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An Exelon/British Energy Company

Clinton Power Station
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U-603434
8G.120

December 18, 2000

Docket No. 50-461

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Clinton Power Station Response to Requests for Additional Information Regarding Generic Letter 96-06 (TAC No. M96796)

Dear Madam or Sir:

The purpose of this letter from AmerGen Energy Company, LLC (AmerGen) is to provide additional information for supporting closure of the Clinton Power Station (CPS) response to Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." Clinton Power Station's initial response to GL 96-06 was provided via letter U-602654 dated October 28, 1996, and was supplemented by letter U-602686 dated January 28, 1997; letter U-602785 dated July 24, 1997, and letter U-603026 dated June 15, 1998.

Since submittal of the June 15, 1998, letter, CPS has received from the NRC two additional requests for information. These requests were by letter dated August 11, 1998, and by facsimile on August 21, 2000. The August 11, 1998, request for additional information concerns the modifications implemented at CPS for containment piping penetrations susceptible to thermally induced overpressurization. The August 21, 2000, request primarily concerns the potential for condensation induced water hammer. Although the first request was issued in 1998, the CPS response to that request was not due until within 45 days following completion of the evaluations for the subject modifications. Since the last of the required evaluations for these modifications was completed during the recently completed refueling outage (RF-7), the CPS response is provided accordingly and is provided in conjunction with the CPS response to the more recent August 21, 2000, request for additional information.

Responses to both requests for additional information, including supporting information, are provided in the attachments to this letter. Attachment 1 provides the responses to the questions contained in the August 11, 1998, request. Attachment 2 provides the responses to the questions received via the August 21, 2000, facsimile. Attachment 3 provides supplemental descriptive information about the systems that are the subject of Attachment 2. Finally, a listing of all applicable CPS containment penetrations subject to

A072

the requirements of GL 96-06, including identification of the final means of disposition for each penetration, is provided as Attachment 4.

Sincerely yours,

Michael T. Coyle
Vice President

DAN/TBE/blf

Attachments

cc: NRC Clinton Licensing Project Manager
NRC Resident Office, V-690
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety

Response to August 11, 1998, Request for Additional Information

The information requested by the NRC in its August 11, 1998, letter concerning the Clinton Power Station (CPS) response to GL 96-06 is provided below. These responses to the NRC questions concern the 7 piping penetrations that Clinton Power Station stated would be modified during the next refueling outage (RF-7) to eliminate the need to monitor and analyze containment isolation leakage.

1. Provide a specific description of the modifications to these 7 penetrations.

AmerGen Response:

The 7 penetrations identified in Clinton Power Station's July 24, 1997, letter, as well as descriptions of the modifications performed for the penetrations, are as follows:

Penetration Number	Penetration Description	GL 96-06 Resolution	Resolution Status
1MC-050	Make-up Condensate (line 1MC06B)	Relief valve to be installed between the containment isolation valves to prevent over-pressurization of the piping and valves.	Modifications completed.
1MC-065	Radwaste Repro. & Disposal (line 1WX12B)		
1MC-069	Drywell Equipment Drains (line 1RE14F)	Isolation valves are air-operated globe valves (spring to close). When pressure under the disk builds sufficiently to overcome spring force and air pressure, the valve will lift and relieve pressure.	Calculations are complete. No modifications are required.
1MC-070	Drywell Floor Drains (line 1RF26E)		
1MC-086	Reactor Water Cleanup to Condenser (line 1RT23)	ASME Appendix F methodology to be used to demonstrate that penetration will deform plastically, but will not rupture.	Calculations are complete. No modification is required.
1MC-103	Drywell Supplemental Chilled Water Supply (line 1WOHIC)	A hole will be drilled in the inboard disk of the inboard containment isolation valve (flex wedge gate) to relieve pressure. This modification was explained in more detail on page 3 of Attachment 2 to the CPS submittal dated January 28, 1997.	Modifications completed.
1MC-104	Drywell Supplemental Chilled Water Return (line 1WOK3C)		

2. If the modifications involve heat transfer and/or structural analyses of the piping segments, then the following information should be provided:

AmerGen Response:

Heat Transfer Analyses

Containment penetrations 1MC-050, -065, -069 and -070 are provided with a spring-loaded pressure relief mechanism. No heat transfer analysis is required for these penetrations.

Penetration 1MC-086 was not evaluated using heat transfer analysis. The analyses for this penetration assumed that the fluid temperature stabilized at peak containment temperature. No heat-up rate was determined.

A bounding heat transfer calculation was performed for penetrations 1MC-103 and -104 to verify that the relief path provided by the flexed disk and the hole drilled in the opposite disk would pass sufficient flow to prevent further pressure accumulation. This calculation assumed the maximum temperature difference (40°F fluid and 185°F containment atmosphere) occurs instantaneously after the valves close and did not credit the installed insulation. An extremely conservative heat transfer coefficient of 1000 BTU/hr-°F-ft^2 was used.

Structural Analyses

Piping, valve, and penetration stresses in all 7 of these penetrations were either completely reanalyzed or verification of margin was performed. For penetrations 1MC-050 and –065 re-analysis was required for all service levels because relief valves were added, which changed loading for all service conditions. Penetrations 1MC-069 and-070 were re-evaluated only for increased pressure stress. The design pressure of the piping at penetration 1MC-069 was increased, so all service levels were evaluated. Penetrations 1MC-070, -103 and 104 were re-evaluated for increased pressure stress for Service Level D only.

Elastic-plastic structural analysis of the piping, valves and penetration at 1MC-086 was performed in accordance with ASME Section III, Appendix F.

a. Provide the applicable design criteria for the piping and valves. Include the required load combinations;

AmerGen Response:

All of the subject lines are ASME Section III, Class 2 between the containment isolation valves. The load combinations for Class 2 piping are summarized as follows:

ASME Equation #	Service Level	Load Combination (Class 2 Stress)	Acceptance Criteria
8		Design Pressure and weight	$1.0S_h$
9	B	Design Pressure and Weight and Combined ($OBE_{response}$ + Pool Loads)	$1.2S_h$
9	C	Design Pressure[1] and Weight and Combined ($SSE_{response}$ + Pool Loads)	$1.8S_h$
9	D	Design Pressure[1] and Weight and Combined ($SSE_{response}$ + Pool Loads)[2]	$2.4S_h$
10		Thermal Range Set + $OBE_{building\ displacement}$	

[1] Pressure term adjusted for Level C and D loads as required.
[2] Faulted loads may also be evaluated in accordance with methods and criteria of ASME Appendix F

These loading combinations and acceptance criteria are as described in the CPS USAR.

b. Provide a drawing of the piping run between the isolation valves. Include the lengths and thicknesses of the piping segments and the type and thickness of the insulation.

AmerGen Response:

The analytical drawings (used for the stress analysis) for the piping through each of the seven penetrations are included in this attachment. These drawings contain dimensions, pipe size, wall thickness, and insulation thickness. The insulation is only of concern for the weight loading imposed on the piping, since it was not credited in the heat transfer calculations.

c. Provide the maximum-calculated temperature and pressure for the pipe run. Describe, in detail, the method used to calculate these pressure and temperature values. This should include a discussion of the heat transfer model used in the analysis and the basis for the heat transfer coefficients used in the analysis.

A bounding heat transfer calculation was performed for penetrations 1MC-103 and -104 to verify that the vent path provided by the flexed disk and the hole drilled in the opposite disk would pass sufficient flow to prevent further pressure accumulation. This calculation assumed the maximum temperature difference (40°F fluid and 185°F containment atmosphere) occurs instantaneously after the valves close and did not credit the installed insulation. The maximum temperature difference produces the highest thermal expansion rate. An extremely conservative heat transfer coefficient of 1000 BTU/hr-°F-ft^2 was used.

The heat transfer calculation used the basic formula:

$$\frac{dT_f}{dt} = \frac{UA\,(T_c - T_f)}{MC_p}$$

where: $\frac{dT_f}{dt}$ is the change in fluid temperature per unit time

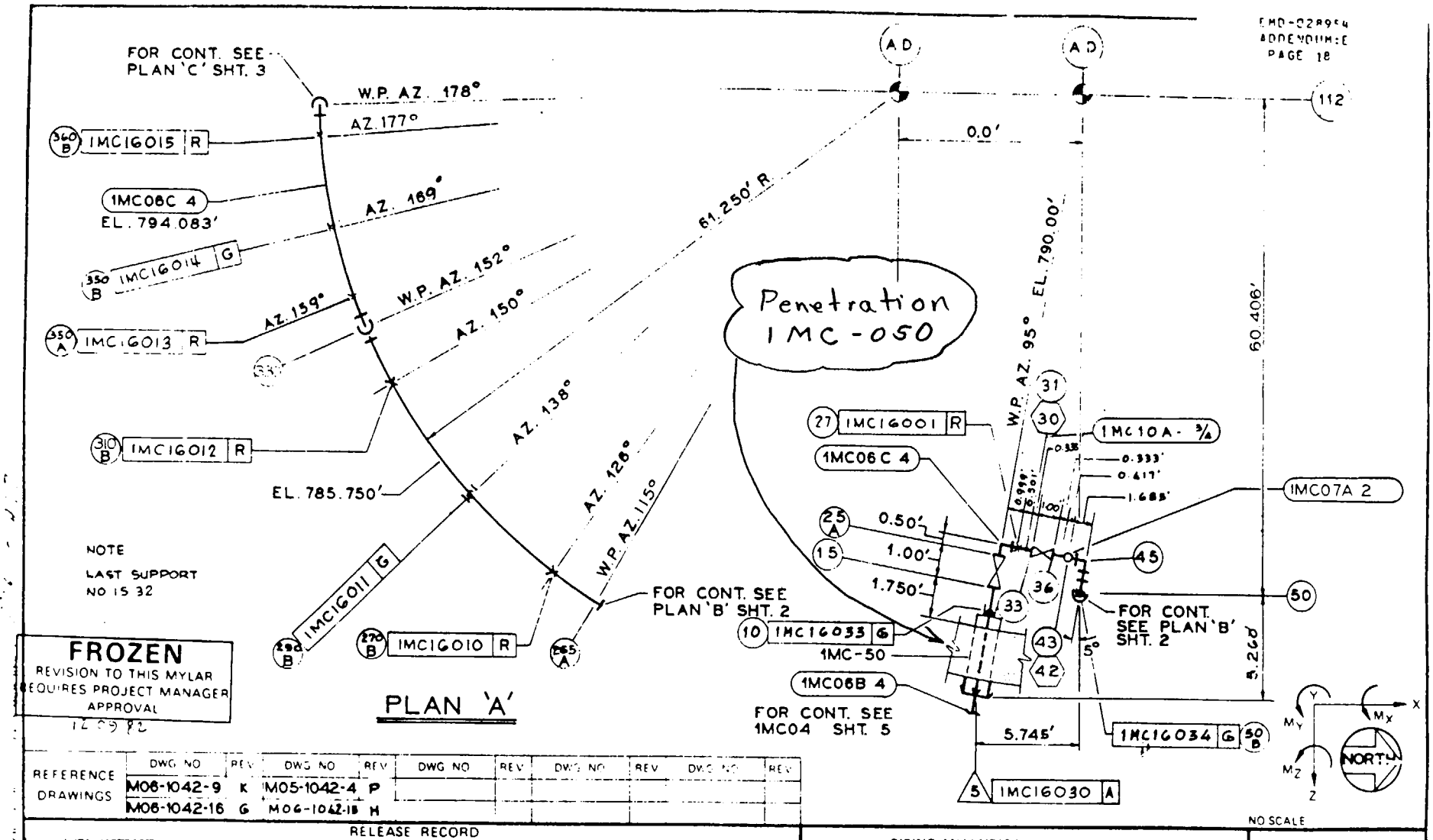
U is the overall heat transfer coefficient, set to 1000 BTU/hr-°F-ft^2
A is surface area for heat transfer
T_c is the temperature of the containment
T_f is the temperature of the fluid inside the piping
M is the mass of the fluid inside the piping
C_p is the heat capacity of water

This formula was used to determine the rate of heat transfer to the fluid volume between the containment isolation valves. The result was used to determine the rate of volume change due to thermal expansion. The rate of volume change was converted to a relief rate (i.e., leak rate) required to prevent a further increase in pressure.

The gap created when the disk flexes and the hole drilled in the opposite disk were treated as series orifices. The differential pressure required to produce a leak rate that exceeds the required relief rate was determined. The pressure to overcome seating forces and downstream pressure were added to produce the total pipe pressure. The piping, valves and penetration assemblies were then analyzed for this higher pressure using Service D allowables.

The final fluid temperature was not calculated, but was assumed to be in equilibrium with the containment (i.e., 185°F). Since the maximum rate of temperature change occurs at the maximum differential temperature between the fluid and the atmosphere and provides the limiting conditions in this methodology, the final temperature is not important. The maximum calculated differential pressure across the disks is 200 psid.

Penetrations 1MC-050, -065, -069 and -070 were not evaluated using heat transfer methods. The maximum calculated pressure for these penetrations is a direct function of the relief devices. Standard methods of performing stress analysis were used, using the same computer code.



FROZEN
REVISION TO THIS MYLAR REQUIRES PROJECT MANAGER APPROVAL
12-29-82

REFERENCE DRAWINGS	DWG NO	REV	DWG NO	REV	DWG NO	REV	DWG NO	REV	DWG NO	REV
	M06-1042-9	K	M05-1042-4	P						
	M06-1042-16	G	M06-1042-18	H						

RELEASE RECORD

	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	06.28.78					
1	04-20-79	M U ARCEO			NOR EXTENDED TO 51" PER DRR #081 RELOCATED SOME HANGERS UPDATED BASED ON LATEST SINGLE DWG PER DRR	
2	08-30-79	M U ARCEO			UPLOATED PER SYS. DWG.	
3						
4	02-20-81				FOR ANALYSIS	
5	12-21-84				UPDATED PIPING DATA FOR EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA
FOR MAKE-UP CONDENSATE STORAGE SYSTEM
PROJECT CLINTON UNIT-1
CLIENT ILLINOIS POWER CO.
PROJECT NO. 4536

SARGENT & LUNDY ENGINEERS CHICAGO
SUB SYSTEM NO. 1MC16
REV 5
SHEET 1 OF 6

Penetration 1MC-050

PIPE DATA

REV	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC	MATERIAL GR	DESIGN PRESS	MAX OPER PRESS	MAX OPER TEMP	O.D.	SCHED	WALL THICK	INSUL THICK	WEIGHTS LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL	OPER TOTAL 1-2-3	4. WATER	HYDRO 1-4
5	5	15	1MC06B 4	B	106 CP	[illegible]	B	150	129	90	4.50	40	0.237	0.50	10.79	5.51	2.25	18.55	5.51	16.30
	25A	30	1MC06C 4	D	100	[illegible]	B	150	129	90	4.50	40	0.237	0.50	10.79	5.51	0.88	17.18	5.51	16.30
	40	720B	1MC06C 4	D	100	[illegible]	B	150	129	90	4.50	40	0.237	0.50	10.79	5.51			5.51	16.30
	42	43	1MC07A 2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28	0.48	6.78	1.28	6.30
	185	187	1MC40AA2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28				
	185	188	1MC40AB 2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28				
	250	253	1MC39A 2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28				
	605	607	1MC37A 2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28				
	737	738	1MC38AA2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28				
	740	745	1MC38AB2	D	100	[illegible]	B	150	129	90	2.375	80	0.218	0.38	5.022	1.28				
	30	31	1MC10A-3/4	D	100	SA-106	B	150	129	90	1.050	80	0.154	0.38	1.47	0.188	0.28	1.94	0.188	1.66

5

5

VALVE & SPECIAL FITTINGS DATA

REV	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL STROKING TIME (SEC) OPEN	VAL STROKING TIME (SEC) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS PRELIM.	OPERATOR WT. LBS ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS
3	15	25A	GATE	150				*335			4.50		ANCHOR/DARLING VALVE CO.	93-15093		0MC010
4	33	36	GATE	150				83			4.50		CRANE CO.	K-6738	N	1MC009
4	182	183	CAP	150			3				4.50		CRANE CATALOGUE			
5	190	192									4.50					
	765	770									4.50					

* INCLUDE OPERATOR

5

5

EMD-028954
ADDENDUM:E
PAGE 22

RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
		Andrew Ferrin				
2	08-30-79	M.U. ARCEO				
3		S. Williams			UPDATED PER SYS. DWG.	
4	02-20-81	O. Daniel	Marcco	R.W. Evans	FOR ANALYSIS	
5	12-21-84	E. Kuzundzic	D. Rana	[illegible]	UPDATED PIPE & VALVE DATA FOR EMD EVALUATION	

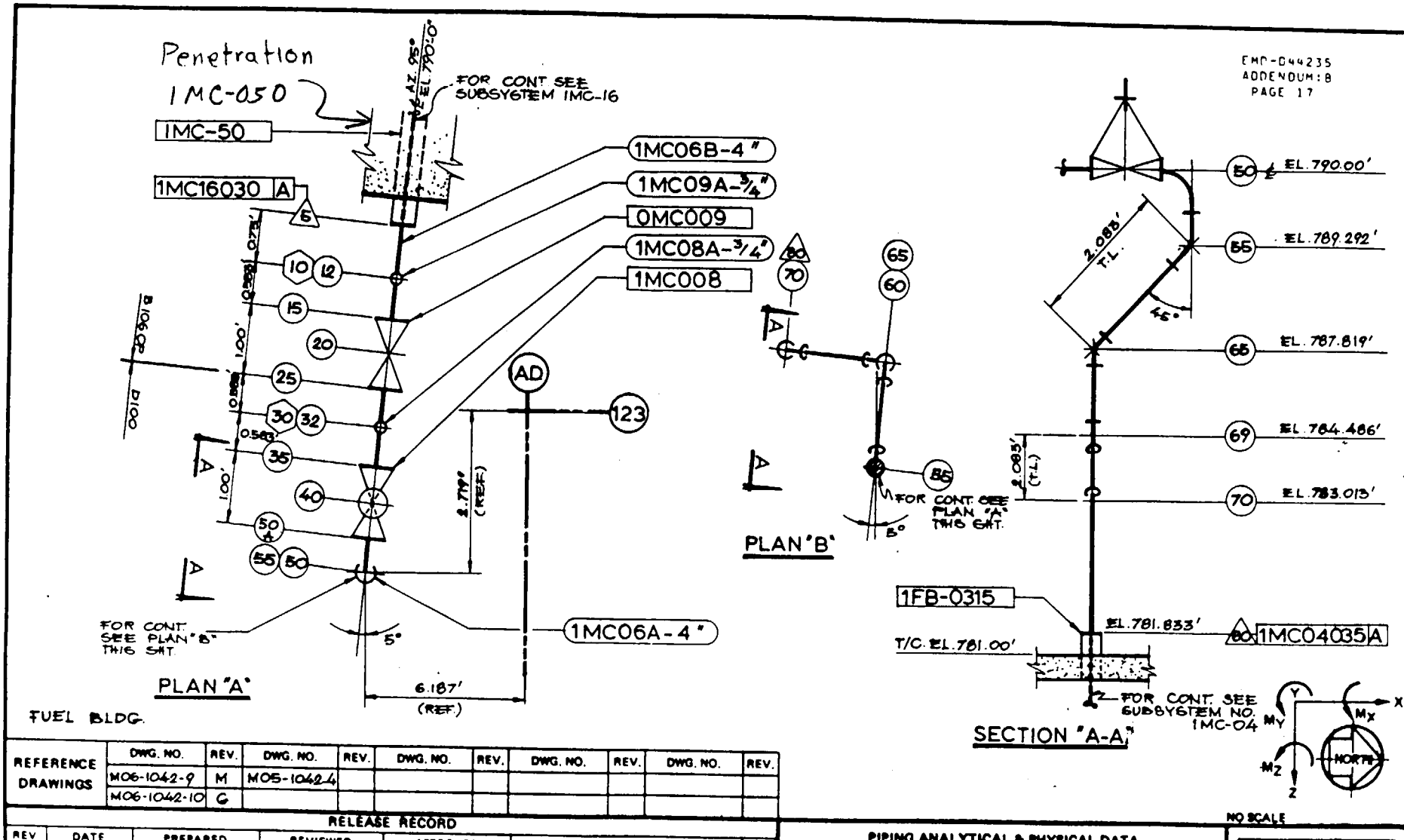
PIPING ANALYTICAL & PHYSICAL DATA
FOR MAKE-UP CONDENSATE STORAGE SYSTEM
PROJECT CLINTON UNIT-1
CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1MC16 REV. 5
SHEET 5 OF 6

ME-15142 (9-75) FORM APPROVED BY [illegible] DEPT MGR



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	M06-1042-9	M	M05-1042-4							
	M06-1042-10	G								

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	10-17-83				FOR FMD COMMENTS	
1	11-15-83				FOR ANALYSIS	X
2	11-21-84				UPDATED PIPE & VALVE DATA PER LATEST LINE LIST & VENDOR DWG	

PIPING ANALYTICAL & PHYSICAL DATA
FOR MAKE-UP CONDENSATE STORAGE SYSTEM
PROJECT CLINTON POWER STATION UNIT-1
CLIENT ILLINOIS POWER COMPANY
PROJECT NO. 4536-00

SARGENT & LUNDY

SUB SYSTEM NO.	REV.
1 MC-04 B	2
SHEET 1 OF 5	

Form MDS-6.4.1 Approved by _____ Dept. Mgr.
Rev. A (10-14-77)

Penetration 1MC-050

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	25	80	1MC06A-4"	D	100	ASTM A106	B	150	129	90	4.500	40	0.237	C1.0"	10.79	5.51	1.40	17.70	-	-
	10	12	1MC09A-3/4"	B	106 CP	ASTM A106	B	150	129	90	1.050	80	0.154	1.0"	1.474	0.187	0.52	2.18	0.187	1.661
	30	32	1MC08A-3/4"	D	100	ASTM A106	B	150	129	90	1.050	80	0.154	1.0"	1.474	0.187	0.52	2.18		
	5	15	1MC06B-4"	B	106CP	ASTM A106	B	150	129	90	4.500	40	0.237	?1.0"	10.79	5.51	1.40	17.70	5.51	16.3

2

VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	15	25	GATE	150				*335			4.500	1.185	ANCHOR/DARLING VALVE CO.	[illegible]	–	OMC009
	35	50A	GATE	150				83			4.500	1.185	CRANE COMPANY	[illegible] K-6725	N	1MC008

2

* INCLUDES OPERATOR

EMD-044235
ADDENDUM:B
PAGE 18

RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
0	10-17-83	[signature]	[signature] N/C		FOR PMD COMMENTS	
1	11-15-83	[signature]	[signature]	[signature]	FOR ANALYSIS	X
2	11-21-84	[signature]	[signature]	[signature]	UPDATED PIPE & VALVE DATA PER LATEST LINE LIST & VENDOR DWG.	

PIPING ANALYTICAL & PHYSICAL DATA
FOR MAKE-UP CONDENSATE STORAGE SYSTEM
PROJECT CLINTON POWER STATION UNIT-1
CLIENT ILLINOIS POWER COMPANY
PROJECT NO. 4536-00

SARGENT & LUNDY

SUB.SYSTEM NO. 1MC-04B
REV. 2
SHEET 2 OF 3

Form MES-6.4.2 Approved by [signature] Dept. Mgr.
Rev. A (10-14-77)

SARGENT & LUNDY ENGINEERS CHICAGO	Calcs. For 1WX32 BLDG. - CONTAINMENT	Calc. No. 1E WX32	477. pg
	X Safety-Related / Non-Safety-Related	Rev. 02 Date 12-19-84	
		Page 3	

Client ILLINOIS POWER COMPANY		Prepared by [signature]	Date 12-19-84
Project CLINTON - 1		Reviewed by [signature]	Date 12-21-84
Proj. No. 4536-00	Equip. No.	Approved by	Date

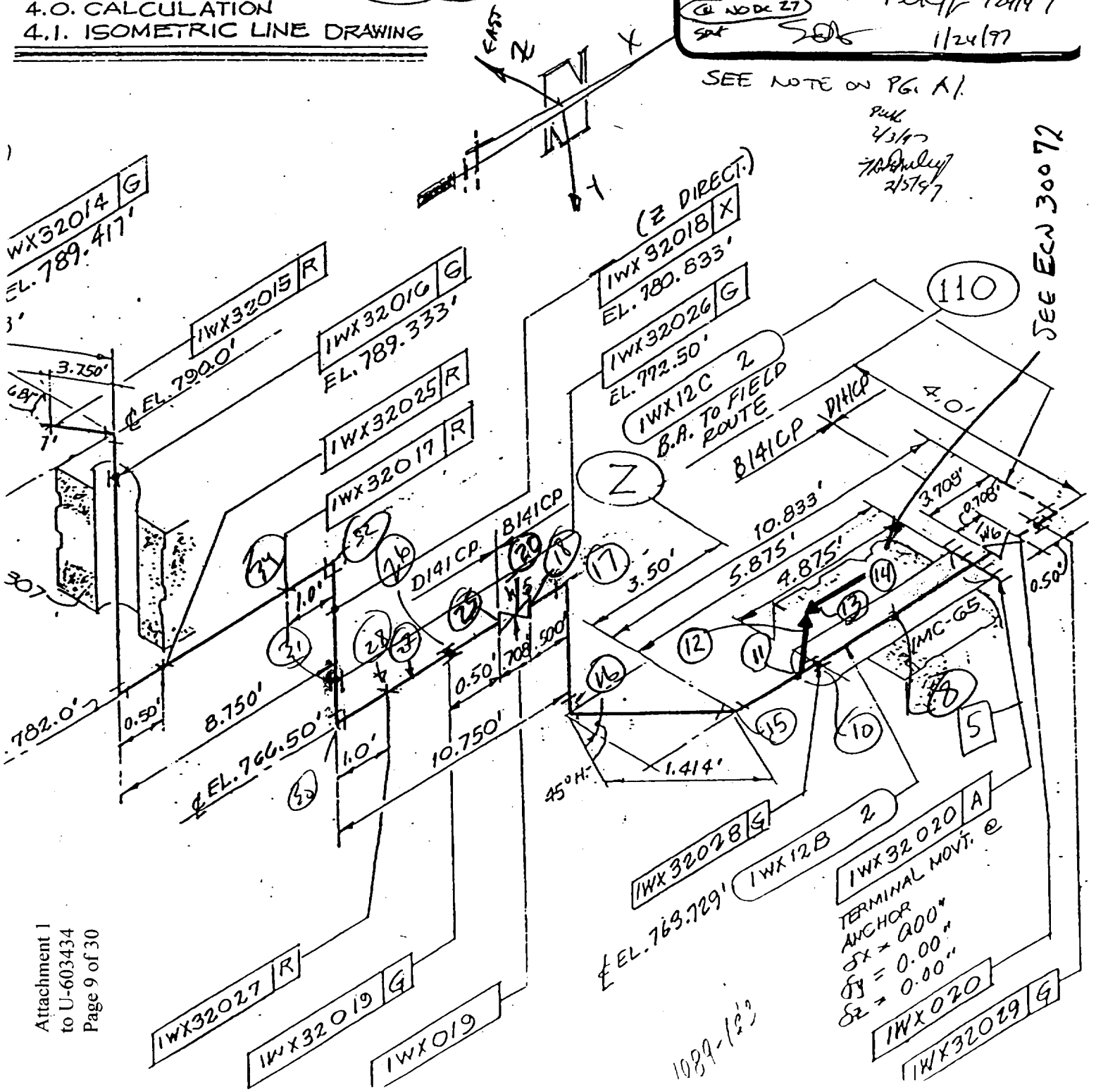
Penetration 1MC-065

ECN 30052 ADDS A RUPTURE DISK + RELIEF VALVE ASSEMBLY (≈ 20 LBS) TO 1WX12AA-2 @ NODE 27 PLK 1/24/97 2/5/97 1/24/97

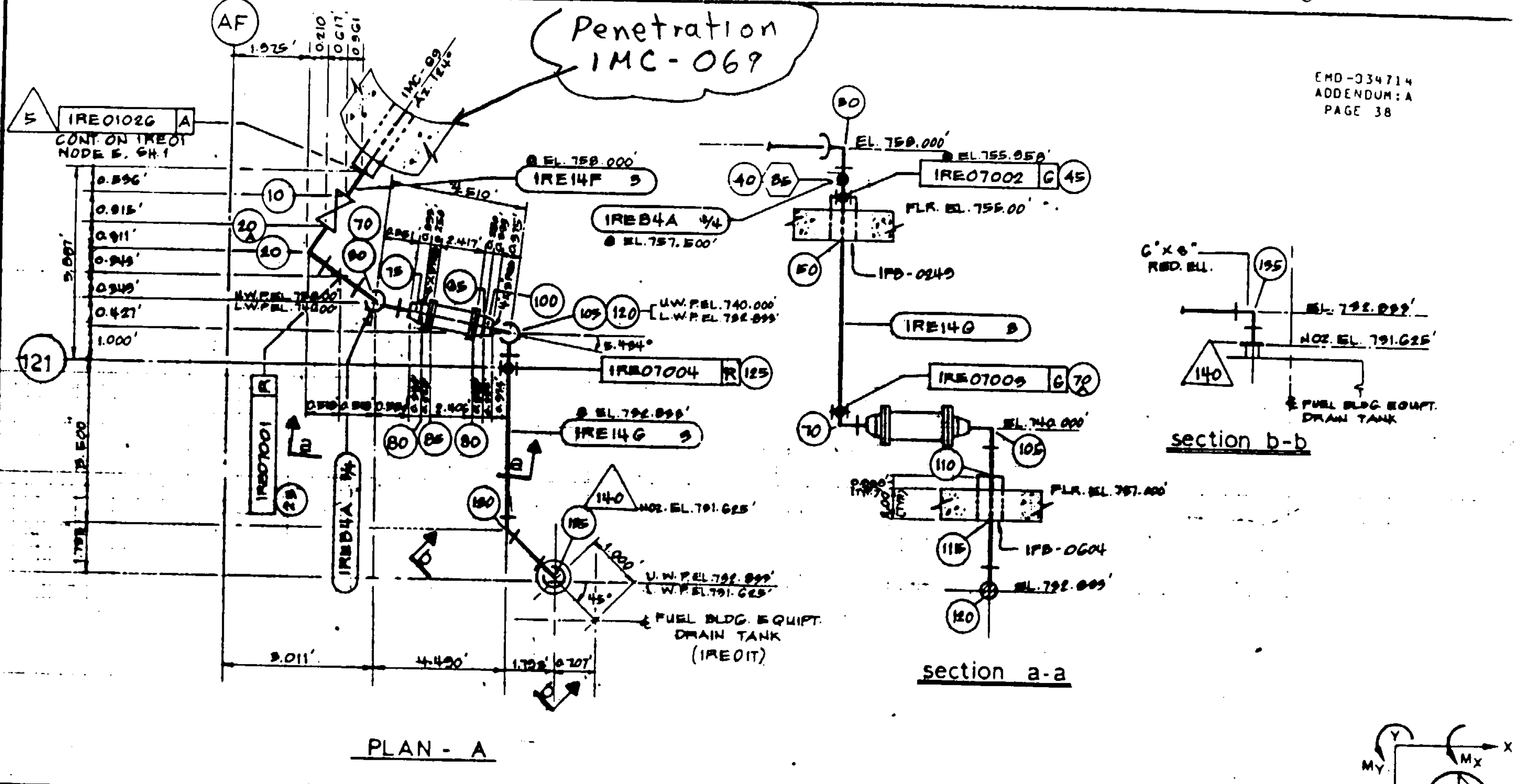
SEE NOTE ON PG. A1.

PLK 2/3/97 2/5/97

4.0. CALCULATION
4.1. ISOMETRIC LINE DRAWING



1089-123



REFERENCE DRAWINGS	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M05-1046-1	D	M06-1046-1	J						
	M05-1046-3	C								

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	12-08-81	Narushu A. Gardala			FOR PMD COMMENTS	
1	12-14-81	Narushu A. Gardala	Joaquin	J. Horika	INCORP. PMD COMMENTS FOR FORMAL ANALYSIS	X
2	01.18.85	[illegible]	Hagartala	J. Horika	UPDATED PIPE & VALVE DATA FOR BMD EVALUATION.	X

PIPING ANALYTICAL & PHYSICAL DATA

FOR FUEL BLDG. EQUIPT. DRAIN SYSTEM

PROJECT CLINTON 1

CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO.	REV.
1RE07	2

SHEET 1 OF 3

Penetration 1MC069

PIPE DATA

REV	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL.	OPER. TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	10	1RE14F 3	B	106CP	SA-106	B	35	33	150	3.50	40	0.216	N	7.58	3.20	0.00	10.780		
	10	140	1RE14G 3	D	105CP	A-106	B	35	35	150	3.50	40	0.216	N	7.58	3.20	0.00	10.780		
	40	42	1REB4A 3/4	D	105CP	A-106	B	35	33	150	1.050	80	0.154	N	1.470	0.187	0.00	1.657		

2

EMD-034714
ADDENDUM: A
PAGE 39

TDK 10-14-97

VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	CLOSE	VAL./FIT. WT. LBS. PRELIM.	ACTUAL	OPERATOR WT. LBS. PRELIM.	ACTUAL	FLEXIBILITY INFO. O.D.	THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	10	20A (2)	CONTROL VALVE	150				260			3.50		FISHER CONTROLS	35AG651	C (2)	1RE022
	85	90	WATER METER	150				415			4.50		HERSEY PRODUCTS	BP-761-GM-5-72		1RE01M
	80	85	R.F.W.N. FLANGE	150			15				4.50		GW TAYLOR FORGE			
	90	95	R.F.W.N. FLANGE	150			15				4.50		GW TAYLOR FORGE			
	135A	135B	REDUCING ELBOW	150			17				6.625 X 3.50		CRANE CATALOG			

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	12-08-81	[signature]			FOR PMD COMMENTS	
1	12-14-81	[signature]	[signature]	[signature]	INCORP. PMD COMMENTS FOR FORMAL ANALYSIS	X
2	01-18-85	[signature]	[signature]	[signature]	UPDATED PIPE & VALVE DATA FOR EMD EVALUATION.	X

PIPING ANALYTICAL & PHYSICAL DATA

FOR FUEL BLDG. EQUIPT. DRAIN SYSTEM

PROJECT CLINTON 1

CLIENT ILLINOIS POWER CO

PROJECT NO. 4536-00

SARGENT & LUNDY
CHICAGO

SUB SYSTEM NO.	REV.
1RE07	2

SHEET 2 OF 3

DEPT MGR REV 1 TDK 10-14-97

FORM APPROVED BY

Penetration 1MC069

PIPE DATA

REV	NODE POINTS FROM	NODE POINTS TO	2" LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	25	1RE14F3	B	106 CP	SA 106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780	3.205	10.78
	25	190	1RE14E 3	D	105 CP	A 106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	190	210	1RE14D3	B	106 CP	SA 106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	70	330	1RE32B3	D	105 CP	A106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780	3.205	10.78
	470	500	1RE32AA3	D	105 CP	A 106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	470	530	1RE32AB3	D	105 CP	A 106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	33	35	1REB2A 3/4	D	105CP	A106	B	35	33	150	1.050	80	0.154	0.0	1.470	0.188	0.0	1.658		
	27	28	1REB3A 3/4	D	105CP	A106	B	35	33	150	1.050	80	0.154	0.0	1.470	0.188	0.0	1.658		

TO BE ANALYSED PER 1RE01A ON LATER DATE

Acc. No.: EMD-044518
Addendum: B
Page 12

VALVE & SPECIAL FITTINGS DATA

REV	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	CLOSE	VAL./FIT. WT. LBS. PRELIM.	ACTUAL	OPERATOR WT. LBS. PRELIM.	ACTUAL	FLEXIBILITY INFO. O.D.	THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	158	25	C.V.	150				260			3.500		FISHER CONTROLS	35A6351	B	1RE021
	37	43	GATE	150				62					CRANE "	K-6738	N	1RE030
	190	200A	C.V.	150				260					FISHER CONTROLS	38A6351	B	1RE020
	475B	485	GATE	150				62					CRANE "	K-6738		1RE039A
	490	495	N.CHECK	150				42					CRANE "	FB-154143		1RE038A
	500	505	FLANGE	150			10						CRANE CATALOGUE			3" W.N.
	510B	520	GATE	150				62					CRANE CONTROLS	K-6738		1RE039B
	525	530	N.CHECK	150				42					CRANE "	FB-154143		1RE038B
	535	540	FLANGE	150			10						CRANE CATALOGUE			3" W.N.
	485	490	FLANGE	150			10						CRANE "			
	520	525	FLANGE	150			10						CRANE "			

TO BE ANALYSED PER 1RE01A ON LATER DATE

RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
0	12-08-78				PRELIMINARY	
1	03-14-81	[signature]	[signature]	R.W. [signature]	FOR FORMAL ANALYSIS	X
2	05-27-84	Y Chan	[signature]	[signature]	UPDATED PER EMD STRESS REPORT NO. 044518	

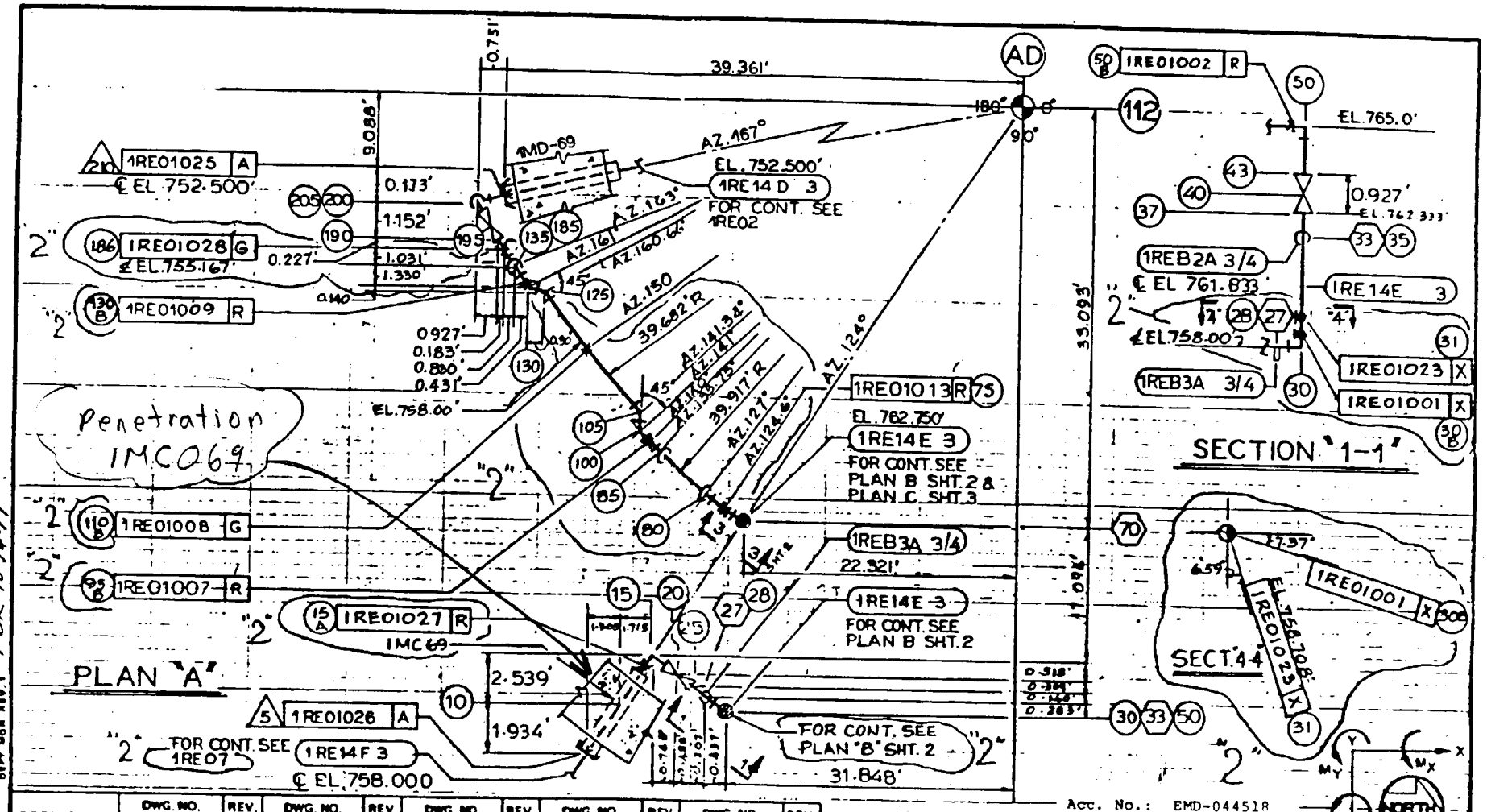
PIPING ANALYTICAL & PHYSICAL DATA

FOR EQUIPMENT DRAIN SYSTEM
PROJECT CLINTON UNIT-1
CLIENT ILLINOIS POWER CO.
PROJECT NO. 4536

SARGENT & LUNDY CHICAGO

SUB SYSTEM NO. 1RE01 REV. 2
SHEET 4 OF 5

FORM APPROVED BY DEPT MGR



REFERENCE DRAWINGS	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV	DWG. NO.	REV.
	M05-1046-3	D	M06-1046-7	K	2"					
	M27-1002-03A	D	2"							

Acc. No.: EMD-044518
Addendum: B
Page 9

RELEASE RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	12-08-78	[signature]			PRELIMINARY	
1	03-14-81	[signature]	[signature]	[signature]	FOR FORMAL ANALYSIS	XX
2	05-27-84	[signature]	[signature]	[signature]	UPDATED PER EMD STRESS REPORT NO. 044518	

PIPING ANALYTICAL & PHYSICAL DATA

FOR EQUIPMENT DRAIN SYSTEM

PROJECT CLINTON UNIT-1

CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536

SARGENT & LUNDY CHICAGO

SUB SYSTEM NO. 1RE01 REV. 2

SHEET 1 OF 5

TDK 10-14-77

Penetration 1MC069

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	2" LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	25	1RE14F3	B	106 CP	SA-106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	25	190	1RE14E3	D	105 CP	A106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780	3.205	10.78
	190	210	1RE14D3	B	106 CP	SA-106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	70	330	1RE32B3	D	105 CP	A106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780	3.205	10.78
	470	500	1RE32AA3	D	105 CP	A106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	470	530	1RE32AB3	D	105 CP	A106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	33	35	1REB2A 3/4	D	105CP	A106	B	35	33	150	3.50	40	0.216	0.0	7.575	3.205	0.0	10.780		
	27	28	1REB3A 3/4	D	105CP	A106	B	35	33	150	1.050	80	0.154	0.0	1.470	0.188	0.0	1.658		
											1.050	80	0.154	0.0	1.470	0.188	0.0	1.658		

TO BE ANALYSED PER 1RE01A ON LATER DATE

Acc. No.: EMD-044518
Addendum: B
Page 12

VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	CLOSE	VAL./FIT. WT. LBS. PRELIM.	ACTUAL	OPERATOR WT. LBS. PRELIM.	ACTUAL	FLEXIBILITY INFO. O.D.	THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	15B	25	C.V.	150				260								
	37	43	GATE	150				62			3.500		FISHER CONTROLS	35A6351 2"	B	1RE021
	190	200A	C.V.	150				260					CRANE "	K-6738	N	1RE030
	475B	485	GATE	150				62					FISHER CONTROLS	35A6351	B	1RE020
	490	495	N.CHECK	150				42					CRANE "	K-6738		1RE039A
	500	505	FLANGE	150			10						CRANE "	FB-158143		1RE038A
	510B	520	GATE	150				62					CRANE CATALOGUE			3" W.N.
	525	530	N.CHECK	150				42					CRANE CONTROLS	K-6738		1RE039B
	535	540	FLANGE	150			10						CRANE "	FB-154143		1RE038B
	485	490	FLANGE	150			10						CRANE CATALOGUE			3" W.N.
	520	525	FLANGE	150			10						CRANE "			
													CRANE "			

"TO BE ANALYSED PER 1RE01A ON LATER DATE"

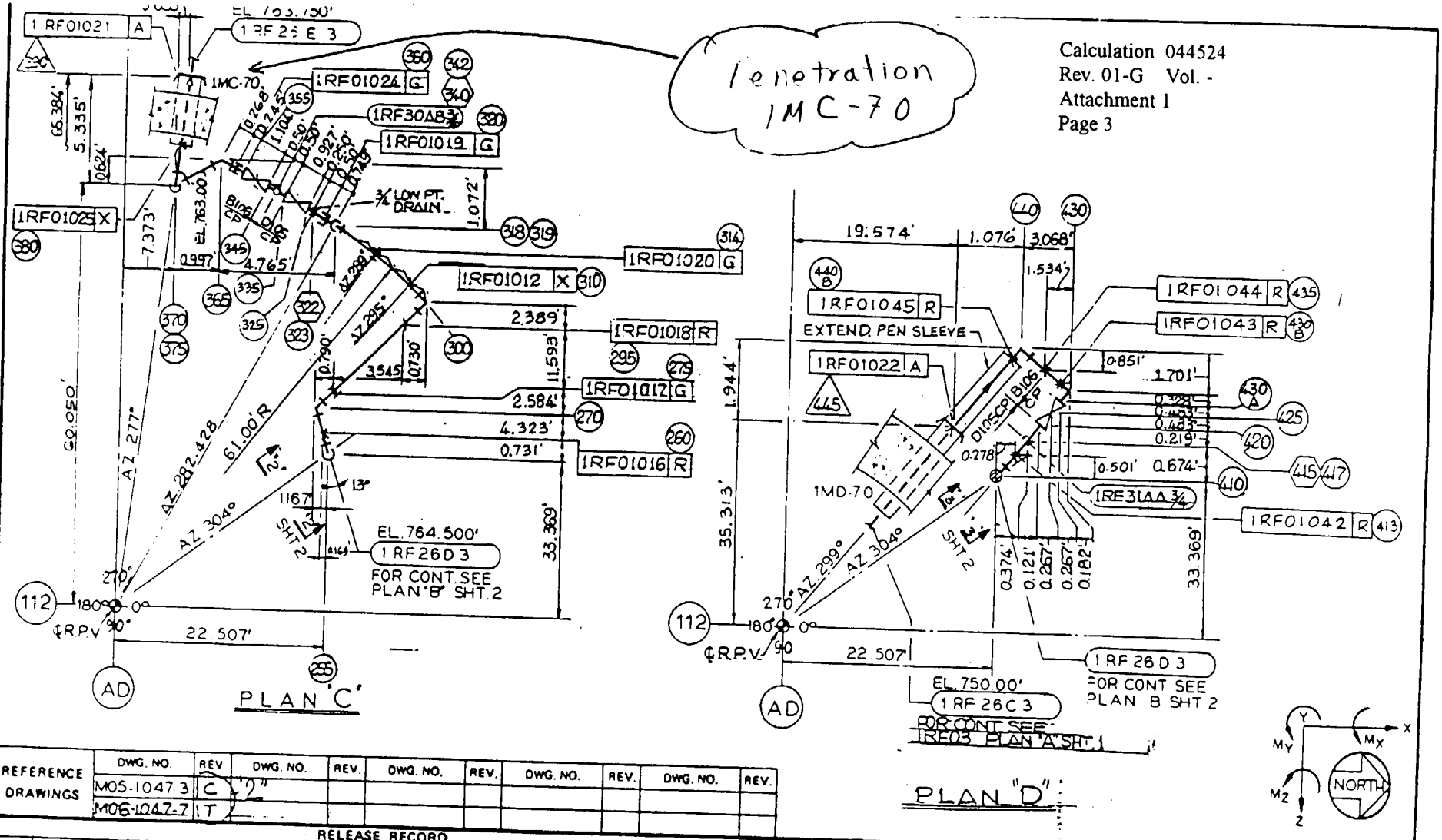
RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
0	12-08-78				PRELIMINARY	
1	03-14-81	Q. Daniel	[illegible]	R.W. Evans	FOR FORMAL ANALYSIS	X
2	05-27-84	Y. Chan	[illegible]	J. Horvitz	UPDATED PER EMD STRESS REPORT NO. 044518	

PIPING ANALYTICAL & PHYSICAL DATA
FOR EQUIPMENT DRAIN SYSTEM
PROJECT CLINTON UNIT-1
CLIENT ILLINOIS POWER CO.
PROJECT NO. 4536

SARGENT & LUNDY CHICAGO

SUB SYSTEM NO. 1RE01 REV. 2
SHEET 4 OF 5



REFERENCE DRAWINGS	DWG. NO.	REV	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M05-1047-3	C								
	M06-1047-7	T								

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	02-24-81	A. Williams			FOR COMMENTS	
1	03-12-81	A. Williams	[illegible]	[illegible]	FOR ANALYSIS	
2	09-19-84	U. Chan	mazatala	Jovita	UPDATE PER STRESS REPORT NO. EMD-044524 REV 01	
3	02-17-85	mazatala	[illegible]	Jovita	UPDATED PIPE & VALVE DATA FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA
FOR CONTAINMENT BLDG. FLOOR DRAIN SYSTEM
PROJECT CLINTON UNIT-1
CLIENT ILLINOIS POWER CO.
PROJECT NO. 4536

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO.	REV.
1RF01	3

SHEET 3 OF 5

NO SCALE

Penetration 1MC-70

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	35	62	1RF29AA 3	D	105CP	ASTM A-106	B	35	32	150	3.500	40	0.216	0.0	7.58	3.20	0.0	10.78		
	5	62	1RF29AB 3	D	105CP	ASTM A-106	B	35	32	150	3.500	40	0.216	0.0	7.58	3.20	0.0	10.78		
3	62	245	1RF29B 3	D	105CP	ASTM A-106	B	35	32	150	3.500	40	0.216	0.0	7.58	3.20	0.0	10.78		
	245	345	1RF26D 3	D	105CP	ASTM A-106	B	35	32	150	3.500	40	0.216	0.0	7.58	3.20	0.0	10.78		
	345	390	1RF26E 3	B	106CP	ASTM A-106	B	35	32	150	3.500	40	0.216	0.0	7.58	3.20	0.0	10.78		
	420	445	1RF26C 3	B	106CP	ASTM A-106	B	35	32	150	3.500	40	0.216	0.0	7.58	3.20	0.0	10.78	3.20	10.78
	7	8	1RF29DA 3/4	D	105CP	ASTM A-106	B	35	32	150	1.050	80	0.154	0.0	1.47	0.19	0.0	1.66	3.20	10.78
	37	38	1RF29CA 3/4	D	105CP	ASTM A-106	B	35	32	150	1.050	80	0.154	0.0	1.47	0.19	0.0	1.66		
	340	342	1RF30AB 3/4	D	105CP	ASTM A-106	B	35	32	150	1.050	80	0.154	0.0	1.47	0.19	0.0	1.66		
	415	417	1RF31AA 3/4	D	105CP	ASTM A-106	B	35	32	150	1.050	80	0.154	0.0	1.47	0.19	0.0	1.66		

Calculation 044524
Rev. 01-G Vol. -
Attachment 1
Page 4

VALVE & SPECIAL FITTINGS DATA

REV	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	5	6	FLANGE	150			10.00				3.50		CRANE CAT.			3" F.F.N.N.
	10	15	CHECK	150				56.00			3.50		CRANE	K-8931-I	I	1RF027B, K-28G9A
	20	30A	GATE	150				62.00			3.50		CRANE	K-6738-N	N	1RF028B, K-28G9A
	35	36	FLANGE	150			10.00				3.50		CRANE CAT.			3" F.F.W.N
	40	45	CHECK	150				56.00			3.50		CRANE	K-8931-I	I	1RF027A, K-28G9A
	50	55A	GATE	150				62.00			3.50		CRANE	K-6738-N	N	1RF028A, K-28G9A
	325	335	GATE	150				62.00			3.50		CRANE	K-6738-N	N	1RF025, K-43G9A
	345	355	C.V.	150				260.00			3.50		FISHER	35A6351	C	1RF021, K-28G4
	420	430A	C.V.	150				260.00			3.50		FISHER	35A6351	C	1RF020, K-28G4
	15	20	FLANGES	150			* 20.00				3.50		CRANE CAT.			3" R.F.W.N
	45	50	FLANGES	150			* 20.00				3.50		CRANE CAT.			3" R.F.W.N
	401	402	FLANGE	150			8.00				3.50		NAVCO DATALOG			3" F.F.S.O.
	402	404	INSTR.	N/A			15.20				3.50		YOKOGAWA ELEC CORP.	CAT. GSIE6D0-E	8TH	1E31-N761
	404	405	FLANGE	150			8.00				3.50		NAVCO DATALOG			3" F.F.S.O.

ADDED IN ADDENDA G

* WEIGHTS INCLUDED 2 MATCHING FLANGES.

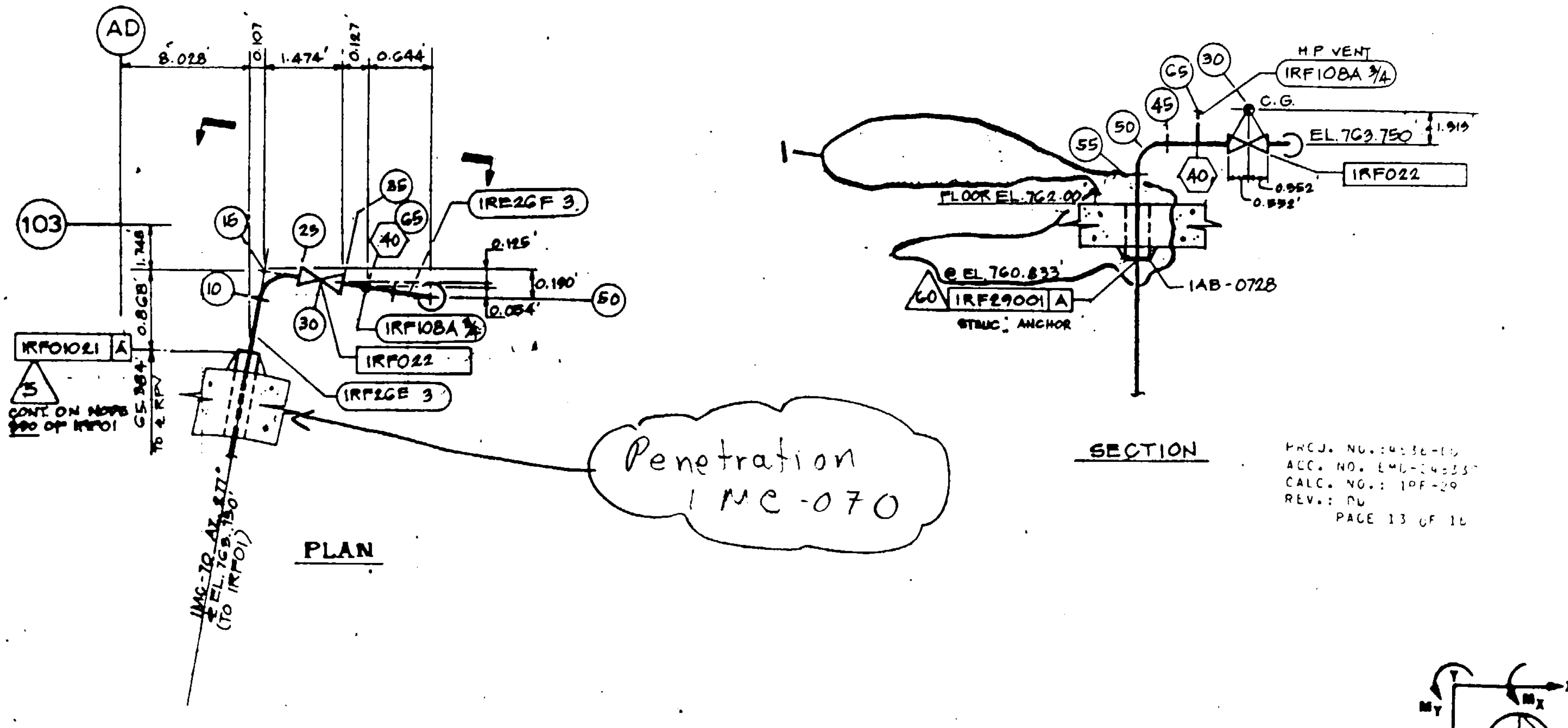
RELEASE RECORD

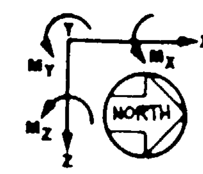
REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
0	02-26-81	D.K. Williams			FOR COMMENTS	
1	03-12-81	D.K. Williams		R.W. Evans	FOR ANALYSIS	X
2	03-19-84	L. Chan			UPDATED PER STRESS REPORT NO. EMD-044524 REV. 01	
3	09-17-85	A. Capitale			UPDATED PIPE & VALVE DATA FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA
FOR CONTAINMENT BLDG. FLOOR DRAIN SYSTEM
PROJECT CLINTON UNIT-1
CLIENT ILLINOIS POWER CO.
PROJECT NO.

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO.	REV.
1RF01	3





NO SCALE

REFERENCE DRAWINGS	DWG NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M05-1047-3	D	S26-1002-MA	L	M03-1117-10	L				
	M06-1047-3	J	M06-1047-4	L						

REVISION RECORD

REV.	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	05.08.84	[signature]	[signature]	[signature]	FOR FORMAL ANALYSIS	✓
1	01-10-85	[signature]	[signature]	[signature]	REVISED FOR END STRESS REPORT & OPERATOR VALVE WITH THE END	✓

ANALYTICAL DRAWING: ORTHOGONAL SHEET

FOR CONTAINMENT FLOOR DRAIN SYSTEM

PROJECT CLINTON-1

CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536-00

SARGENT & LUNDY ENGINEERS

SUBSYSTEM NO.	REV.
1RF29	1
SHEET 1 OF 3	

Penetration 1MC070

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT 1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	25	1RF26E 3	B	106CP	ASTM A106	B	35	32	150	3.50	40	0.216	N	7.58	3.200	0.00	10.78	3.20	10.78
	35	60	1RF26F 3	D	105CP	ASTM A106	B	35	32	150	3.50	40	0.216	N	7.58	3.200	0.00	10.78	0.00	0.00
	40	65	1RF108A 3/4	D	"	"	"	"	"	"	1.050	80	0.154	N	1.47	0.188	0.00	1.658	0.00	0.00

VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	25	35	CONTROL VALVE	150				260			3.50	1.080	FISHER CONTROLS	35A6351	C	VALVE NO./SPEC NO. 1RF022/K-2864

PROJ. NO.: 4536-00
ACC. NO. EMD-[illegible]
CALC. NO.: 1RF-29
REV.: 00
PAGE 14 OF 16

RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV DESCRIPTION	FILM
0	05.08.84	[illegible]	[illegible]	[illegible]	FOR FORMAL ANALYSIS	X
1	01-10-85	[illegible]	[illegible]	[illegible]	REVISED FOR EMD STRESS REPORT #04[illegible]/ A UPDATED VALVE DATA FOR EMD EVALUATION	X

PIPING ANALYTICAL & PHYSICAL DATA

FOR CONTAINMENT FLOOR DRAIN SYSTEM

PROJECT CLINTON 1

CLIENT ILLINOIS POWER CO.

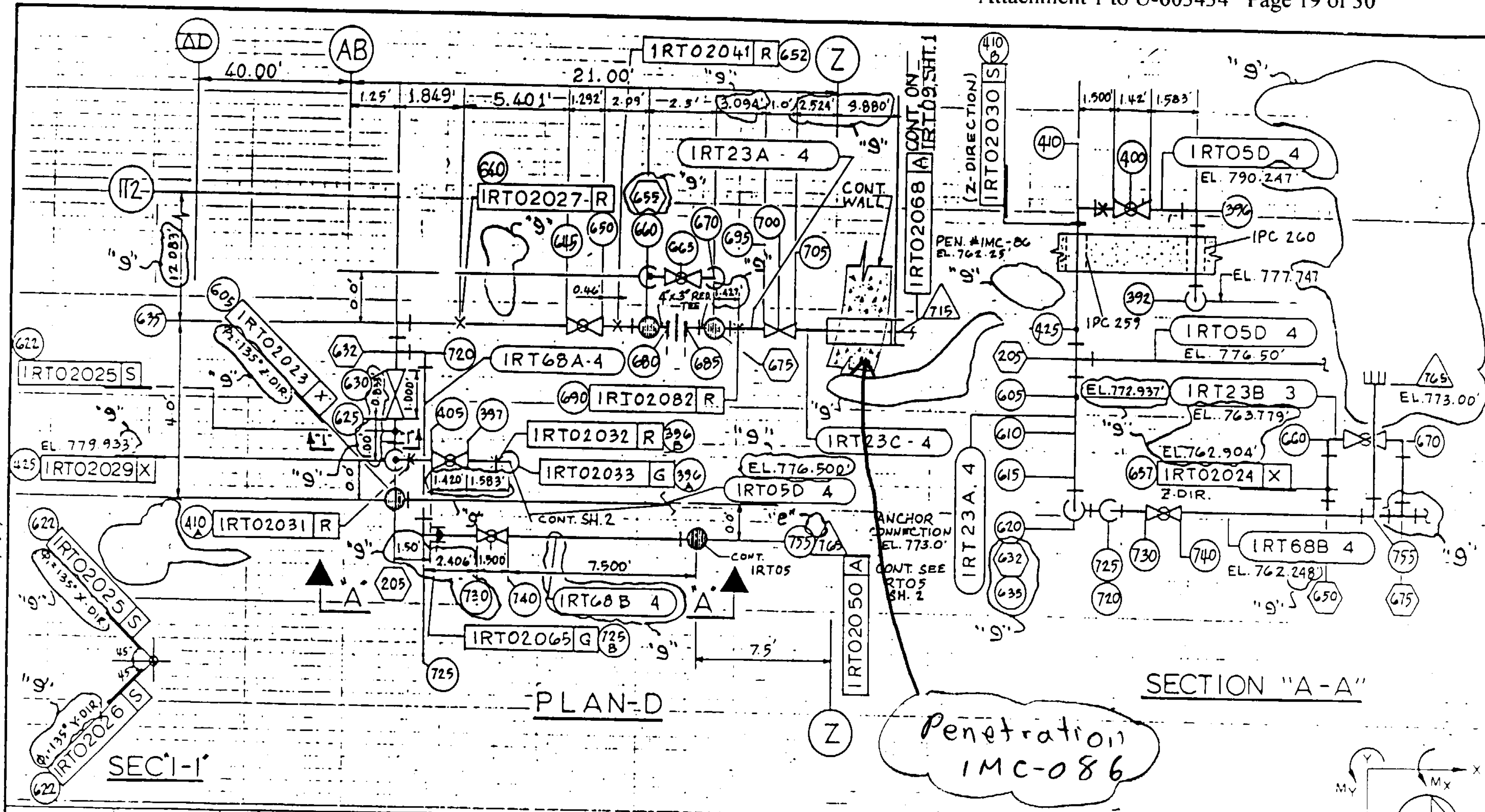
PROJECT NO. 4536.00

SARGENT & LUNDY

SUB SYSTEM NO. 1RF29 REV. 1

SHEET 2 OF 3

Form MES-6.4.2 Approved by [illegible] Dept. Mgr.
Rev. A (10-14-77)



TDK 10-14-77

EMD-052792 ADDENDUM C PAGE 33

REFERENCE DRAWINGS

DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
M05-1076-1	E	M06-1076-2	E	M06-1076-15	E	M06-1076-16	D		

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
6	10-10-79	[signature]	[signature]	[signature]		X
7	10-09-84	[signature]	[signature]	[signature]	UPDATED WT. OF METALLIC INSUL. FOR EMD EVALUATION	
8	01-11-85	[signature]	[signature]	[signature]	UPDATED PIPE & VALVE DATA FOR EMD EVALUATION	X
9	11-18-85	[signature]	[signature]	[signature]	UPDATED PER DIT-CP-EMD-1035-3.	X

NO SCALE

PIPING ANALYTICAL & PHYSICAL DATA

FOR REACTOR WATER CLEAN-UP SYSTEM

PROJECT CLINTON - 1

CLIENT ILLINOIS POWER COMPANY

PROJECT NO. 4536

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1RT02 REV 9

SHEET 4 OF 9

Penetration 1HC-086

PIPE DATA

REV	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	65	1RT05FA 6	C	607CP	SA-106	B	1410	1141	120	6.625	120	0.562	0.00	36.39	10.30	0.00	46.69	10.30	46.69
9	65	95	1RT05EA 4	"		"	"	"	"	"	4.5		0.438		18.96	4.48	"	23.44	4.48	23.44
	205	N215	1RT05D 4	"		"	"	"	"	"						"	"			
	210	280	1RT04AA 4	"		"	"	"	1208	"						"	"			
9																				
	280	N415	1RT04B 4	C	607CP	SA-106	B	1410	1208	120	4.50	120	0.438	0.00	18.96	4.48	0.00	23.44	4.48	23.44
	205	293	1RT05D 4	"	"	"	"	"	1141	"	"	"	"	"	"	"	"	"	"	"
9	280	485	1RT04AB 4	C	607CP	SA106	B	1410	1208	120	4.50	120	0.438	0.00	18.96	4.48	0.00	23.44	4.48	23.44
	490	575	1RT05FB 6	C	607CP	SA106	B	1410	1141	120	6.625	120	0.562	0.00	36.39	10.30	0.00	46.69	10.30	46.69
9	575	175	1RT05EB 4	C	607CP	"	"	"	"	"	4.5	"	0.438	0.00	18.96	4.48	0.00	23.44	4.48	23.44
	205	695	1RT23A 4	C	607CP	"	"	"	"	"	4.5	120	0.438	0.00	18.96	4.48	0.00	23.44	"	"

VALVE & SPECIAL FITTINGS DATA

REV	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	VALVE REMARKS NO.
	65B	70	GATE	600				200			4.5	2.19	ANCHOR/DARLING CO.	W7820022	A	1G33F304A
	241	245	GATE	600				180			"	"	" "	93-14683	B	-1G33F303A
9	397	405	MOGLOBE	600				340			"	"	" "	W7820098		1G33F044
	445	446	GATE	600				180			"	"	" "	93-14683	B	1G33F303B
	5758	580	GATE	600				200			"	"	" "	W7820022	A	1G33F304B
	625	630	GATE	600				200			"	"	" "	"	"	1G33F032
	645	650	CONTROL	600							"	"	ACF INDUSTRIES	VPF NO. 3736-62		1G33F033
	660B	670A	M.O GLOBE	600				275			3.5	"	ANCHOR/DARLING CO.	W7820097	B	1G33F031
	680	685	FLANGES	600			100.8*				4.5	"	FLUIDIC TECHNIQUES INC.	S-NP-1021	B	1G33D001
	695	705	M.O GATE	600				390			"	"	ANCHOR/DARLING CO.	93-15094		1G33F028
	730	740	M.O GLOBE	900				400			4.5	2.19	ANCHOR/DARLING CO.	93-14696	B	1G33F107

* INCLUDES WT. OF 2 FLANGES

RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
6	10-10-79					X
7	10-09-84				UPDATED WT. OF METALLIC INSUL. FOR EMD EVALUATION	
8	01-11-85				UPDATED PIPE & VALVE DATA FOR EMD EVALUATION.	X
9	11-18-85				UPDATED PER DIT-CP-EMD-1035-3.	X

PIPING ANALYTICAL & PHYSICAL DATA
FOR REACTOR WATER CLEAN-UP SYSTEM
PROJECT CLINTON-1
CLIENT ILLINOIS POWER COMPANY

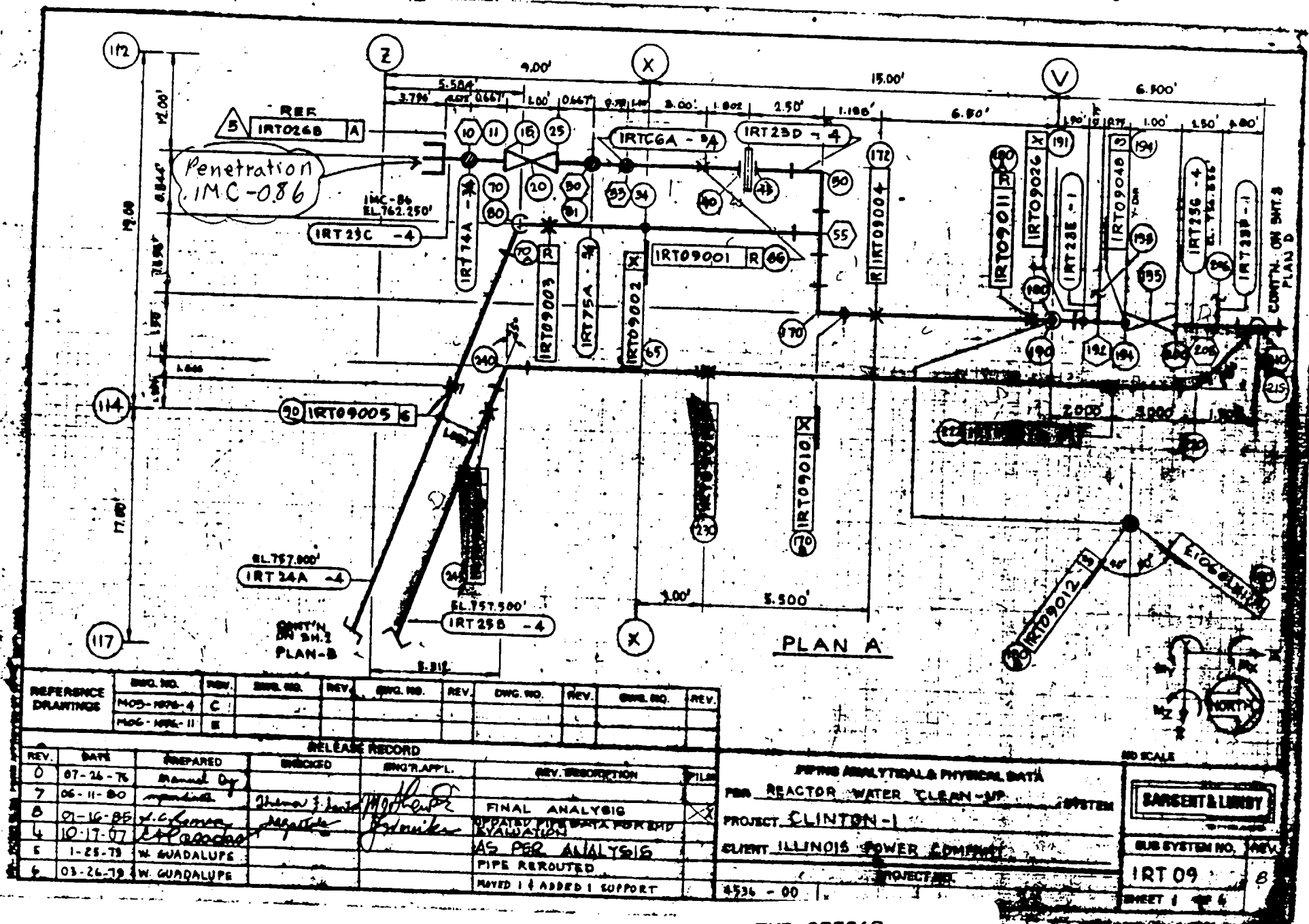
SARGENT & LUNDY ENGINEERS CHICAGO

PROJECT NO. 4536

SUB SYSTEM NO. IRT02 REV. 9

SHEET 6 OF 9

EMD-052792
ADDENDUM C



REFERENCE DRAWINGS	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M05-1076-4	C								
	M06-1081-11	E								

RELEASE RECORD

REV.	DATE	PREPARED	CHECKED	ENGR. APPL.	REV. DESCRIPTION	FILED
0	07-26-76	Manuel Dy				
7	06-11-80		Thomas J. Smith		FINAL ANALYSIS	X
8	01-16-85	V.C. Lenon	Jagadish		UPDATED PIPE DATA FOR EVALUATION	
4	10-17-07	E.P. Rondon			AS PER ANALYSIS	
5	1-25-79	W. GUADALUPE			PIPE REROUTED	
6	03-26-79	W. GUADALUPE			MOVED 1 & ADDED 1 SUPPORT	

PIPING ANALYTICAL & PHYSICAL DATA
FOR REACTOR WATER CLEAN-UP SYSTEM
PROJECT CLINTON-1
CLIENT ILLINOIS POWER COMPANY
PROJECT NO. 4536 - 00

SARGENT & LUNDY
SUB SYSTEM NO. IRT 09
REV. 8
SHEET 1 OF 4

EMD-025062
ADDENDUM: H
PAGE: 49

Penetration IMC-07E

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER. FLUID	3. INSUL.	OPER. TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	40	IRT 23C -4	B	607 CP	SA-106	B	1410	1141	120	4.500	120	0.438	0.0	18.98	4.47	0.00	23.45	4.47	23.45
	55	140	IRT 24A -4	C	"	"	"	1410	"	"	"	120	"	0.0	"	"	"	"	"	"
	45	194	IRT 23D -4	C	"	"	"	1410	"	"	"	120	"	0.0	"	"	"	"	"	"
	210	305	IRT 29B -4	D	106CP	"	"	150	25	"	"	40	0.237	0.0	10.79	5.51	"	16.30		
	313	160	IRT 25A -3	D	"	"	"	150	25	"	3.500	40	0.216	0.0	7.58	3.20	"	10.78		
	200	770	IRT 23G -4	D	106CP	"	"	150	25	"	4.900	40	0.237	0.0	10.79	5.51	"	16.30		
	180	395	IRT 24B -4	D	"	"	"	150	25	"	"	40	0.237	0.0	"	"	"	"		
	10	11	IRT 74A-¾	B	607CP	"	"	1410	1141	"	1.050	160	0.219	0.0	1.94	0.128	"	2.068	0.128	2.068
	30	81	IRT 75A-¾	C	607CP	"	"	1410	1141	"	1.050	160	0.219	0.0	1.94	0.128	"	2.068	"	"
	192	193	IRT 23E-1	C	607CP	"	"	1410	1141	"	1.315	160	0.250	0.0	2.84	0.226	"	3.066	0.226	3.066
	205	206	IRT 23F-1	D	106CP	"	"	150	25	"	1.315	80	0.179	0.0	2.17	0.312	"	2.482		
	99	84	IRT 66A-¾	C	607CP	"	"	1410	1288	534	1.050	160	0.219	2.0	1.94	0.128	4.9	2.968	0.128	2.968
	302	303	IRT 72A-¾	D	106CP	"	"	150	25	120	1.050	80	0.154	0.0	1.47	0.188	0.00	1.658		

B B B B

VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS/OR VALVE NO.
	15	25	FLOW ELEMENT	600#				885			4.50		ANCHOR/DARLING VALVE CO.	VV7820044		1633F034
	40	45	"	"			97				4.50		CRANE CATALOG			0338011
	194	200	M.O.GATE	"				390			4.50		ANCHOR/DARLING VALVE CO.	33-19096		1633F046
	140	150	M.O.GATE	"				390			4.50		"	33-19095		1633F035
	307	313	RELIEF	150				140			4.50		INDUSTRIAL VALVE & INSTR. DIV.	BNC3007		1633F036
	305	307	FLANGE	150			15				4.50		CRANE			
	313	314	FLANGE	300			15				3.50		CRANE			

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ADDENDUM: H
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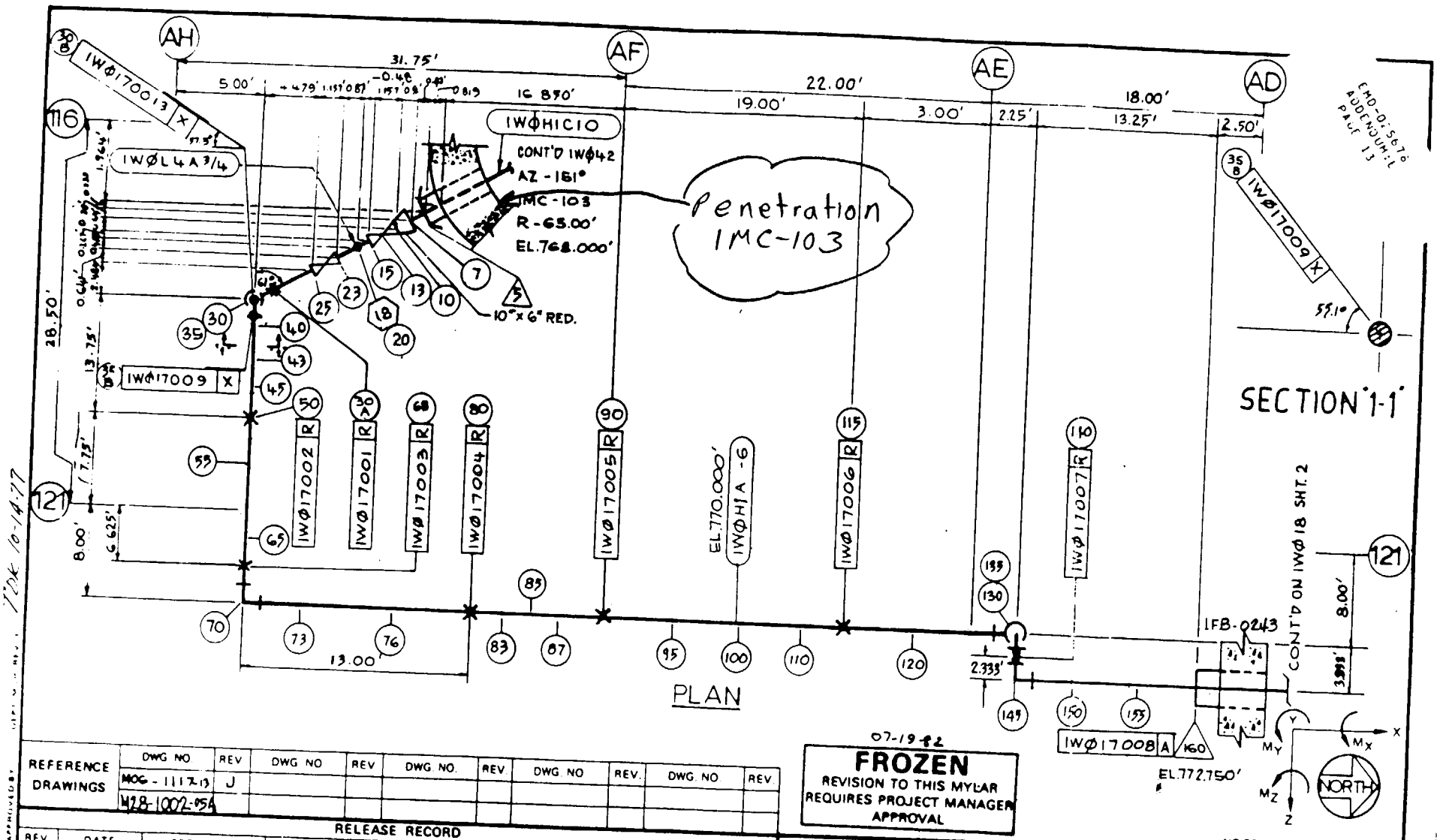
RELEASE RECORD

REV.	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
5	1-23-79	W. GUADALUPE			PIPE REROUTED	
6	03.26.79	W. GUADALUPE			MOVED & ADDED HANGERS	X
7	06-11-80	[illegible]	[illegible]	[illegible]	FINAL ANALYSIS	X
8	01-16-85	R.C. Romero	Margo Tate	[illegible]	UPDATED PIPE DATA FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA
FOR REACTOR WATER CLEAN-UP SYSTEM
PROJECT CLINTON-1
CLIENT ILLINOIS POWER COMPANY
PROJECT NO. 4536-00

SARGENT & LUNDY

SUB SYSTEM NO. IRT 09 REV. 8
SHEET 5 OF 6



REFERENCE DRAWINGS	DWG NO	REV	DWG NO	REV	DWG NO.	REV	DWG NO	REV.	DWG NO	REV
	M06-1117-13	J								
	M28-1002-05A									

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	03-22-78	[illegible]				
1	08-22-78	A. Bonomo				
2	08-30-78	E. Pasadas			ADD'L. RESTRAINTS	
3	07-23-80	N.P. AGUILA	[illegible]	M. [illegible]	ENTER ENG'RS COMMENTS	
4	11-26-84	[illegible]	[illegible]	J. [illegible]	FOR FINAL ANALYSIS UPDATED PIPE AND VALVE DATA FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA

FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-1

CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1WØ17 REV. 4

SHEET 1 OF 3

Penetration 1MC-105

PIPE DATA

REV	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2 OPER FLUID	3. INSUL	OPER TOTAL 1+2+3	4 WATER	HYDRO 1+4
	5	15	1WØH1C10	B	106 CP	SA106	B	250	205	60	10.750	40	0.365	1.5	40.50	34.20	3.95	78.65	34.20	74.70
	15	160	1WØH1A6	D	100	SA106	B	250	205	60	6.625	40	0.280	1.5	18.97	12.51	2.70	34.18		
	18	20	1WØL4A3/4	D	100	SA106	B	250	205	100	1.050	80	0.154	1.5	1.47	0.188	0.91	2.57		

4 4 4

VALVE & SPECIAL FITTINGS DATA

REV	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	CLOSE	VAL./FIT. WT. LBS. PRELIM.	ACTUAL	OPERATOR WT. LBS. PRELIM.	ACTUAL	FLEXIBILITY INFO. O.D.	THICK	VENDOR	DRAWING NO.	REV.	REMARKS/VAL. NO.
	10	15	MO GATE VA	150				694 lbs.								
	23	25	GATE VA.	150				148 lbs.					ANCHOR/DARLING VALVE CO.	W792068B	A	1WØ001A
													CRANE CO.	STD-K-6738-7,8	N	1WØ302

4

EMD-025678 ADDENDUM: E PAGE 14

RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
2	08-30-78	E POSADAS				
3	07-23-80	N.P. AGUILA	[signature]	[signature]	FOR FINAL ANALYSIS	
4	11-26-84	[signature]	[signature]	[signature]	UPDATED PIPE AND VALVE DATA FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-I

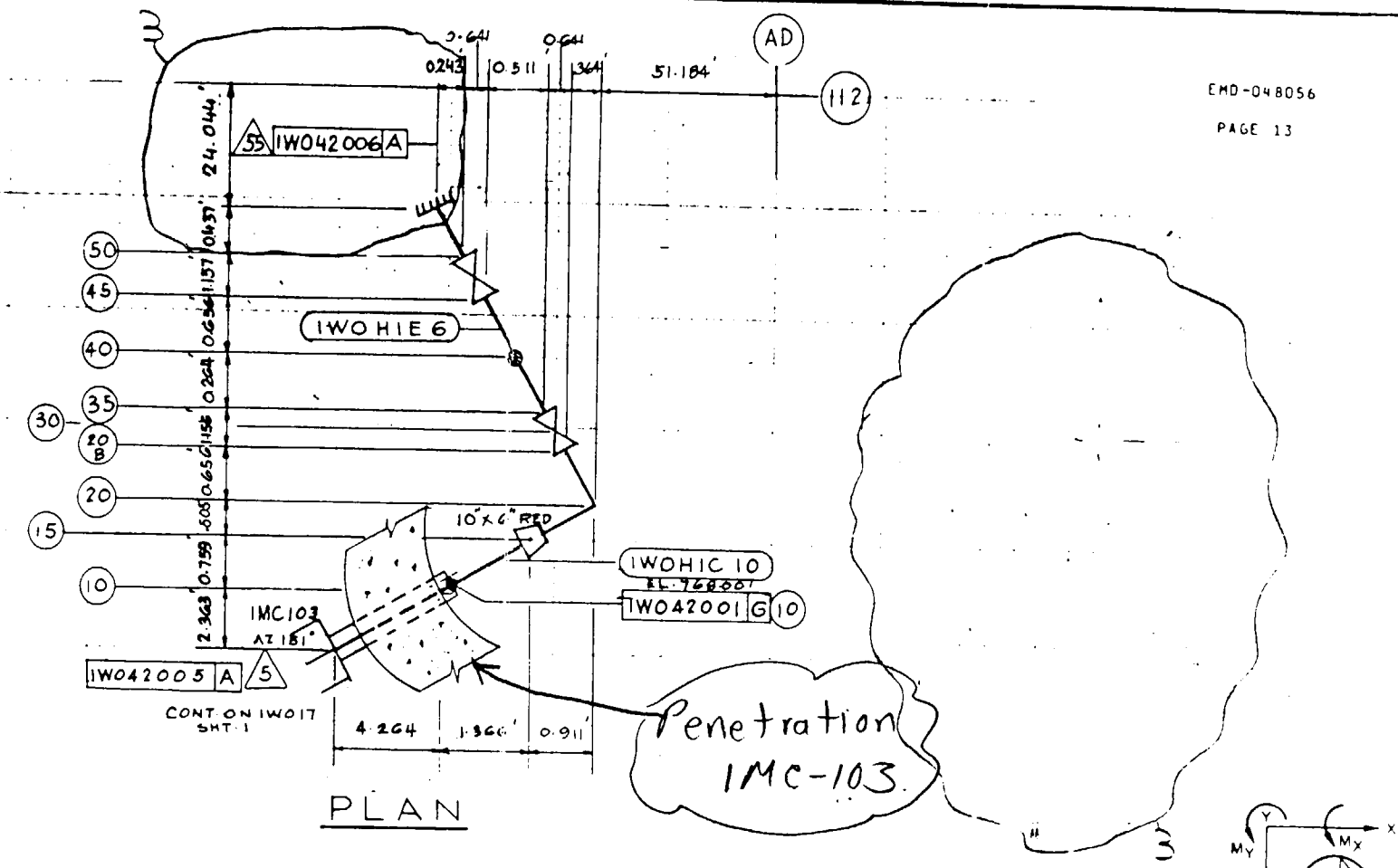
CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO.	REV.
1W017	4
SHEET 2 OF 3	

DEPT MGR APPROVED BY



REFERENCE DRAWINGS	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M06-1117-61	B	M05-1117-19	C						
	M06-1117-62	B								

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	04-05-79	M.U. ARCEO				
1	04-11-79	M.U. ARCEO	[signature]	M. J. McDonnell	INC. ENGRS. COMMENTS	
2	01-21-80	M. Arceo	[signature]	M. J. McDonnell	UPDATE ANALYTICAL DWG. FOR FINAL ANALYSIS	
3	09-06-84	Regina Perez	Jane Belshaw	[signature]	REVISED PER LATEST LINE LIST AND DIT-CP-SED-0157 FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA

FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-1

CLIENT ILLINOIS POWER CO.

PROJECT NO 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1W042 REV. 3

SHEET 1 OF 3

TDK 10-14-77

DEPT MGR REV 1

ME 15 14 1 (10 77) FORM APPROVED BY

Penetration 1MC-103

PIPE DATA

REV	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS - LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	20B	1WOHIC10	B	106CP	A106	B	250	205	60	10.75	40	0.365	1.50	40.50	34.20	3.88	78.58	34.20	74.70
	35	55	1WOHIE6	D	100	A106	B	250	205	60	6.625	40	0.280	1.50	18.97	12.61	2.63	34.11	—	—

EMD-048056

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VALVE & SPECIAL FITTINGS DATA

REV	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	20B	35	GATE VALVE	150				694	(INCL. OPERATOR)		6.625		ANCHOR DARLING VALVE CO	W7920689	-	1W00018 MC
	45	50	GATE VALVE	150				148			6.625		CRANE CO.	KG738	-	1W0303 M

RELEASE RECORD

REV.	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
0	04-03-79	M U ARCEO				
1	04-11-79	M U ARCEO	[illegible]	[illegible]	INC. ENG'RS. COMMENTS	
2	01-21-80	[illegible]	[illegible]	[illegible]	UPDATE ANALYTICAL DWG. FOR FINAL ANALYSIS	
3	09-06-84	[illegible]	[illegible]	[illegible]	REVISED PER LATEST LINE LIST AND OFF-CP-BED-0157 FOR EMD EVALUATION	

PIPING ANALYTICAL & PHYSICAL DATA

FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-1

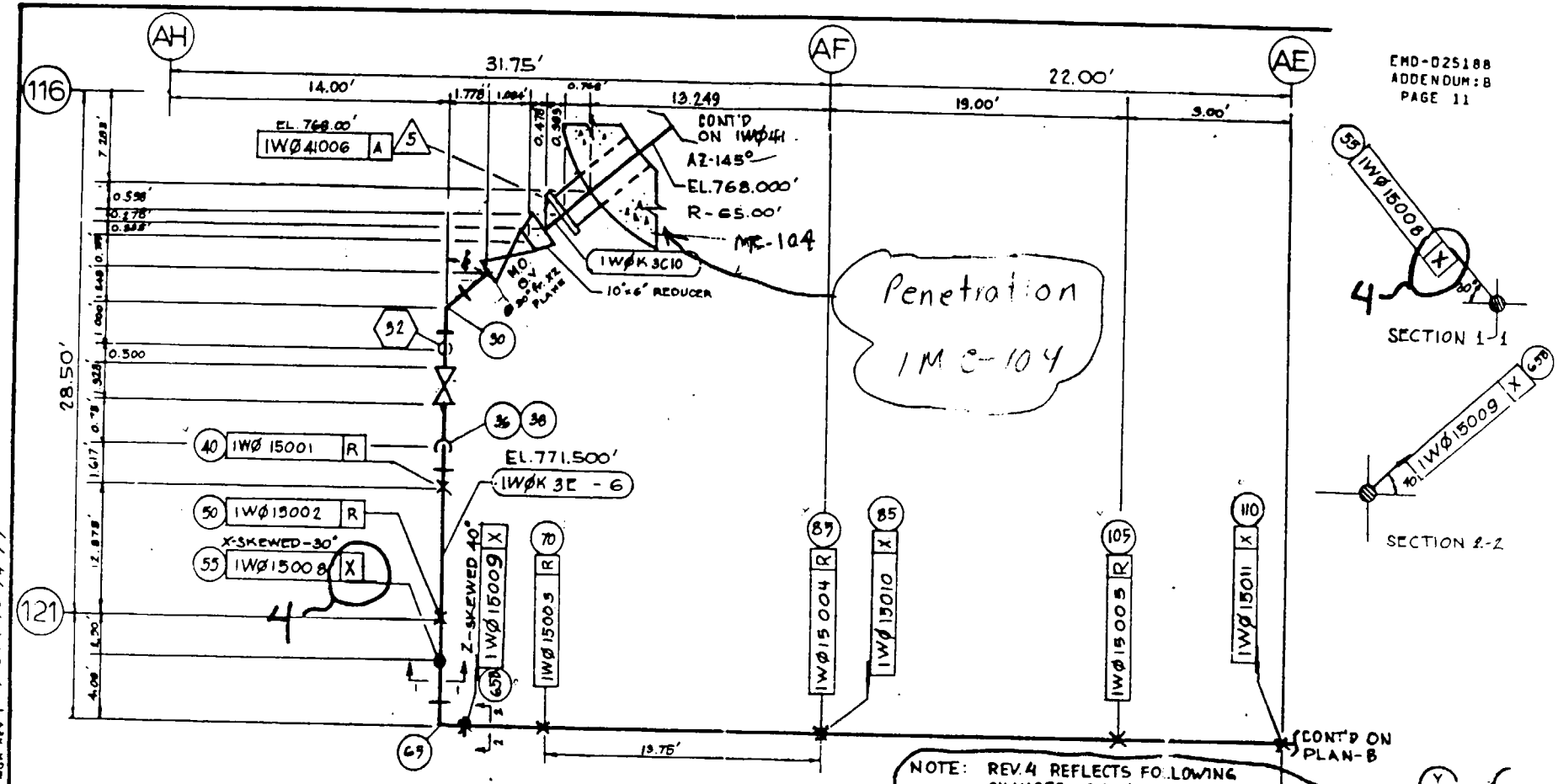
CLIENT ILLINOIS POWER CO.

PROJECT NO

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO.	REV.
1W042	3

F-18142 (8-78) FORM APPROVED BY DEPT. MGR



EMD-025188
ADDENDUM: B
PAGE 11

PLAN-A

NOTE: REV.4 REFLECTS FOLLOWING CHANGES ONLY:
1. 1WØ15008S CHANGED TO 1WØ15008X AS PER ECN # 2991
2. WEIGHTS OF OPER. FLUID, INSUL. HYDRO, AND VALVE.
3. VALVE ADDED ON MODE DWG. (SHT.4)

NORTH

NO SCALE

REFERENCE DRAWINGS	DWG. NO.	REV	DWG NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M06-1117-10	G	M05-1117-16	D						
	M06-1117-7	L	M05-1117-18	D						

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	03-18-78	[illegible]				
1	08-22-78	A. BONOMO			ADD'L RESTRAINTS	
2	08-30-78	[illegible]			ENTER ENGRS. COMMENTS	
3	08-04-80	[illegible]	[illegible]	M. J. ANF[illegible]	FINAL ANALYSIS	
4	04-17-84	I. AZBEL	[illegible]	M. J. ANF[illegible]	UPDATED PIPE & VALVE DATA	

PIPING ANALYTICAL & PHYSICAL DATA

FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-1

CLIENT ILLINOIS POWER CO.

PROJECT NO 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1WO15 REV 4

SHEET 1 OF 4

TDK 10-14-77

Penetration 1MC-104

EMD-025188
ADDENDUM:B
PAGE 13

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER. FLUID	3. INSUL.	OPER. TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	10	1WOK3C-10	B	106 CP	SA106	B	250	205	60	10.75	40	0.865	1.5	40.50	34.2	3.95	78.65	34.2	74.70
	25	140	1WOK3E-6	D	100	SA106	B	250	205	60	6.625	40	0.280	1.5	19.00	12.50	2.63	34.13	0	
	--																			

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VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS/VAL. NO.
	15	25	M.O GATE V.	150				694.0					ANCHOR DARLING VALVE Co.	W-7920688	A	1WO002A
	33	36A	GATE VALVE	150			4	148.0					CRANE	K-6738-K	K	1WO307

RELEASE RECORD

REV.	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
3	08-04-80	[illegible]	[illegible]	M. [illegible]	FINAL ANALYSIS	
4	04-17-84	I. Azbel	Y. Chan	M. [illegible]	UPDATED PIPE & VALVE DATA	

PIPING ANALYTICAL & PHYSICAL DATA

FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-1

CLIENT ILLINOIS POWER CO.

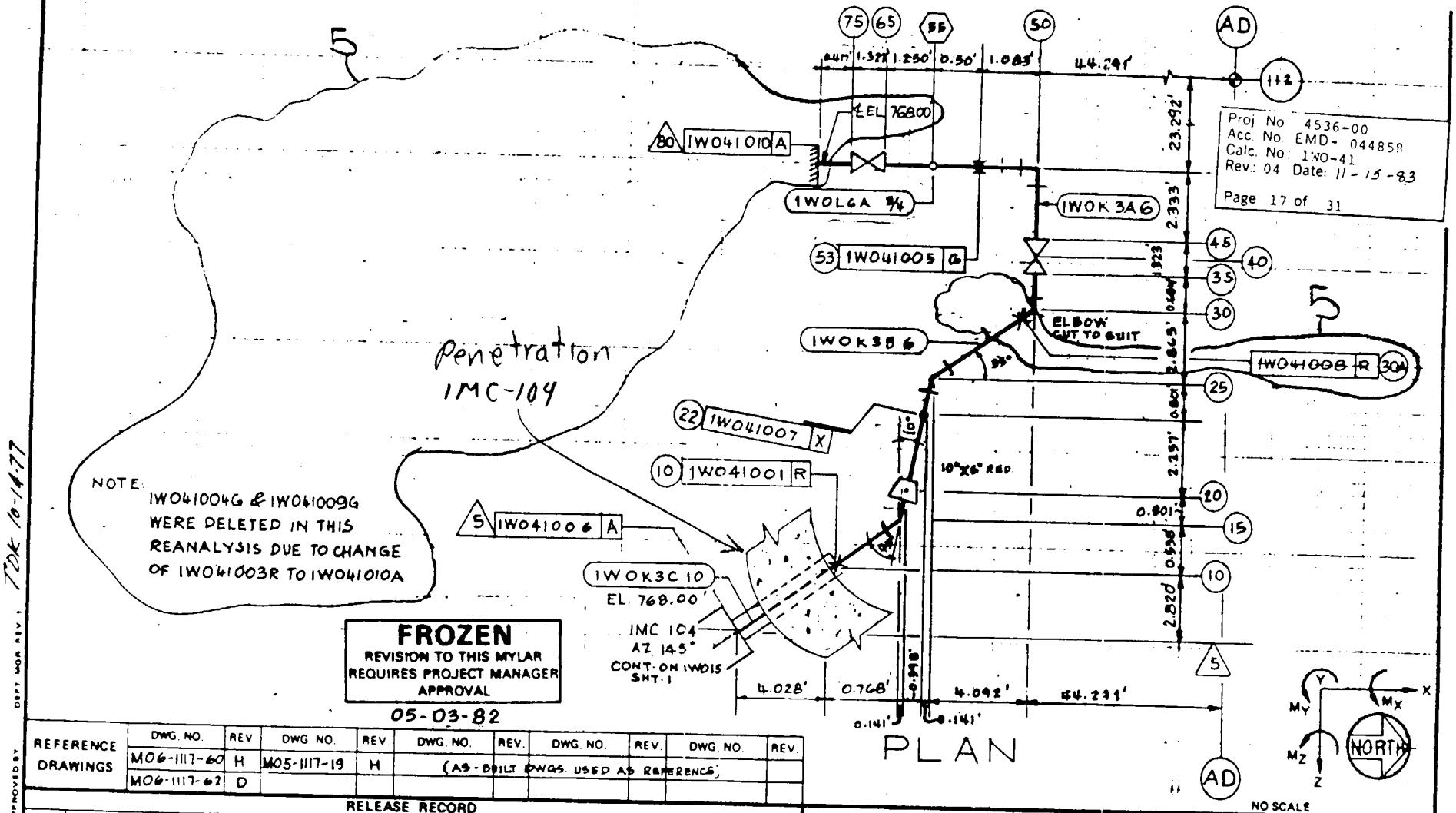
PROJECT NO 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1WO15 REV. 4

SHEET 3 OF 4

MS-18142 (8-78) FORM APPROVED BY [illegible] DEPT. MGR.



FROZEN
REVISION TO THIS MYLAR REQUIRES PROJECT MANAGER APPROVAL
05-03-82

REFERENCE DRAWINGS	DWG. NO.	REV	DWG NO.	REV	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M06-1117-60	H	M05-1117-19	H	(AS-BUILT DWGS. USED AS REFERENCE)					
	M06-1117-62	D								

RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	APPROVED	PURPOSE	FILM
0	04-04-79	M.U. ARCEO				
1	04-11-79	M.U. ARCEO	[signature]	M. J. McDonnell	INC. ENG'RS COMMENTS	
2	01-15-80	M. Arceo	[signature]	M. J. McDonnell	UPDATE ANALYTICAL DWG. FOR FINAL ANALYSIS	
3	03-12-82	A. Damil	Daisy J. Sastala	M. J. McDonnell	FOR "RECORD" ANALYSIS	
4	07-19-83	A. Damil	[signature]	M. J. McDonnell	FOR RE-ANALYSIS DUE TO NCR 8837	
5	09-01-83	Regina Peck	A. Damil	M. J. McDonnell	UPDATED PER STRESS REPORT # 044858 REV. 4	

PIPING ANALYTICAL & PHYSICAL DATA
FOR PLANT CHILLED WATER SYSTEM
PROJECT CLINTON-1
CLIENT ILLINOIS POWER CO.
PROJECT NO. 4536-00

SARGENT & LUNDY ENGINEERS CHICAGO

SUB SYSTEM NO. 1W041 REV. 5
SHEET 1 OF 5

TDK 10-14-77

Penetration 1MC-104

PIPE DATA

REV.	NODE POINTS FROM	NODE POINTS TO	LINE NUMBER	PIPE CLASS	PIPING DESIGN TABLE	MATERIAL SPEC.	MATERIAL GR.	DESIGN PRESS.	MAX. OPER. PRESS.	MAX. OPER. TEMP.	O.D.	SCHED.	WALL THICK	INSUL. THICK	WEIGHTS – LBS/LINEAL FT. 1. PIPE	2. OPER FLUID	3. INSUL.	OPER TOTAL 1+2+3	4. WATER	HYDRO 1+4
	5	20	1WOK3C 10	B	106CP	A106	B	250	205	60	10.750	40	0.365	1.50	40.48	34.20	3.642	78.32	34.20	74.68
	20	35	1WOK3B 6	B	106CP	A106	B	250	205	60	6.625	40	0.280	1.50	18.97	12.51	2.464	33.93	12.51	31.48
	45	80	1WOK3A 6	D	100	A106	B	250	205	60	6.625	40	0.280	1.50	18.97	12.51	2.494	33.93		
	55	60	*1WOL6A 3/4	D	100	A106	B	250	205	100	1.050	80	0.154	1.50	1.94	0.128	0.848	2.92		

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* CODED AS SOCKOLET

VALVE & SPECIAL FITTINGS DATA

REV.	NODE POINTS FROM	NODE POINTS TO	TYPE	PRESSURE RATING	VAL. STROKING TIME (SEC.) OPEN	VAL. STROKING TIME (SEC.) CLOSE	VAL./FIT. WT. LBS. PRELIM.	VAL./FIT. WT. LBS. ACTUAL	OPERATOR WT. LBS. PRELIM.	OPERATOR WT. LBS. ACTUAL	FLEXIBILITY INFO. O.D.	FLEXIBILITY INFO. THICK	VENDOR	DRAWING NO.	REV.	REMARKS
	35	45	GATE VALVE	150				694	(INCL. OPERATOR)		6.625		ANCHOR DARLING VALVE	W7920688	—	1W0002B M.O
	65	75	GATE VALVE	150				148			6.625		CRANE CO.	K-6738	—	1W0306 M.

Proj. No.: 4536-00
Acc. No.: EMD- 044858
Calc. No.: 1WO-41
Rev.: 04 Date: 11-15-83
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RELEASE RECORD

REV	DATE	PREPARED	CHECKED	ENG'R APP'L	REV. DESCRIPTION	FILM
0	04-04-79	M U ARCEO				
1	04-11-79	M U ARCEO	[signature]	M. J. McDonnell	INC ENG'RS COMMENTS	
2	01-15-80	M Arceo	[signature]	M. J. McDonnell	UPDATE ANALYTICAL DWG FOR FINAL ANALYSIS	
3	03-12-82	A. Daniel	[signature]	M. J. McDonnell	FOR "RECORD" ANALYSIS	
4	07-19-83	A. Daniel	[signature]	M. J. McDonnell	FOR RE-ANALYSIS DUE TO NCR 8857	
5	09-01-83	[signature]	[signature]	M. J. McDonnell	UPDATED PER STRESS REPORT 044858 REV. 4	

PIPING ANALYTICAL & PHYSICAL DATA

FOR PLANT CHILLED WATER SYSTEM

PROJECT CLINTON-1

CLIENT ILLINOIS POWER CO.

PROJECT NO. 4536-00

SARGENT & LUNDY CHICAGO

SUB SYSTEM NO. 1W041 REV. 5

SHEET 2 OF 3

ME-19 14 2 (8-78) FORM APPROVED BY [signature] DEPT MGR.

Responses to Questions Received by Facsimile on August 21, 2000

The following are the specific responses to the questions faxed to CPS on August 21, 2000.

Question 1: Condensation induced waterhammer (CIWH) was not analyzed. Are there any long horizontal piping runs in the Drywell (VP) or Supplemental Drywell (WO) cooling systems where CIWH could occur? CIWH might occur either during the draining of the VP and WO systems or the subsequent refill.

Response: There are no locations in the Drywell (VP) or Supplemental Drywell (WO) cooling systems where CIWH could occur because no vapor bubble of significant size can form. The systems are not subject to drain down and refill post-LOCA. The system configuration which prevents water hammer is described in more detail in Attachment 3 to this letter.

Question 2: Describe the isolation valves for the VP and WO systems. What is their position during plant operation? Do they receive an automatic containment isolation closure signal?

Response: The cooling systems in the drywell are non-safety related systems not credited for post-accident cooling. The VP and WO systems are power generation systems, which provide cooling water for economic purposes during plant operation. As such, the containment isolation valves receive a containment isolation signal (based on High Drywell Pressure or Reactor Vessel Low Water Level) as required by NUREG-0737, Item II.E.4.2, "Containment Isolation Dependability." As described in the CPS letter dated June 15, 1998, the emergency operating procedures allow operators to override the containment isolation signal and re-establish containment cooling. The VP and WO systems are described in more detail in Attachment 3.

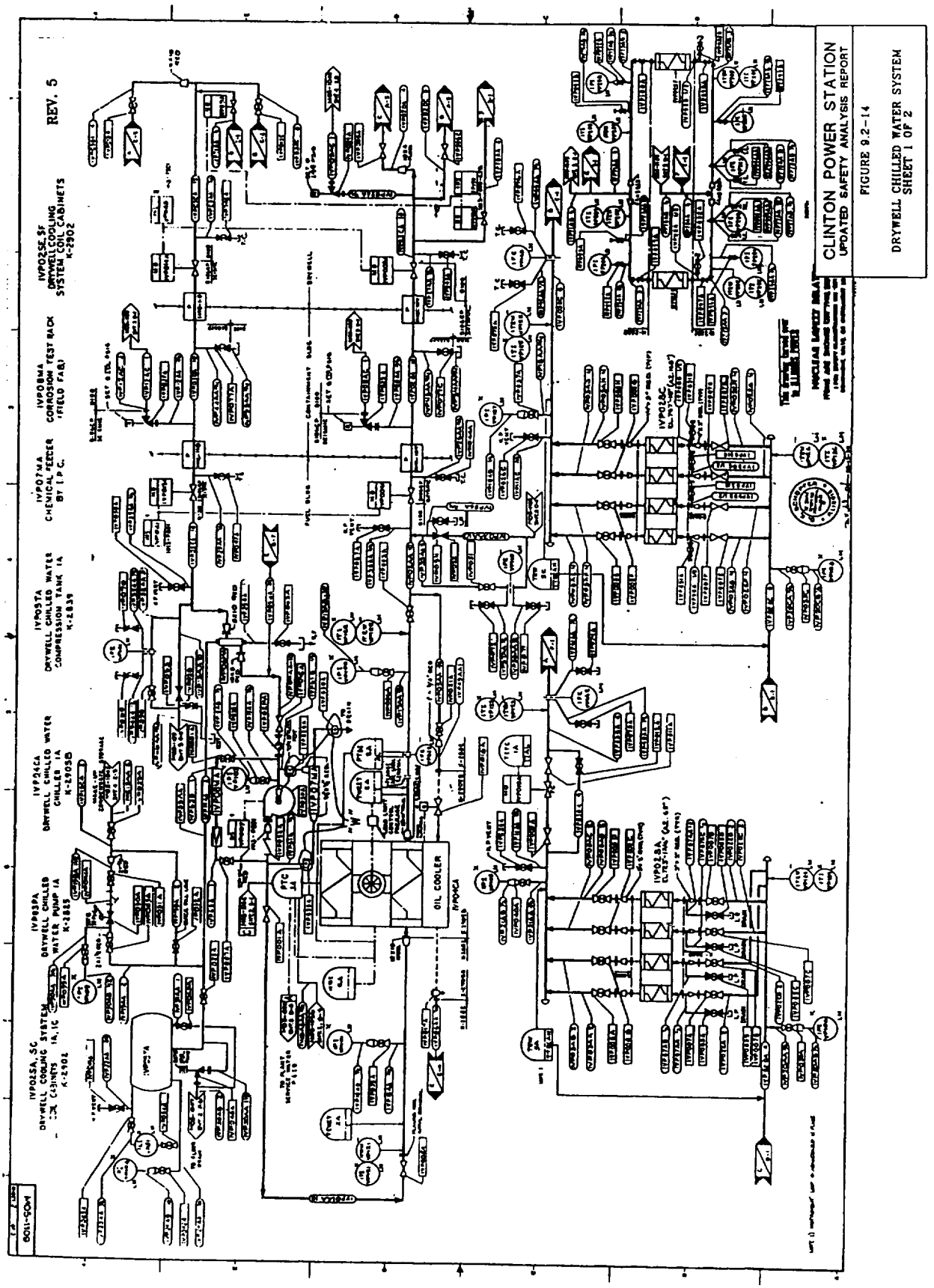
Question 3: Could you provide a system diagram of the VP and WO systems showing the location of the containment isolation valves?

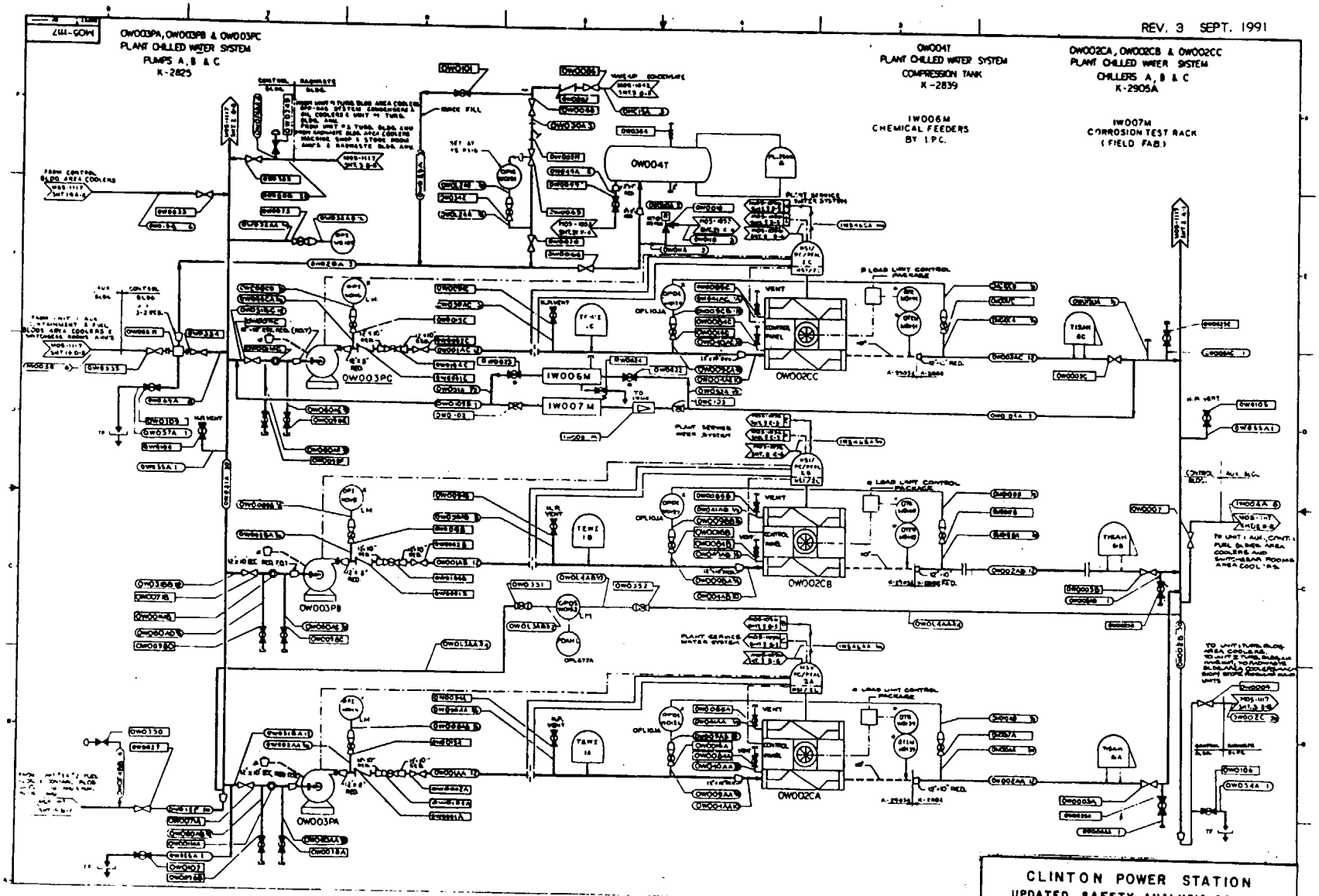
Response: P&ID's for these systems are attached.

Question 4: Relief valve 1VP024 is described as opening at a set pressure of 140 psid. What is the pressure at which the valve would close if it were opened by water expansion in the system piping? Compare the closure pressure to the conditions within the containment for a LOCA.

Response: Relief valves 1VP024 A/B are thermal relief valves, which are expected to seep, but not pop under slow thermal expansion conditions. If the valve does open it is expected to reset (close) within 10% of the set pressure or about 125 psig. Maximum post-accident temperature and pressure in containment are 185°F and 15 psig. The inboard isolation valves are within the drywell, where the maximum post-accident temperature is 330°F. The saturation pressure at 330°F is

approximately 89 psig. The range of possible system pressures and temperatures is described in more detail in Attachment 3.

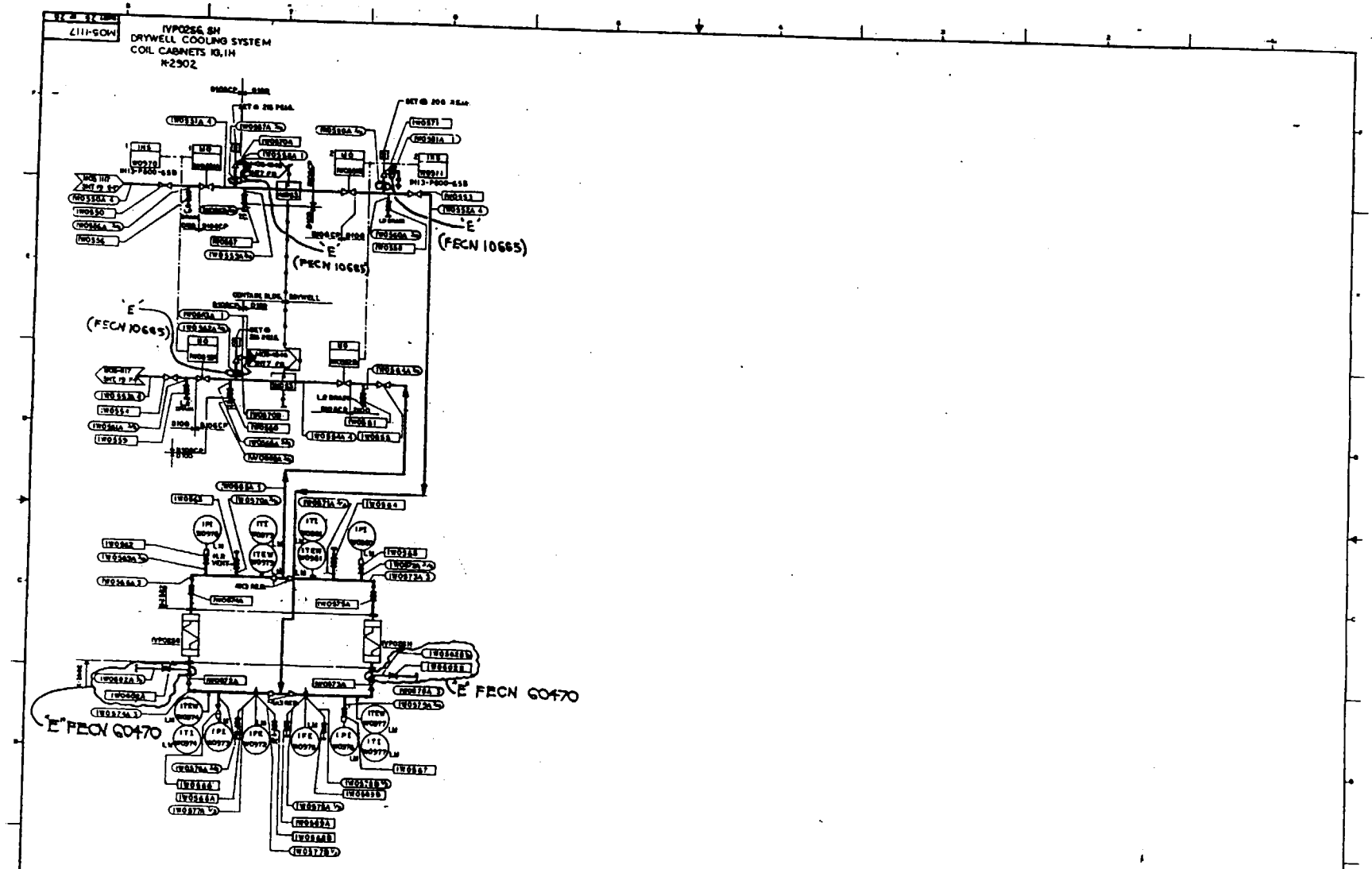

REV. 5
CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT
FIGURE 9.2-14
DRYWELL CHILLED WATER SYSTEM
SHEET 1 OF 2
OIL COOLER



CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 9.2-15

STATION CHILLED WATER SYSTEM
SHEET 1 OF 26



CLINTON POWER STATION
UPDATED SAFETY ANALYSIS REPORT

FIGURE 9.2-15

STATION CHILLED WATER SYSTEM
SHEET 26 OF 26

General Discussion of LOCA-Generated Waterhammer in CPS Drywell Cooling Systems

Description of Systems

The Drywell Cooling (VP) System and Supplemental Drywell Cooling systems (WO) are non-safety-related, closed-loop systems that support normal operation of the plant. The systems' containment isolation valves are open during normal operation and receive a close signal in the event of a LOCA (High Drywell Pressure or Reactor Vessel Low Water Level).

Each system contains a pressurized head tank located outside containment that provides system make-up and maintains the required pressure on the suction of the respective system pumps, which are also located outside containment. The make-up for each system is also non-safety related.

The VP system contains a compression tank located in the auxiliary building at approximately elevation 757' that is normally pressurized to 35 psig. The VP system pumps operate with a normal discharge pressure of approximately 100 psig. On a loss of offsite power the pumps are tripped, but the system water volume is maintained since the system is closed and pressurized. On a containment isolation signal, the volume of water in the closed system inside containment (drywell) is also trapped within the containment/drywell, maintaining this loop water solid. Since the loop is water solid, any heat-up from elevated drywell ambient temperatures will cause expansion of the fluid, which will lift relief valve 1VP024A or B. These thermal relief valves are set at 140 psig and are located inside the drywell. Additional relief valves (1VP027A/B and 1VP023A/B) are located inside containment and protect the length of piping between the containment isolation valves.

The WO system provides chilled water for power generation systems throughout the plant, including containment cooling and drywell supplemental cooling. It contains a compression tank located outside containment at elevation 762' that is normally pressurized to 75 psig. The remaining aspects of this system are similar to the VP System, except that relief valve 1WO327 is set at 250 psig.

System Response to a DBA LOCA

Due to the slow heat-up caused by ambient heat transfer through the piping insulation, the relief valves 1VP024A/B are not expected to lift (pop), but to "weep" maintaining system pressure very near to 140 psig. However, if the relief valves do lift, the minimum expected reset pressure is 140 psig – 10% (i.e., 125 psig). The maximum design drywell temperature during a DBA LOCA is 330°F, which is well below the saturation temperature at 125 psig. The maximum containment temperature of 185°F is also below the saturation temperature at atmospheric pressure.

The maximum temperature of 330°F occurs during a postulated Main Steam Line Break (MSLB) and is short lived. The temperature decays to less than 250°F in less than 10 seconds and to approximately 240°F in 100 seconds. The drywell temperature following a Recirculation Line break has a lower peak and also falls to approximately 240°F within 100 seconds. [See USAR figures 6.2-3 and 6.2-12 (copies provided as pages 4 and 5 of this attachment).] In less than two

minutes, sufficient heat transfer cannot occur between the atmosphere and the insulated piping for the fluid to exceed 240°F.

The emergency operating procedures (EOP-6) allow operators to restore drywell cooling if drywell temperature exceeds preset limits (150°F). Restoration requires defeating the containment isolation interlocks by installing jumpers per EOP support procedure 4410.00C006. This procedure contains cautions to prevent water hammer if drywell temperature is above 212°F when restoring chilled water flow. These cautions require maintaining a compression tank pressure of at least 30 psig if temperature is up to 270°F prior to opening the containment isolation valves. (Saturation pressure at 270°F is approximately 27 psig.) Normal tank pressure is higher than 30 psig for both systems. The EOP's do allow the emergency response organization to provide other guidance, if needed.

In a DBA LOCA, the predicted drywell temperature after 100 seconds is about 240°F, which corresponds to a saturation temperature of approximately 10 psig. Accounting for elevation differences, the static pressure in either the VP or WO system will be above saturation pressure for a temperature of 240°F at all points in the system, with about 5 psi of margin.

Water Hammer Discussion

Since the pressure in the VP and WO systems is not expected to drop below saturation pressure following a LOCA, a significant vapor bubble cannot form. These systems have already been evaluated for conventional water hammer (bubble collapse) impact on the containment isolation valves for conservatism.

Even if post-LOCA temperatures caused the formation of a vapor bubble in the system(s), the bubble that would be formed would cause only the conventional water hammer already evaluated. The vapor would collect at high points in the system, forming a limited size bubble that would collapse at a wave speed corresponding to the pumping rate or less. This type of bubble has been evaluated for impact to the containment isolation valves as described in the CPS supplemental response to GL 96-06 dated June 15, 1998. No other parts of the systems inside the drywell are safety related. These systems are evaluated for seismic interactions (II over I concerns), but breach of system integrity following a LOCA is not a concern for equipment qualification or flooding. (By design, the Mark III containment forms a large pool inside the drywell following a LOCA. Increased water inventory would increase heat sink size and decrease the severity of the accident).

NUREG/CR 5220 attributes condensation-induced water hammer to five different phenomena and places them in five corresponding classes. The watercannon and thermal inversion classes require physical configurations unlike those present in a drywell cooling system.

The subcooled water slug that can occur in long horizontal lines requires a large void, a high pressure steam source, and fill water that is subcooled. In the configurations applicable to the drywell cooling systems, a large void cannot form and no steam source is available. If a void is formed, the wave front of water that will approach any void will be at approximately saturation temperature, so a sudden collapse due to condensation will not occur, although conventional water hammer may occur.

Saturated water slugs occur in lines that are steam/vapor filled with a condensation slug forming at a low point in the system. In a drywell cooling system, this would require a complete system draindown. The CPS configuration is such that only a breach of the piping would allow such a draindown.

Although the system configuration does not have closed valves in vertical piping that could provide a location for component-trapped voids, high points at coolers could constitute a similar configuration. However, in this case the impact surface is not flat and the differential pressure is driven by the pumping rate. As described in NUREG/CR 5220, volume I, the slug velocities are limited by the pumping rate. For small relatively low flow rate in lines such as the drywell cooling system (at high points, the lines are no larger than 8" and flow rates are no greater than 830 gpm), the impact velocity is similar to the conventional water hammer velocities already evaluated.

Summary:

The configuration and operation of the VP and WO systems is such that no vapor bubble is expected to form under design basis accident conditions. For conservatism, CPS evaluated a conventional water hammer event for its impact on the containment isolation valves. If a vapor bubble does form, its size will be limited and the basic system configuration will prevent a water hammer of greater magnitude than the conventional water hammer already evaluated.

Additional Pages:

Drywell Temperature profiles – 2 pages
Drywell Cooling P&ID (Div 1 only) – 1 page (Attachment 2, page 3 of 5)
Supplemental Cooling P&ID (portions) – 2 pages (Attachment 2, pages 4 and 5)

References:

1. P&ID's M05-1109, sheets 2 and 3
2. P&ID's M05-1117, sheets 1, 19, 20, and 26
3. Wiring Diagrams E02-0WO99, sheets 9 and 10
4. Wiring Diagrams E02-1VP99, sheets 7, 8, 9, 10, 11, 12, and 13
5. Emergency Operating Procedure 6, Primary Containment Control
6. EOP Support Procedure 4410.00C006, Defeating VP/WO Interlocks
7. M06-1109, sheets 3, 4, 5, 6, and 9
8. M07-1109, sheet 2
9. M06-1117, Sheets 53, 60 , 61, 62, and 63

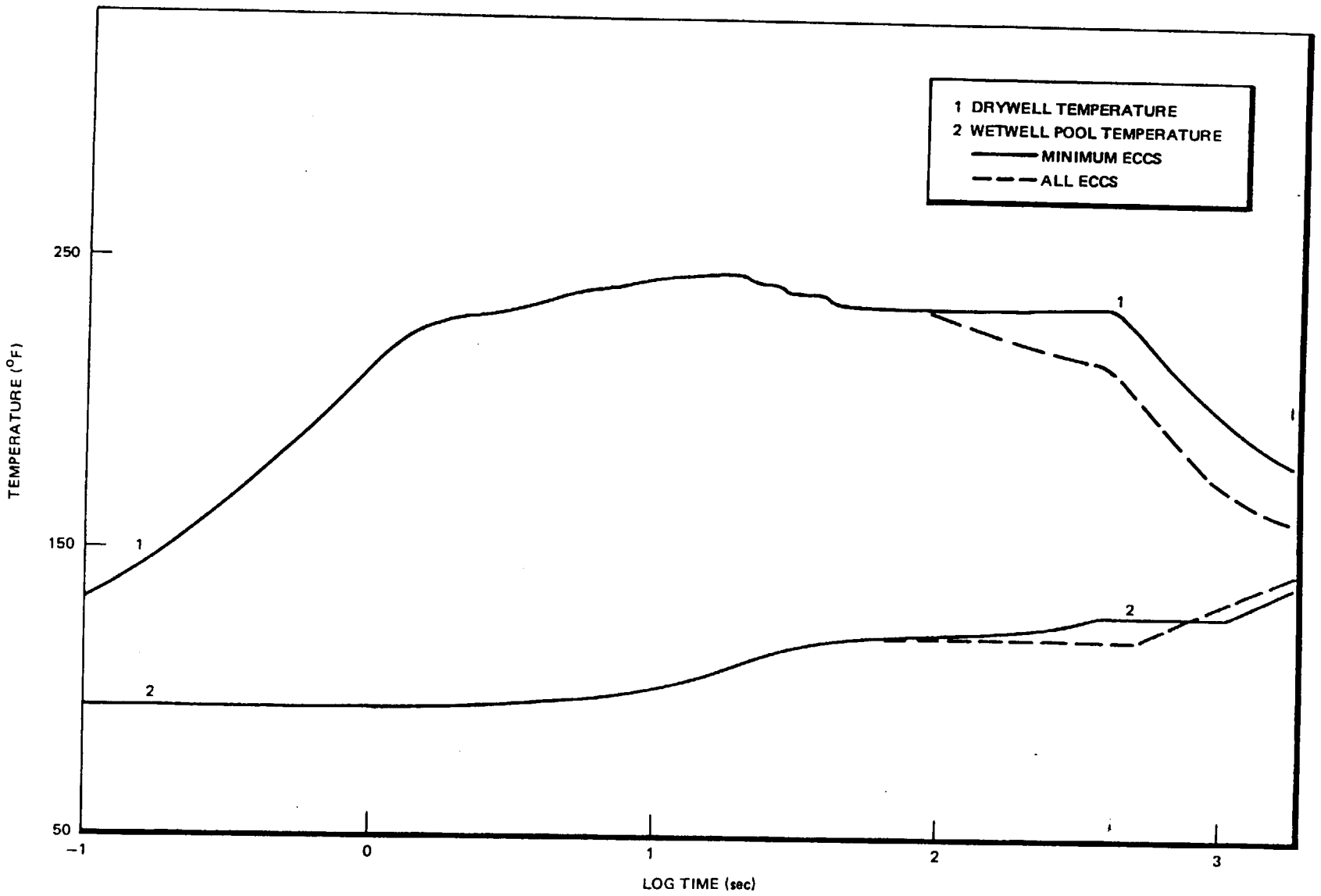


Figure 6.2-3. Short-Term Temperature Response Following a Recirculation Line Break

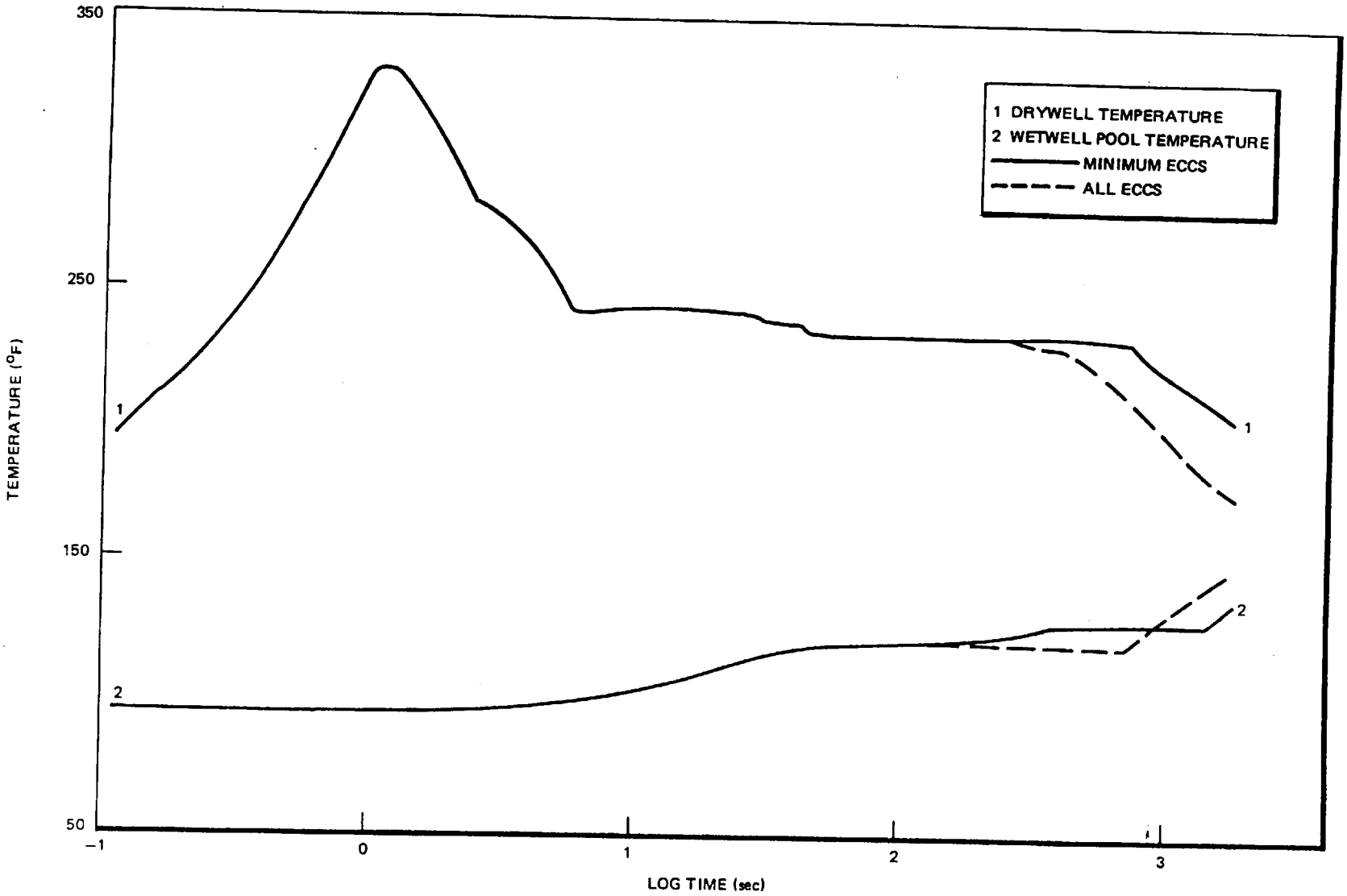


Figure 6.2-12. Short-Term Temperature Response Following a Main Steamline Break

The following Table provides a summary of the disposition of all the CPS containment penetrations related to the penetration pressurization issue discussed in Generic Letter 96-06. This table is an updated version of Attachment 3 to CPS letter dated January 28, 1997. The 23 justification categories provided in the earlier letter have been summarized into 7 categories. Penetrations listed as crediting valve leakage in the earlier letter are now noted with the final disposition. Penetrations with multiple lines are annotated if the justification is different for the different lines. Some typographical errors were also corrected.

NO.	SYSTEM	DESCRIPTION	JUSTIFICATION
1MC-001		Equipment Hatch	2
1MC-002		Personnel Lock	2
1MC-003		Personnel Lock	2
1MC-004		Fuel Transfer Tube	2
1MC-005	MS	Main Steam "C"	2
1MC-006	MS	Main Steam "A"	2
1MC-007	MS	Main Steam "D"	2
1MC-008	MS	Main Steam "B"	2
1MC-009	FW	Feedwater "A"	1
1MC-010	FW	Feedwater "B"	1
1MC-011	RH	RHR Pump Suction "A"	1
1MC-012	RH	RHR Pump Suction "B"	1
1MC-013	RH	RHR Pump Suction "C"	1
1MC-014	RH	RHR Shutdown Suction	6
1MC-015	RH	RHR LPCI "A"	3
1MC-016	RH	RHR LPCI "B"	3
1MC-017	RH	RHR LPCI "C"	1
1MC-018	RH	RHR Test to Supp. "A"	1
1MC-019	RH	RHR Test to Supp. "C"	1
1MC-020	RH	RHR Test to Supp. "B"	1
1MC-021	RH	RHR "A" P.R.V	1
1MC-022		Spare	2
1MC-023	RH	RHR "A" P.R.V.	1
1MC-024	RH	RHR "A" P.R.V.	1
1MC-025	RH	RHR "B" P.R.V. (Pump Suction)	1
1MC-026	RH	RHR "B" P.R.V. (Heat Exchanger)	1
1MC-027	RH	RHR "B" P.R.V. (Shutdown Return)	1
1MC-028	RI	RCIC Pump Suction	1
1MC-029	RH	RHR "C" P.R.V. (Pump Suction)	1
1MC-030	RH	RHR "C" P.R.V. (Pump Discharge)	1
1MC-031	RH	RHR "B" P.R.V. (Crosstie to RCIC)	1
1MC-032	LP	LPCS Pump Suction	1
1MC-033	HP	HPCS Test to Supp.	1
1MC-034	SF	Suppression Pool Clean Up	1
1MC-035	HP	HPCS Pump Discharge	1
1MC-036	LP	LPCS Pump Discharge	1
1MC-037	HP	HPCS Pump Suction	1
1MC-038	LP	LPCS P.R.V. (Pump Discharge)	1
1MC-039		Spare	2

NO.	SYSTEM	DESCRIPTION	JUSTIFICATION
1MC-040	RI	RCIC Min. Flow	1
1MC-041	RI	RCIC Turbine Steam Exhst.	2
1MC-042	RI	RCIC Head Spray	1
1MC-043	RI	RCIC Turbine Steam Supply	2
1MC-044	RI	RCIC Turbine Vacuum breaker	2
1MC-045	MS	Main Steam Drain	4
1MC-046	CC	CC Supply	6
1MC-047	CC	CC Return	6
1MC-048	SX	SX Service Water Supply	5
1MC-049	RA	Breathing Air	2
1MC-050	MC	Make-up Condensate (MC)	3
1MC-051		Spare	2
1MC-052	FC	Fuel Pool Cooling & Cleanup	3
1MC-053	FC	Fuel Pool Cooling & Cleanup	3
1MC-054		Spare	2
1MC-055		Spare	2
1MC-056	FP	F.P. Containment Standpipe	3
1MC-057	IA	Instrument Air	2
1MC-058	IA	Instrument Booster Air	2
1MC-059	SA	Service Air	2
1MC-060	RT	RWCU Pump Supply	4
1MC-061	RT	RWCU Pump Return	4
1MC-062	HG	Hydrogen Recombiner to Cont.	2
1MC-063	RD	C.R.D. Pump Discharge	1
1MC-064	RT	RWCU to RHR Return	4
1MC-065	WX	Radwaste Repro. & Disposal	3
1MC-066		Spare	2
1MC-067	SA	Containment SA (Cnmt. Press)	2
1MC-068	PS	PS - CNTM ATMOS	2
1MC-069	RE	Cont. Equipment Drains RE	2
1MC-070	RF	Containment Floor Drains RF	2
1MC-071	HG	Hydrogen Recombiner from Cont.	2
1MC-072	HG	Hydrogen Recombiner to Contnt.	2
1MC-073		Spare	2
1MC-074		Decontamination	2
1MC-075		Spare	2
1MC-076	RH	RHR P.R.V. (Drain)	1
1MC-077		Spare	2
1MC-078	CC	Component Cooling Water	2
1MC-079	SF	Suppression Pool Clean-Up	1
1MC-080		Spare	2
1MC-081	FP	Fire Protection	2
1MC-082	FP	Fire Protection	2
1MC-083		Spare	2
1MC-084		Spare	2
1MC-085	CY	Cycle Condensate	2
1MC-086	RT	RWCU to Condenser	7

NO.	SYSTEM	DESCRIPTION	JUSTIFICATION
1MC-087	RH	RHR "A" P.R.V.	1
1MC-088	CC	CCW Return	2
1MC-089	RH	RHR Ht. Exch. Shell Vent	2
1MC-101	VR	Cont. Vent Air Supply	2
1MC-102	VQ	Cont. Vent Air Purge & Exhaust	2
1MC-103	WO	Cont. Cooling Chilled Water Supp.	2
1MC-104	WO	Cont. Cooling Chilled Water Return	2
1MC-105		Spare	2
1MC-106	VR	Continuous Cnmt. Purge Air Exh.	2
1MC-107	VP	Drywell Cooling Water Supp.	3
1MC-108	VP	Drywell Cooling Water return.	3
1MC-109	VP	Drywell Cooling Water Supp.	3
1MC-110	VP	Drywell Cooling Water return.	3
1MC-111		Spare	2
1MC-112		Spare	2
1MC-113	VR	Cnmt. Purge Air Supply	2
1MC-114		Spare	2
1MC-115		Spare	2
1MC-116	SC	Standby Liquid Control	2
1MC-150	CM	Cnmt. Pressure Monitors	1, 2*
1MC-151	CM	Cnmt. Pressure Monitors	2
1MC-152	CM	Containment Monitoring	2
1MC-153	CM	Drywell Pressure	2
1MC-154		Spare	2
1MC-155		spare	2
1MC-156	VG	Conmnt.Pressure (SGTS Train A)	1, 2*
1MC-157	CM	Suppression Pool Water Level	1, 2*
1MC-158		Spare	2
1MC-159		Spare	2
1MC-160	CM	Containment Monitoring System	1
1MC-161		Spare	2
1MC-162		Spare	2
1MC-163		Spare	2
1MC-164	SM	Suppression Pool Makeup	1, 2*
1MC-165	VR	Containment Differential Pressure	2
1MC-166	HG	Hydrogen Recombiner from Comnt	2
1MC-167	VG	Contmnt Pressure (SGTS Train B)	2
1MC-168	CM	Containment Differential Pressure	2
1MC-169	VR	Contmnt. Purge Damper Control	2
1MC-170		Spare	2
1MC-171	SM	Suppression Pool Makeup	1, 2*
1MC-172	RH	RHR Ht. Exch. Shell Vent	2
1MC-173	CM	Containment Monitoring System	2
1MC-174		Spare	2
1MC-175		Spare	2
1MC-176		Spare	2
1MC-177	RI	Supp. Pool Water Level (RCIC)	1

NO.	SYSTEM	DESCRIPTION	JUSTIFICATION
1MC-178		Spare	2
1MC-179	HP, SM	H.P. Core Spray System & Suppr Pool Make-Up	1
1MC-180	HP	H.P. SUP. PooL LEVEL	1, 2*
1MC-181	SM	Supp. Pool Water Level	1
1MC-182		Spare	2
1MC-183	CM	Supp. Pool Water Level	1, 2*
1MC-184		Spare	2
1MC-200	RI	Supp. Pool Water Level (RCIC)	1,2*
1MC-201		Spare	2
1MC-202		Spare	2
1MC-203	CM	Containment Monitoring	2
1MC-204	SX	S/D Service Water	5
1MC-205	SX	S/D Service Water	5
1MC-206	IA	Instrument Air	2
1MC-207		Spare	2
1MC-208	SX	S/D Service Water Return	5
1MC-209		Spare	2
1MC-210	PS	Post Accident Sample	2
1MC-211		Spare	2

*Multiple lines share the penetration. Some, but not all, are water filled during normal operation. The lines not water filled are dependent on the other listed justification.

Justification Codes:

1 Line cannot pressurize due to arrangement of containment isolation valves. These lines either have no inboard isolation valve or one of the containment isolation valves is a check valve installed to prevent pressure buildup inside the penetration.

2 Line is not water filled during normal operation. The process fluid is steam or air, or the penetration is spare, or it is abandoned.

3 A relief valve or expansion chamber is installed between the isolation valves, or an air operated globe valve provides pressure relief.

4 Process operating temperature is hotter than containment atmosphere temperature post-LOCA. Line will cool after a plant trip.

5 Valves are not closed post-LOCA. Surveillance procedures have been modified to cycle one valve at a time

6 Inboard valve is a flex wedge gate with the inboard disk drilled or otherwise bypassed.

7 ASME Appendix F methodology used to demonstrate pipe will plastically deform rather than burst.