Docket files

May 20, 1981

Docket No. 50-219
LS05-81-05-035

MEMORANDUM FOR: D. M. Crutchfield, Chief
Operating Reactors Branch 5, DL

FROM: W. A. Paulson, Project Manager
Operating Reactors Branch 5, DL

SUBJECT: SUMMARY OF MEETING HELD WITH JERSEY CENTRAL POWER & LIGHT COMPANY (JCP&L) TO DISCUSS HIGH ENERGY LINE BREAKS INSIDE CONTAINMENT (SEP TOPIC III-5.A.)

On April 13, 1981, a meeting was held in Bethesda, Maryland, with representatives of JCP&L. The purpose of the meeting was to discuss SEP Topic III-5.A with regard to the Oyster Creek Nuclear Generating Station. Enclosure 1 is a list of attendees.

The following items were discussed during the meeting:

1. JCP&L responses to NRC questions raised during the March 25, 1981 meeting.

2. JCP&L response to the NRC request for additional information on the analysis of the 0.35 square-foot break.

3. Brief discussion on pipe break interaction evaluations.

A handout provided by JCP&L that provides responses to certain NRC concerns is enclosed (Enclosure 2).

Original signed by

Walter A. Paulson, Project Manager
Operating Reactors Branch 5

Enclosures: As stated

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DATE	5/15/81	5/19/81	5/19/81	5/20/81

DISTRIBUTION FOR MEETING SUMMARY

Docket 50-219
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Walter A. Paulson, Project Manager
Operating Reactors Branch 5

Enclosures: As stated

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ENCLOSURE 1

Attendance List

MEETING WITH JERSEY CENTRAL POWER & LIGHT CO.

APRIL 13, 1981

SYSTEMATIC EVALUATION PROGRAM TOPIC III-5.A
PIPE BREAKS INSIDE CONTAINMENT

Name	Affiliation
W. Paulson	NRC
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Yueh-Li C. Li	NRC
David Terao	NRC (MEB)
Pei-Ying Chen	NRC/SEPB
R. A. Hermann	NRC/SEPB
J. Knubel	JCP&L/GPU
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ENCLOSURE 2

April 13, 1981

OYSTER CREEK NUCLEAR GENERATING STATION UNIT 1

SEP TOPIC III-5.A
HIGH ENERGY PIPE BREAKS INSIDE CONTAINMENT

AGENDA

1. Response to NRC questions of March 25, 1981.

2. Response to NRC request for further information on analysis of 0.35 square foot break.

3. Pipe break interaction evaluations:

   a. NRC general questions.

   b. Spot check of previously identified targets based on detailed drawings.

RESPONSE TO NRC QUESTIONS OF MARCH 25, 1981

1. Questions which NRC indicated on March 25, 1981, needed additional response were: B.1, C.2, E.1 and F.2.

2. Question B.2

   a. Summary of Question: Correct any inconsistencies between Figures B-6, -8, -9, -10, and -16 and their respective tables in the submittal of February 6, 1979, and confirm that the analyses were performed on the finally selected locations.

   b. Response:

      (1) Figure B-6 shows 11 break locations while Table 6 shows ten break locations. Break location #6 in the figure did not appear in the stress table. This is because it is the mid-point of a straight run of pipe and therefore not a "mesh" point in the stress analysis. It was selected as a break point to satisfy the R.G. 1.46 requirement for breaks at two intermediate locations. The interaction analysis covered this break point.

      (2) Figure B-8 shows 11 break locations while Table 8 includes four break locations. Break locations 2, 3, 4, 7, 8, 9 and 10 did not appear in the table. These break locations were deleted based on the revised seismic analyses, as documented in the submittal of February 6, 1979, Page 5. Accordingly, while these break locations were included in the original interaction evaluation, they were <u>not</u> included in any subsequent evaluations.

      (3) Figure B-9 shows six break locations while Table 9 includes four break locations. Break locations 2 and 3 did not appear in the table. These breaks were deleted based on revised seismic analyses. Accordingly, while included in the original interaction evaluation, they were <u>not</u> included in any subsequent evaluations.

      (4) Figure B-10 shows four break locations while Table 10 shows three break locations. Break

location #3 is missing from the table. The reason for this is not clear. This break was included in the analyses.

(5) Break locations 3 and 4 in Figure B-16 are at different locations than given in Table 16. The break locations in the table are the correct ones, although the break locations in the figure were the ones analyzed. It is considered, however, that this would not significantly affect the evaluations because:

(a) The correct location for break #3 is adjacent to break #1 and would have the same analysis results.

(b) While the correct location for break #4 was not analyzed, the break locations 3 and 4 which were analyzed need not have been. The net effect is that one extra break was analyzed.

3. Question C.2

a. Summary of Question: The original question asked for confirmation that the only targets struck by jet impingement are cable trays, and do not include additional targets such as the containment, the biological shield, valve operators, pump motors, pipe lines, etc. During the discussions on March 25, 1981, it was indicated that additional targets were struck by jet impingement, but were shown to be capable of withstanding the jet. Accordingly, the question was revised to request references to information discussing additional targets which were considered.

b. Response:

(1) Containment: Page 7 of Attachment 7C to the document submitted on September 7, 1978, indicates that previous analyses demonstrated the ability of the containment wall to withstand the effects of jet impingement. A report of the test work which supports this conclusion was included as Attachment B to the document submitted on July 30, 1979.

(2) Biological Shield: Page 4 of the document submitted on September 7, 1978, summarizes

evaluations which showed that jet impingement forces would not cause damage to the biological shield or shield gates. The evaluations were included as Attachment 6B. Additional information is included as Attachment 7G in response to NRC questions on Attachment 6B. This information is summarized on Pages 7 and 8.

(3) Valve Operators: Appendix C to Attachment 7C of the document submitted on September 7, 1978, contains various references to valve operators which were considered in the interaction evaluation.

(4) Pump Motors: The only pump motors inside containment are those for the recirculation pumps. Operation of these pumps is not required for a safety function. Accordingly, these motors were not included in the interaction evaluation.

(5) Pipe Lines: Mechanical interactions between jets and pipe lines were not included in the original interaction evaluation. This was the reason the NRC requested on February 6, 1979, that such effects be considered for Category 2 and 3 breaks. The response to this NRC question is contained in the document submitted to the NRC on July 30, 1979.

4. Question E.1

a. Summary of Question: Provide the basis for the assumption that plastic deformation will not take place in the containment penetration assemblies.

b. Response: It was indicated during the meeting of March 25, 1981, that this topic had been previously discussed with the NRC, most likely in Amendment Number 50, although the pertinent documentation had not been included in the documentation submitted in conjunction with SEP Topic III-5.A. It has since been confirmed that both Amendments 50 and 51 contain the pertinent information.

5. Question F.2

a. Summary of Question: Provide the basis for concluding there are no adverse effects associated with cascading breaks, e.g., break number 1 in the recirculation piping interacts with the north main steam line, which in turn interacts with the north feedwater and control rod drive hydraulic return lines.

b. Response: The document submitted on July 30, 1979, included an analysis of the secondary effect of each postulated pipe break which resulted in an interaction with other piping. The approach taken was to show that each "target" pipe had been considered during the detailed evaluations of the primary effects of pipe whip and the effects of jet impingement on electrical equipment and adjacent piping, and were shown to not prevent safe shutdown. Accordingly, it was concluded there should be no adverse secondary effects.

Cascading breaks clearly increase the number of "target" pipes which can occur as a result of an initial break. However, except for the effect on blowdown transients which are evaluated in accordance with the requirements of Appendix K to 10CFR50, the conclusions of the analysis of secondary breaks are applicable as well to cascading breaks. For example, in the particular cascading break described in the NRC question, a break in the recirculation line, the main steam line, the feedwater line and the control rod drive hydraulic return line can each be shown to not prevent safe shutdown. Accordingly, the combination of these events would have the same result, i.e., safe shutdown would not be prevented.

SPOT CHECK OF PREVIOUSLY IDENTIFIED TARGETS

BREAK POINTS SELECTED BY THE NRC

1. Cleanup return line, 6-inch ND-10, Isometric Figure B-8, break point number 1 (a Category 3 break*).

2. Emergency condenser, 10-inch NE-2 from NE01-B, Isometric Figure B-3, break point number 1 (a Category 2 break).

3. Feedwater south, 10-inch RF-2, Isometric Figure B-12, break point number 2 (a Category 2 break).

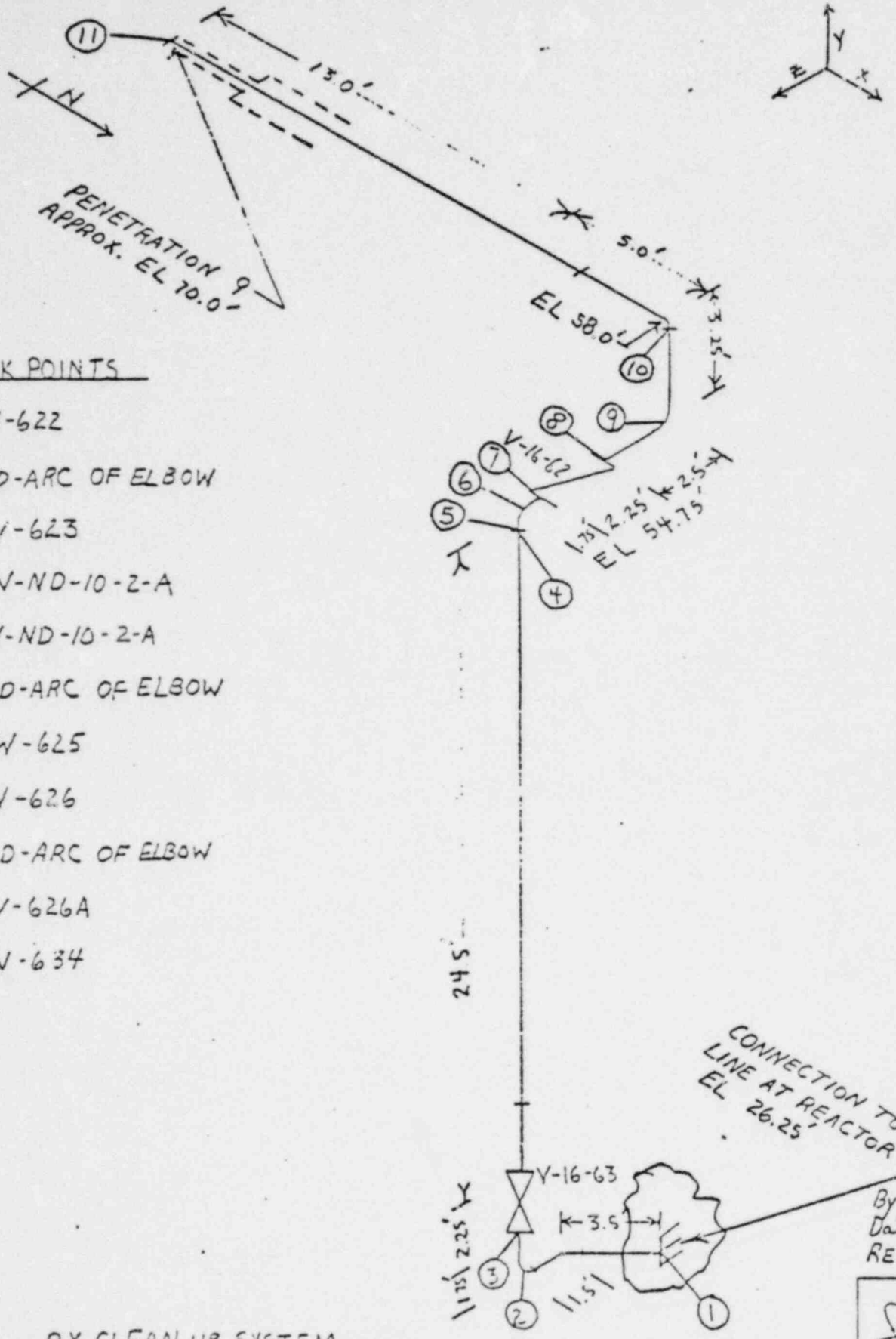
4. Recirculation loop B, 25-inch, Isometric Figure B-15, break point number 1 (a Category 2 break).

5. Core spray south, 8-inch NZ-3, Isometric Figure B-5, break point number 1 (a Category 1 break).

The following information from Attachment 7C to the document submitted on September 7, 1978, is included for each of these five break points:

- The isometric drawing.
- The tabular interaction matrix summary in Appendix C.
- The written evaluation summary in Appendix C.

*Category 1 - No unacceptable interactions
Category 2 - Unacceptable interaction at location of low stress
Category 3 - Unacceptable interaction at location of high stress



BREAK POINTS

1- FW-622

2- MID-ARC OF ELBOW

3- FW-623

4- SW-ND-10-2-A

5- SW-ND-10-2-A

6- MID-ARC OF ELBOW

7- FW-625

8- FW-626

9- MID-ARC OF ELBOW

10- FW-626A

11- FW-634

By: G.T.R
Date: 6/17/74
REV. 1

RX CLEAN UP SYSTEM

6" ND-10, SS-A312 TP 316, Design P-1250 psig, T- 575°F

LEGEND:

U - Unacceptable Interaction (Damage Possible)

A - Acceptable Interaction (Damage not Possible)

N - No Interaction

		SOURCE										
	System	REACTOR CLEANUP										
	Line	6" ND-10 (To Recirculation Piping)										
	ISO	B-8										
TARGET	Bk. Pt.	1	2	3	4	5	6	7	8	9	10	11
Emergency Condenser	NE01-B 10" NE-5	N	N	N	N	N	N	N	N	N	N	N
	NE01-A 10" NE-5											
	NE01-B 10" NE-2											
	NE01-A 10" NE-2											
Core Spray	(South) 8" NZ-3											
	(North) 8" NZ-3											
Main Steam	(South) 24" MS											
	(North) 24" MS											
Reactor Cleanup	6" ND-10	-	-	-	-	-	-	-	-	-	-	-
	6" ND-1	N	N	N	N	N	N	N	N	N	N	N
Shutdown Cooling	14" NU-1, NU-4											
	14" NU-2, NU-3											
Feedwater	(South) 10" RF-2											
	(South) 18" RF-2											
	(North) 10" RF-2											
	(North) 18" RF-2											
Liquid Poison - 1.5" NP-2												
Reactor Vessel Head Cooling 2" RHC-2												
Reactor Recirc.	(Loop A)											
	(Loop B)											
	(Loop C)											
	(Loop D)											
	(Loop E)											
Reactor Recirc.	(Bypass A)											
	(Bypass B)											
	(Bypass C)											
	(Bypass D)											
	(Bypass E)											
Control Rod Drive	3" NC-4, NC-2											
	(Supply) 1" NC-3											
	(Return) 3/4" NC-3											
Containment Spray	14" CS-2, NQ-2											
	12" NQ-2											
	10" NQ-2				A	A	A	A				
	8" NQ-2											
Reactor [illegible]sel					N	N	N	N				
Biologic[illegible] Shield Wall												
Main Steam Relief Valve Discharge												
	8" (4 lines)											
	14" (2 lines)											
Main Steam Safety Valve Discharge												
	8" (16 lines)											
Containment [illegible]ssel Shell					U	U						
Electrical	(Whip)				N	N						
	(Impingement)	U	U	U	N	N	N	N	N	N	N	N

at the third elbow downstream of the reactor which would result in an unacceptable interaction with 3" NC-4 at elevation 75', azimuth 270° of Sheet 5 (3) or in an acceptable interaction with the Biological Shield Wall at elevation 82', azimuth 270° of Sheet 5 (3).

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 56', azimuth 270° or an unacceptable interaction with 3" NC-4 at elevation 75', azimuth 270° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the connection at penetration 28 which would result in an unacceptable interaction with 10" RF-2 (north) at elevation 49', azimuth 260° of Sheet 4 (3).

A circumferential break at point 4 will not result in interaction with any of the listed targets (2).

A break at point 3 will result in an unacceptable jet impingement interaction with the cable tray at elevation 44', azimuth 210° of Sheet 3 (3). A break at any of the remaining points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

REACTOR CLEANUP SYSTEM - 6" ND-10

A circumferential break at point 1 will not result in an interaction with any of the listed targets.

A circumferential break at either point 2 or 3 will most likely cause the pipe to whip about a hinge formed at the connection to the recirculation piping in such a manner as to result in no interactions.

A circumferential break at point 4 or 5 will most likely place the connection to the recirculation piping in torsion causing the pipe to whip in such a manner as to result in an acceptable interaction with 8" NQ-2 at elevation 37', azimuth 25° of Sheet 3 (3). Such a break could also cause the pipe to whip about a hinge formed at the connection to the recirculation piping which would result in an unacceptable interaction with the containment vessel at elevation 51', azimuth 65° of Sheet 4 (3).

A circumferential break at point 6 or 7 will most likely place the connection to the recirculation piping in torsion causing the pipe to whip in such a manner as to result in an acceptable interaction with 8" NQ-2 at elevation 37', azimuth 25° of Sheet 3 (3). Such a break could also cause the pipe to whip about a hinge formed at the connection to the recirculation piping which would have the same result.

A circumferential break at points 8 thru 11 will not result in pipe whip as check valve V-16-62 isolates these points from the energy reservoir (reactor).

A break at point 1, 2, or 3 will result in an unacceptable jet impingement interaction with the cable tray at 40', azimuth 80°-90° of Sheet 3 (3). A break at any of the remaining points postulated on this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

REACTOR CLEANUP SYSTEM - 6" ND-1

A circumferential break at point 1 will not result in an interaction with any of the listed targets (1).

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection to the recirculation piping in such a manner as to result in no interactions with any of the listed targets.

A circumferential break at either point 3 or 4 will most likely cause the pipe to whip about a hinge formed at the connection to recirculation piping in such a manner as to result in an acceptable interaction with 24" MS (south) at elevation 60', azimuth 90° of Sheet 5 (3).

A circumferential break at point 5 will most likely place the connection to recirculation piping in torsion causing the pipe to whip in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 60', azimuth 95° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the first elbow downstream of the connection which would have the same result.

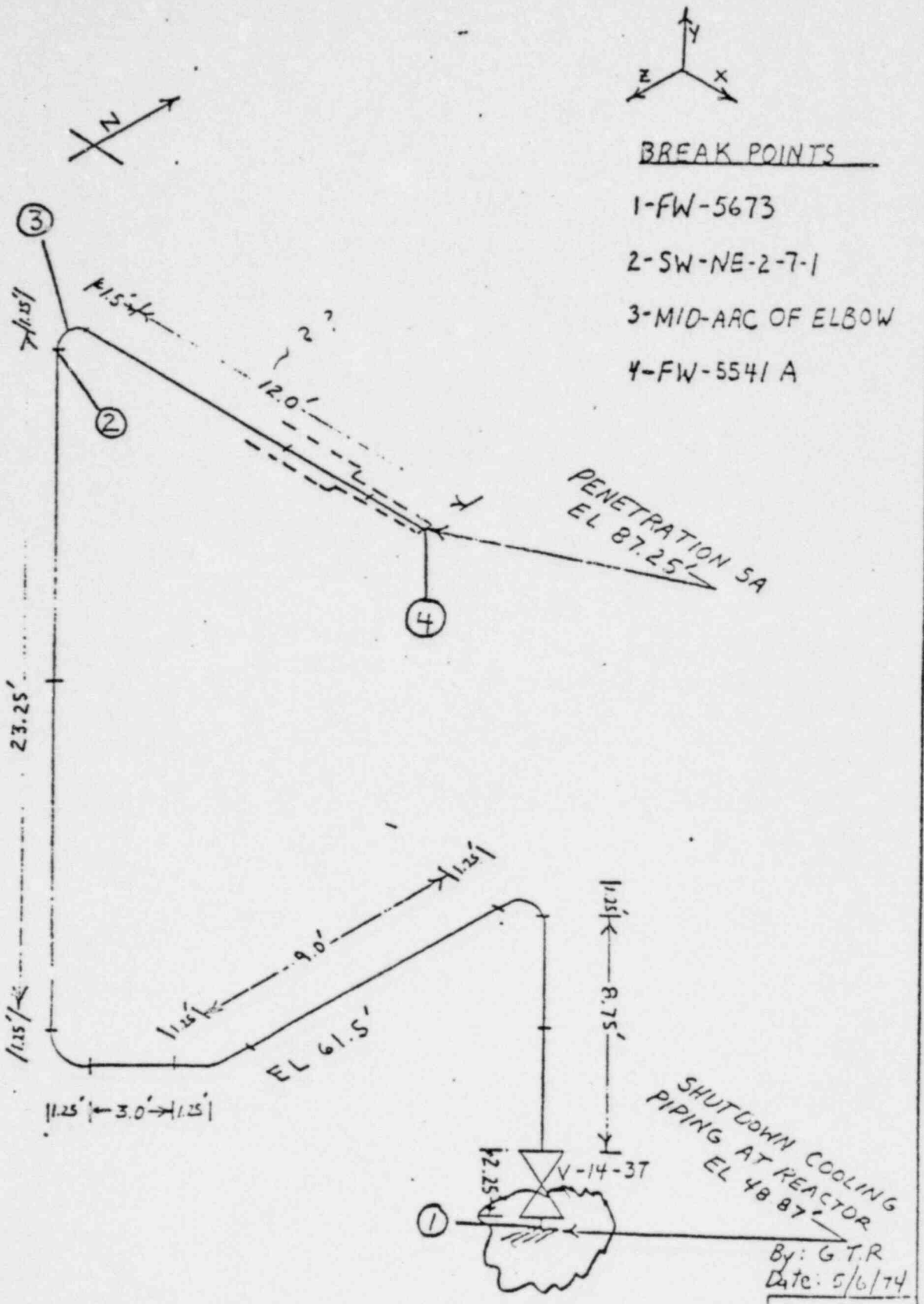
A circumferential break at point 6 will not result in an interaction with any of the listed targets (2).

A break at any of the points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

SHUTDOWN COOLING SYSTEM - 14" NU-1 and NU-4

A circumferential break at point 1 will not result in an interaction with any of the listed targets (1).

A circumferential break at either point 2 or 3 will most likely cause the pipe to whip about a hinge formed at the connection to the recirculation piping in such a manner as to result in an acceptable interaction with 14" NU-2 at elevation 49', azimuth 300° of Sheet 4 (3).



EMERGENCY CONDENSER SYSTEM (NE01-B to Reactor)

10" NE-2, SS-A312 TP 316, Design - P-1250 psig, T-575 °F

LEGEND:

U - Unacceptable Interaction (Damage Possible)

A - Acceptable Interaction (Damage not Possible)

N - No Interaction

		SOURCE							
	System	EMERGENCY CONDENSER							
	Line	10" NE-2 (from NE01-B)				10" NE-2 (from NE01-A)			
	ISO	B-3				B-4			
TARGET	Bk. Pt.	1	2	3	4	1	2	3	4
Emergency Condenser — NE01-B 10" NE-5		N	N	N	N	N	N	N	N
Emergency Condenser — NE01-A 10" NE-5		↓	↓	↓	↓	↓	↓	↓	↓
Emergency Condenser — NE01-B 10" NE-2		–	–	–	–	–	–	–	–
Emergency Condenser — NE01-A 10" NE-2		N	N	N	N				
Core Spray — (South) 8" NZ-3						N	N	N	N
Core Spray — (North) 8" NZ-3						↓	↓	↓	↓
Main Steam — (South) 24" MS									
Main Steam — (North) 24" MS									
Reactor Cleanup — 6" ND-10									
Reactor Cleanup — 6" ND-1									
Shutdown Cooling — 14" NU-1, NU-4									
Shutdown Cooling — 14" NU-2, NU-3			↓						
Feedwater — (South) 10" RF-2			A						
Feedwater — (South) 18" RF-2			N				↓		
Feedwater — (North) 10" RF-2							A		
Feedwater — (North) 18" RF-2							N		
Liquid Poison - 1.5" NP-2									
Reactor Vessel Head Cooling — 2" RHC-2									
Reactor Recirc. — (Loop A)									
Reactor Recirc. — (Loop B)									
Reactor Recirc. — (Loop C)									
Reactor Recirc. — (Loop D)									
Reactor Recirc. — (Loop E)									
Reactor Recirc. — (Bypass A)									
Reactor Recirc. — (Bypass B)									
Reactor Recirc. — (Bypass C)									
Reactor Recirc. — (Bypass D)									
Reactor Recirc. — (Bypass E)									
Control Rod Drive — 3" NC-4, NC-2									
Control Rod Drive — (Supply) 1" NC-3									
Control Rod Drive — (Return) 3/4" NC-3									
Containment Spray — 14" CS-2, NQ-2									
Containment Spray — 12" NQ-2									
Containment Spray — 10" NQ-2									
Containment Spray — 8" NQ-2									
Reactor Vessel				↓				↓	
Biological Shield Wall				A				A	
Main Steam Relief Valve Discharge — 8" (4 lines)									
Main Steam Relief Valve Discharge — 14" (2 lines)				N				N	
Main Steam Safety Valve Discharge — 8" (16 lines)									
Containment Vessel Shell									
Electrical — (Whip)		↓	↓	↓	↓	↓	↓	↓	↓
Electrical — (Impingement)		U				U			

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in an acceptable interaction with 10" NE-5 (reactor to NE01-B) at elevation 85', or with the reactor vessel at elevation 84', azimuth 335° of Sheet 6 (3). Such a break could cause the pipe to whip about a hinge formed at the first elbow downstream of the reactor which would have the same result.

A circumferential break at point 4 will not result in an interaction with any of the listed targets (2).

A break at any of the points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

EMERGENCY CONDENSER SYSTEM - 10" NE-2 (NE01-B to Reactor)

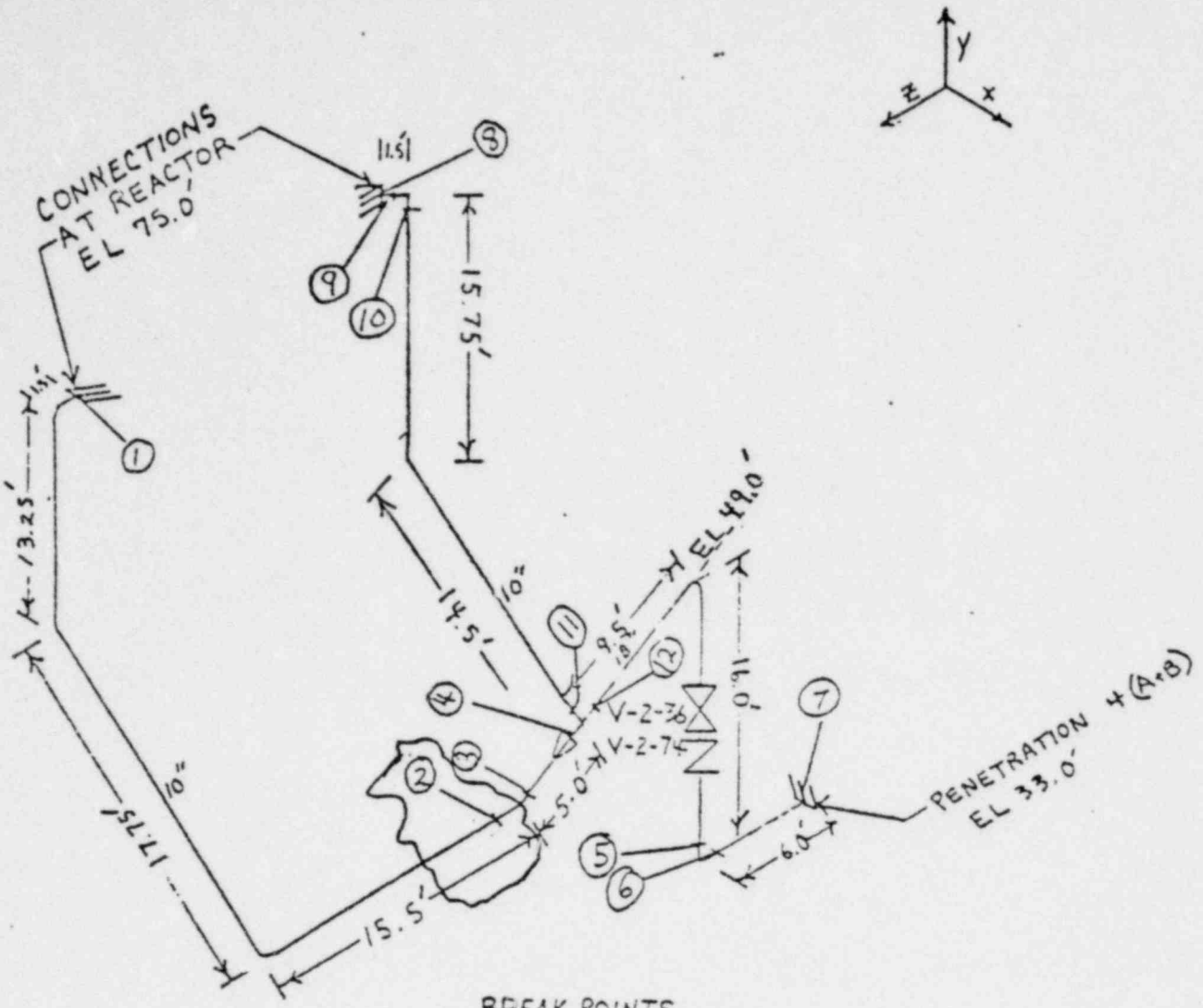
A circumferential break at point 1 will not result in an interaction with any of the listed targets (1).

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection to the Shutdown Cooling Piping in such a manner as to result in an acceptable interaction with 10" RF-2 (south) at elevation 75', azimuth 45° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the first weld upstream of the connection which would have the same result.

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection to the Shutdown Cooling Piping in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 82', azimuth 25° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the first weld upstream of the connection which would have the same result.

A circumferential break at point 4 will not result in an interaction with any of the listed targets (2).

A break at point 1 will result in an unacceptable jet impingement interaction with the cable tray at elevation 40', azimuth 300°-360° of Sheet 3 (3), or in an acceptable interaction with motor operators V-14-37, V-17-54 or V-17-19. A break at any of the remaining points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.



BREAK POINTS

North loop

Main line	Branch line
1-FW-1278	8-FW-1269
2-SW-1007	9-SW-1013
3-FW-1270	10-SW-1012
4-SW-1476	11-FW-1267
5-SW-1172A	
6-FW-1263	
7-SW-1364	

South loop

Main line	Branch line
1-FW-1287	8-FW-1283
2-SW-1022	9-SW-1028
3-FW-1284	10-SW-1027
4-SW-1477	11-FW-1281
5-SW-1173A	
6-FW-1277	
7-SW-1376	

By: G.T.R
Date: 6/10/71
REV-1

FEEDWATER SYSTEM (North and South)

10" and 18" RF-2, CS-A106 GRC, Design P-1250 psig
T-575 °F

Figure II-12

LEGEND:

U - Unacceptable Interaction (Damage Possible)

A - Acceptable Interaction (Damage not Possible)

N - No Interaction

		SOURCE											
	System	FEEDWATER											
	Line	10" RF-2 (North)				18" RF-2 (North)				10" RF-2 (North)			
	ISO	B-12				B-12				B-12			
TARGET	Bk. Pt.	1	2	3	4	5	6	7	12	8	9	10	11
Emergency Condenser	NE01-B 10" NE-5	N	N	N	N	N	N	N	N	N	N	N	N
	NE01-A 10" NE-5												
	NE01-B 10" NE-2												
	NE01-A 10" NE-2												
Core Spray	(South) 8" NZ-3												
	(North) 8" NZ-3												
Main Steam	(South) 24" MS					Y							Y
	(North) 24" MS					A							A
Reactor Cleanup	6" ND-10					N							N
	6" ND-1												
Shutdown Cooling	14" NU-1, NU-4												
	14" NU-2, NU-3												
Feedwater	(South) 10" RF-2												
	(South) 18" RF-2	Y	Y	Y	Y					Y	Y	Y	Y
	(North) 10" RF-2	-	-	-	-	Y	Y	Y	Y	-	-	-	-
	(North) 18" RF-2	N	N	N	N	-	-	-	-	N	N	N	N
Liquid Poison - 1.5" NP-2						N	N	N	N				
Reactor Vessel Head Cooling	2" RHC-2												
Reactor Recirc.	(Loop A)												
	(Loop B)												
	(Loop C)						Y	Y					
	(Loop D)						A	A					
	(Loop E)						N	N					
Reactor Recirc.	(Bypass A)												
	(Bypass B)												
	(Bypass C)												
	(Bypass D)												
	(Bypass E)	Y	Y	Y	Y								
Control Rod Drive	3" NC-4, NC-2	U	U	U	U								
	(Supply) 1" NC-3	N	N	N	N								
	(Return) 3/4" NC-3												
Containment Spray	14" CS-2, NQ-2												
	12" NQ-2												
	10" NQ-2	Y								Y	Y		
	8" NQ-2	U								U	U		
Reactor Vessel		N					Y	Y		N	N	Y	Y
Biological Shield Wall							A	A				A	A
Main Steam Relief Valve Discharge													
	3" (4 lines)						N	N				N	N
	14" (2 lines)						A	A					
Main Steam Safety Valve Discharge													
	8" (16 lines)					Y	N	N	Y				
Containment Vessel Shell						U	U		U				
Electrical	(Whip)	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y
	(Impingement)	N	U	U	U	N	U	U	U	N	N	N	N

FEEDWATER SYSTEM (NORTH) - 10" RF-2 and 18" RF-2

A circumferential break at point 1 will most likely cause the pipe to whip about a hinge formed at the connection between the tee and the reducer in such a manner as to result in an unacceptable interaction with 3" NC-4 at elevation 56', azimuth 290° of Sheet 4 (3), or with 8" NQ-2 at elevation 66', azimuth 315° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the third elbow upstream of the reactor which would have the same result.

A circumferential break at any of points 2 thru 4 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in an unacceptable interaction with 3" NC-4 at elevation 56', azimuth 290° of Sheet 4 (3).

A circumferential break at point 5 will most likely cause the pipe to whip about a hinge formed at the connection to the tee in such a manner as to result in no interactions with any of the listed targets. Such a break would also cause the pipe to whip about a hinge formed at the connection at penetration 4B which would result in an unacceptable interaction with the containment vessel at elevation 27', azimuth 190° of Sheet 2 (3), or in an acceptable interaction with 24" MS (north) at elevation 27', azimuth 190° of Sheet 2 (3).

A circumferential break at point 6 will most likely cause the pipe to whip about a hinge formed at the connection at peretration 4B in such a manner as to result in an unacceptable interaction with the containment vessel at elevation 33', azimuth 195° of Sheet 2 (3). Such a break would also cause the pipe to whip about a hinge formed at the connection to the tee which would result in an acceptable interaction with loop D of the recirculation piping at elevation 35', azimuth 216° of Sheet 2 (3), or with the Biological Shield Wall at elevation 40', azimuth 215° of Sheet 3 (3) or in an acceptable interaction with 14" MS relief valve at elevation 47', azimuth 210° of Sheet 4 (3).

A circumferential break at point 7 will most likely cause the pipe to whip about a hinge formed at the connection to the tee in such a manner as to result in an acceptable interaction with loop D of the recirculation piping at elevation 35', azimuth 216° of Sheet 2 (3), or with the Biological Shield Wall at elevation 40', azimuth 215° of Sheet 3 (3), or in an acceptable interaction with 14" MS relief valve at elevation 47', azimuth 210° of Sheet 4 (3).

A circumferential break at either point 8 or 9 will most likely cause the pipe to whip about a hinge formed at the connection to the tee in such a manner as to result in an unacceptable interaction with 8" NQ-2 at elevation 66', azimuth 225° of Sheet 5 (3).

A circumferential break at point 10 will most likely cause the pipe to whip about a hinge formed at the connection to the tee in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 74', azimuth 225° of Sheet 5 (3).

A circumferential breat at point 11 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 60', azimuth 225° of Sheet 5 (3), or with 24" MS (north) at elevation 47', azimuth 225° of Sheet 4 (3).

A circumferential break at point 12 will most likely cause the pipe to whip about a hinge formed at the connection at penetration 4B in such a manner as to result in an unacceptable interaction with the containment vessel at elevation 49', azimuth 185° of Sheet 4 (3).

A break at point 2, 3, 4, 6, 7 or 12 will result in an unacceptable jet impingement interaction with the cable tray at elevation 40', azimuth 210°-250° of Sheet 3 (3). A break at any of the remaining points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

LIQUID POISON SYSTEM - 1-1/2" NP-2

A circumferential break at point 1 will not result in an interaction with any of the listed targets (1).

A circumferential break at point 2 will most likely place connection at the reactor in torsion such as to result in an unacceptable interaction with the containment vessel at elevation 82', azimuth 155° of Sheet 6 (3).

A circumferential break at either point 3 or 4 will most likely place the connection at the reactor in torsion such as to result in an acceptable interaction with 8" NZ-3 (south) at elevation 79', azimuth 115° of Sheet 6 (3).

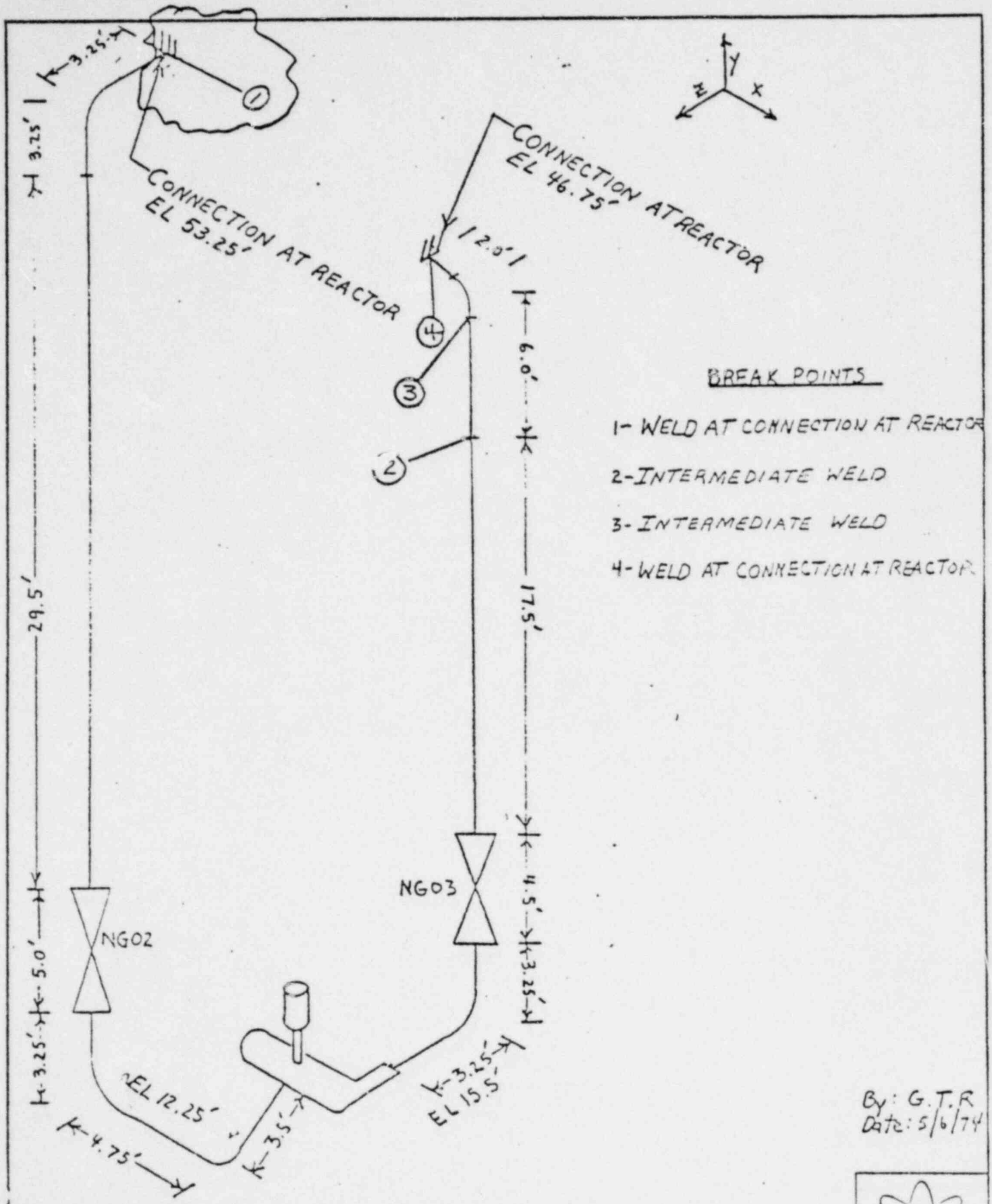
A circumferential break at point 5 will not result in an interaction with any of the listed targets (2).

A break at any of the points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

REACTOR VESSEL HEAD COOLING SYSTEM - 2" RHC-2

A circumferential break at point 1 will not result in an interaction with any of the listed targets (1).

A circumferential break at either point 2 or 3 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in no interactions with any of the listed targets.



BREAK POINTS

1- WELD AT CONNECTION AT REACTOR

2- INTERMEDIATE WELD

3- INTERMEDIATE WELD

4- WELD AT CONNECTION AT REACTOR

By: G.T.R
Date: 5/6/74

REACTOR RECIRCULATION SYSTEM (Typical for loops A, B, C, D and E)

26" , SS-A312 TP316 , Design P-1200 psig, T-570 °F

LEGEND:

U - Unacceptable Interaction (Damage Possible)

A - Acceptable Interaction (Damage not Possible)

N - No Interaction

TARGET		SOURCE: REACTOR RECIRCULATION LOOP											
System Line		Loop A				Loop B				Loop C			
ISO		B-15				B-15				B-15			
	Bk. Pt.	1	2	3	4	1	2	3	4	1	2	3	4
Emergency Condenser	NE01-B 10" NE-5	N	N	N	N	N	N	N	N	N	N	N	N
	NE01-A 10" NE-5												
	NE01-B 10" NE-2												
	NE01-A 10" NE-2												
Core Spray	(South) 8" NZ-3												
	(North) 3" NZ-3					Y							
Main Steam	(South) 24" MS					U				Y			
	(North) 24" MS					N				U			
Reactor Cleanup	6" ND-10									N			
	6" ND-1												
Shutdown Cooling	14" NU-1, NU-4												
	14" NU-2, NU-3												
Feedwater	(South) 10" RF-2												
	(South) 18" RF-2												
	(North) 10" RF-2												
	(North) 18" RF-2												
Liquid Poison	1.5" NP-2												
Reactor Vessel Head Cooling	2" RHC-2	Y	Y	Y	Y		Y	Y					
Reactor Recirc.	(Loop A)	-	-	-	-	Y	A	A	Y		Y	Y	
	(Loop B)	N	N	N	N	-	-	-	-	Y	A	A	Y
	(Loop C)			Y		N	N	N	N	-	-	-	-
	(Loop D)		Y	Y						N	N	N	N
	(Loop E)		A	A									
Reactor Recirc.	(Bypass A)		N	N									
	(Bypass B)												
	(Bypass C)												
	(Bypass D)												
	(Bypass E)												
Control Rod Drive	3" NC-4, NC-2												
	(Supply) 1" NC-3												
	(Return) 3/4" NC-3												
Containment Spray	14" CS-2, NQ-2	Y											
	12" NQ-2	U											
	10" NQ-2	N											
	8" NQ-2		Y	Y			Y	Y			Y	Y	
Reactor Vessel													
Biological Shield Wall			A	A			A	A			A	A	
Main Steam Relief Valve Discharge	8" (4 lines)		N	N			N	N			N	N	Y
	14" (2 lines)												A
Main Steam Safety Valve Discharge	8" (16 lines)				Y				Y				U
Containment Vessel Shell		Y			U				U	Y			U
Electrical	(Whip)	U	Y	Y	U	Y	Y	Y	U	N	Y	Y	U
	(Impingement)	A	U	U	U	A	U	U	U	A	U	U	U

A circumferential break at point 4 will not result in an interaction with any of the listed targets [2].

A break at any of the points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

REACTOR RECIRCULATION SYSTEM - LOOP A

A circumferential break at point 1 will most likely cause the pipe to whip about a hinge formed at the connection at the pump suction in a manner as to result in an unacceptable interaction with the cable tray at elevation 41', azimuth 42° of Sheet 3 [3], or with 12" NQ-2 at elevation 26', azimuth 42° of Sheet 4 [3].

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection at the pump discharge in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 40', azimuth 340°, or with loop E of the recirculation piping at elevation 40', azimuth 330° of Sheet 3 [3].

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection at the pump discharge in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 45', azimuth 340° or with loop E of the recirculation piping at elevation 45', azimuth 330° of Sheet 3 [3].

A circumferential break at point 4 will most likely place the connection at the pump discharge in torsion causing the pipe to whip in such a manner as to result in an unacceptable interaction with the containment vessel at elevation 45', azimuth 0° of Sheet 3 [3], or with the cable tray at elevation 41', azimuth 0° of Sheet 3 [3].

A break at point 1 will result in an acceptable jet impingement interaction with motor operator V-14-36, elevation 49', azimuth 25° of Sheet 4 [2]. A break at point 2, 3, or 4 will result in an unacceptable jet impingement interaction with the cable tray at elevation 40', azimuth 0° of Sheet 3 [3].

REACTOR RECIRCULATION SYSTEM - LOOP B

A circumferential break at point 1 will most likely cause the pipe to whip about a hinge formed at the connection at the pump suction in such a manner as to result in an unacceptable interaction with 24" MS (south) at elevation 49', azimuth 110° of Sheet 4 [3].

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection at the pump discharge in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 40', azimuth 54° of Sheet 3 (3), or with loop A of the recirculation piping at elevation 40', azimuth 42° of Sheet 3 (3).

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection at the pump discharge in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 45', azimuth 54° of Sheet 3 (3), or with loop A of the recirculation piping at elevation 40', azimuth 42° of Sheet 3 (3).

A circumferential break at point 4 will most likely place the connection at the pump discharge in torsion causing the pipe to whip in such a manner as to result in an unacceptable interaction with the containment vessel at elevation 45', azimuth 72° of Sheet 3 (3), or with the cable tray at elevation 38', azimuth 72° of Sheet 3 (3).

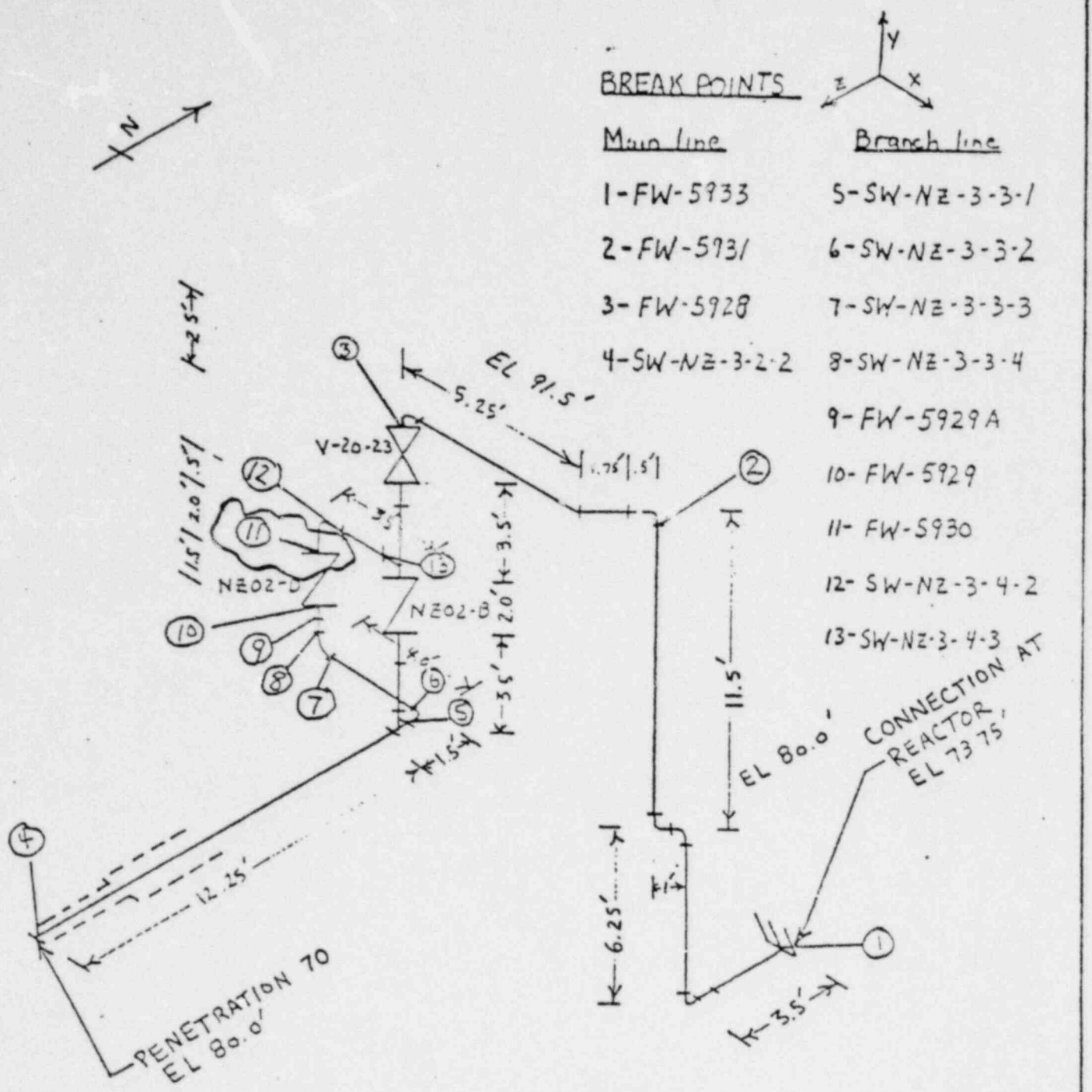
A break at point 1 will result in an acceptable jet impingement interaction with the motor operator for MS relief valve at elevation 49', azimuth 155° of Sheet 4 (3). A break at point 2, 3, or 4 will result in an unacceptable jet impingement interaction with the cable tray at elevation 40', azimuth 72° of Sheet 3 (3).

REACTOR RECIRCULATION SYSTEM - LOOP C

A circumferential break at point 1 will most likely cause the pipe to whip about a hinge formed at the connection at the pump suction in such a manner as to result in an unacceptable interaction with 24" MS (north) at elevation 49', azimuth 190° of Sheet 4 (3).

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection at the pump discharge in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 40', azimuth 126° of Sheet 3 (3), or with loop B of the recirculation piping at elevation 40', azimuth 114° of Sheet 3 (3).

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection at the pump discharge in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 45', azimuth 126° of Sheet 3 (3), or with loop B of the recirculation piping at elevation 45', azimuth 114° of Sheet 3 (3).



By: G.T.R
Date: 6/10/74
REV. 1

CORE SPRAY SYSTEM (SOUTH SIDE)

8" NZ-3, SS-A312 TP 316, Design P-1250 psig, T-575°F

Figure B-5

LEGEND:

U - Unacceptable Interaction (Damage Possible)

A - Acceptable Interaction (Damage not Possible)

N - No Interaction

		SOURCE												
	System	CORE SPRAY												
	Line	8" NZ-3 (South)												
	ISO	B-5												
TARGET	Bk. Pr.	1	2	3	4	5	6	7	8	9	10	11	12	1
Emergency Condenser	NE01-B 10" NE-5	N	N	N	N	N	N	N	N	N	N	N	N	
	NE01-A 10" NE-5	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
	NE01-B 10" NE-2													
	NE01-A 10" NE-2													
Core Spray	(South) 8" NZ-3	-	-	-	-	-	-	-	-	-	-	-	-	
	(North) 8" NZ-3	N	N	N	N	N	N	N	N	N	N	N	N	
Main Steam	(South) 24" MS													
	(North) 24" MS													
Reactor Cleanup	6" ND-10													
	6" ND-1													
Shutdown Cooling	14" NU-1, NU-4													
	14" NU-2, NU-3													
Feedwater	(South) 10" RF-2													
	(South) 18" RF-2													
	(North) 10" RF-2													
	(North) 18" RF-2													
Liquid Poison - 1.5" NP-2														
Reactor Vessel Head Cooling 2" RHC-2														
Reactor Recirc.	(Loop A)													
	(Loop B)													
	(Loop C)													
	(Loop D)													
	(Loop E)													
Reactor Recirc.	(Bypass A)													
	(Bypass B)													
	(Bypass C)													
	(Bypass D)													
	(Bypass E)													
Control Rod Drive	3" NC-4, NC-2													
	(Supply) 1" NC-3													
	(Return) 3/4" NC-3													
Containment Spray	14" CS-2, NQ-2													
	12" NQ-2													
	10" NQ-2													
	8" NQ-2													
Reactor Vessel														
Biological Shield Wall														
Main Steam Relief Valve Discharge														
	8" (4 lines)													
	14" (2 lines)													
Main Steam Safety Valve Discharge														
	8" (16 lines)		↓	↓		↓	↓	↓	↓	↓	↓	↓	↓	
Containment Vessel Shell			U	U		N	N	N	N	N	N	N	N	
Electrical	(Whip)	↓	N	N	↓	N	N	N	N	N	N	N	N	
	(Impingement)	N	N	N	N	N	N	N	N	N	N	N	N	

EMERGENCY CONDENSER SYSTEM - 10" NE-2 (NE01-A to Reactor)

A circumferential break at point 1 will not result in an interaction with any of the listed targets [1].

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection to the Recirculation Piping in such a manner as to result in an acceptable interaction with 10" RF-2 (north) at elevation 75', azimuth 315° of Sheet 5 [3]. Such a break could also cause the pipe to whip about a hinge formed at the second elbow upstream of the connection which would have the same result.

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection to the Recirculation Piping in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 82', azimuth 335° of Sheet 5 [3]. Such a break could also cause the pipe to whip about a hinge formed at the second elbow upstream of the connection which would have the same result.

A circumferential break at point 4 will not result in an interaction with any of the listed targets [2].

A break at point 1 will result in an unacceptable jet impingement interaction with the cable tray at elevation 40', azimuth 0°-60° of Sheet 3 [3]. A break at any of the remaining points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

CORE SPRAY - 8" NZ-3 (South)

A circumferential break at point 1 will not result in an interaction with any of the listed targets [1].

A circumferential break at point 2 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in an unacceptable interaction with the containment vessel at elevation 90', azimuth 70° of Sheet 6 [3]. Such a break could also cause the pipe to whip about a hinge formed at the first elbow upstream of the reactor which would result in an unacceptable interaction with the containment vessel at elevation 89', azimuth 95° of Sheet 6 [3].

A circumferential break at point 3 will most likely place the connection at the reactor in torsion causing the pipe to whip in such a manner as to result in an unacceptable interaction with the containment vessel at elevation 90', azimuth 65° of Sheet 6 [3]. Such a break could also cause the pipe to whip about a hinge formed at the first elbow upstream of the reactor which would have the same result.

A circumferential break at point 4 will not result in an interaction with any of the listed targets (2).

Circumferential breaks at points 5 thru 10 will not result in pipe whip as check valves NZ-02B and NZ-02D isolate these points from the high energy reservoir (reactor).

A circumferential break at any of points 11 thru 13 will most likely cause the pipe to whip about a hinge formed at the connection of the bypass line to the main line in such a manner as to result in no interactions with any of the listed targets.

A break at any of the points postulated in this line will not result in any jet impingement interactions with the cable tray or any of the motor operators.

CORE SPRAY SYSTEM - 8" NZ-3 (North)

A circumferential break at point 1 will not result in an interaction with any of the listed targets (1).

A circumferential break at point 2 will most likely place the connection at the reactor in torsion causing the pipe to whip in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 62', azimuth 240° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the connection at the reactor which would result in an acceptable interaction with 10" RF-2 (north) at elevation 75', azimuth 225° of Sheet 5 (3).

A circumferential break at point 3 will most likely cause the pipe to whip about a hinge formed at the connection at the reactor in such a manner as to result in an acceptable interaction with the Biological Shield Wall at elevation 62, azimuth 250° of Sheet 5 (3). Such a break could also cause the pipe to whip about a hinge formed at the second elbow upstream of the reactor which would have the same result.

A circumferential break at point 4 will not result in an interaction with any of the listed targets (2).

Circumferential breaks at points 5 thru 8 will not result in pipe whip as check valves NZ-02A and NZ-02C isolate these points from the energy reservoir (reactor).

A circumferential break at any of points 9 thru 11 will most likely cause the pipe to whip about a hinge formed at the connection of the bypass line to the main line in such a manner as to result in no interactions with any of the listed targets.