip Tank Vent Line.xls
08/02/2004	02:59 PM	77,312	Drywell Floor Drain Line.xls
03/25/2004	11:45 AM	77,824	Drywell Floor Tank Vent Line.xls
03/25/2004	11:45 AM	142,848	Feedwater Lines.xls
08/04/2004	04:11 PM	510,464	IAS-GSN-CPS Lines.xls
08/02/2004	02:57 PM	138,752	Main Steam Drain Lines.xls
05/04/2004	04:04 PM	276,480	Main Steam Lines.xls
08/04/2004	03:24 PM	94,720	NMP2 Bypass Piping Analysis Summary.xls
08/02/2004	03:11 PM	268,288	PASS Lines.xls
03/25/2004	12:03 PM	19,968	Pipe Data.xls
08/03/2004	02:39 PM	76,800	RWCU Line.xls