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ATTACHMENT 1

Georgia Power
the southern electric system

J. T. Beckham, Jr.
Vice President and General Manager
Nuclear Generation

NED-83-324

May 26, 1983

U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region II - Suite 2900
101 Marietta Street, NW
Atlanta, Georgia 30303

REFERENCE:
RII: JPO
50-366
I&E Bulletin
83-02

ATTENTION: Mr. James P. O'Reilly

GENTLEMEN:

Georgia Power Company (GPC) hereby submits the following information concerning inservice inspection activities at Plant Hatch Unit 2 in response to NRC I&E Bulletin 83-02. The subject bulletin pertains to stress corrosion cracking in large-diameter stainless steel recirculation system piping at BWR plants.

Item 1 (as applicable to Plant Hatch Unit 2)

Some of the licensees listed in Table 1 (of the subject bulletin) have completed efforts to validate the UT detection capability to be used to perform plant inspections in accordance with the requirements of Action Item 1 of I&E Bulletin 82-03, Revision 1. These licensees need not repeat this effort in accordance with Action Item 1 of this bulletin provided that: the previous validated inspection group performs the new plant examination using identical UT procedures, standards, make and model of UT instrument, and the same make and model transducers that were used to complete the previous validation effort. In addition, the UT personnel employed in the new examination must be the same; or those having appropriate training (documented) in IGSCC inspection using cracked thick-wall pipe specimens, and are under direct supervision of the Level II/III UT operators who successfully complete the performance demonstration tests.

Response

Validation of the UT procedures was performed under NRC I&E Bulletin 82-03, Rev. 1 for the examination of large-diameter stainless steel piping at Plant Hatch Unit 1 during the Fall 1982 maintenance/refueling outage. Pursuant to I&E Bulletin 83-02, the licensee need not repeat the validation process. Similar procedures, equipment, and transducers were used at Plant Hatch Unit 2. In addition, each Level II UT technician was satisfactorily tested after receiving training in IGSCC detection using cracked thick-wall pipe specimens under the direct supervision of a Level III who had performed the qualification for I&E Bulletin 82-03, Revision 1.

Item 2 (as applicable to Plant Hatch Unit 2)

Before resuming power operations licensees are to augment their ISI programs to include an ultrasonic examination of the following minimum number of recirculation system welds:

a. Ten welds in recirculation piping of 20-inch diameter, or larger.

b. Ten welds of the jet pumps inlet riser piping and associated safe-ends.

c. Two sweepolet-to-header (manifold) welds of jet pump risers nearest the end caps, if applicable to the design.

If flaws indicative of cracking are found in the above examination, additional inspection is to be conducted in accordance with IWB-2430 of ASME Code Section XI.

Response

The ISI program was augmented to include the minimum number of welds required by this particular item of the bulletin. As a result of observing unacceptable flaw-like indications, the original scope of examinations was increased in accordance with the guidance of ASME Section XI, IWB-2430. Ultimately, a 100% examination of the Class 1 Recirculation System welds (ASME Category B-J welds only) was performed. Fifty percent (50%) of the ASME Category B-F welds in the Recirculation System were examined with no unacceptable indications observed; therefore, the scope of examinations for this particular category weld was not increased. In addition to the examination of Recirculation System welds, a 100% examination of the stainless steel welds in the RHR System was performed pursuant to NRC NUREG-0313, Revision 1 guidance. Five welds in the RWCU System were examined with no unacceptable flaw-like indications observed; therefore, the scope of examinations for RWCU was not increased.

Item 3

Before resuming power operations following the outage, the licensee is to report the results of the Item 2 inspection and any corrective actions (in the event cracking is identified). This report should also include the susceptibility matrix used as a basis for welds selected for examination (e.g., stress rule index, carbon content, high stress location, repair history) and their values for each weld examined.

Response

The welds in the original scope of examination and the initial increased scope of examination for the Recirculation System were chosen based on high stress rule index (SRI) number and carbon content. As a result of observing unacceptable flaw-like indications in the original scope and then the initial increased scope of examinations, all remaining Recirculation System welds (i.e., ASME Category B-J welds only) were then examined. As noted above, 100% of the stainless steel welds of the RHR System were examined, thereby precluding the necessity of weld selection criteria (i.e., susceptibility matrix) as discussed in bulletin item 3. High SRI number and carbon content served as the basis for the selection criteria of the five RWCU System welds examined.

Attachment 1 lists the Recirculation, RHR, and RWCU system welds examined, their SRI number, carbon content, and examination results.

Attachment 2 lists those welds for which corrective action in the form of repairs, analysis, or replacement is being conducted. Details of the analyses, repairs, and replacement will be submitted to NRC NRR under separate cover. A copy of that submittal will be provided to NRC Region II.

Please refer to Attachment 3 for isometric drawings of the Recirculation, RHR, and RWCU system piping. ASME Category B-F and B-J welds examined during the 1983 inservice inspection are denoted by circled weld numbers.

Item 4

The NRC has an on-going program to evaluate possible additional longer-term requirements relative to the IGSCC problem in the BWR recirculation system piping. The NRC may need additional information as part of this program. Therefore, licensees are requested to retain the records and data developed pursuant to the inspections performed in accordance with Item 2.

Response

The inservice inspection records and data developed pursuant to the inspections performed in accordance with bulletin item 2 will be retained. The subject records and data will be incorporated into the inservice inspection report to be issued by the ISI contractor. Inservice inspection reports are required by Technical Specification 6.10.2h to be retained for the life of the plant.

Georgia Power

U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region II - Suite 2900
May 26, 1983
Page Four

Should you have any questions in this regard, please contact this office.

J. T. Beckham, Jr. states that he is Vice President of Georgia Power Company and is authorized to execute this oath on behalf of Georgia Power Company, and that to the best of his knowledge and belief the facts set forth in this letter are true.

GEORGIA POWER COMPANY

By: J. T. Beckham, Jr.

Sworn to and subscribed before me this 26th day of May, 1983.

Mae H. Battle
Notary Public

Notary Public, Georgia, State at Large
My Commission Expires Sept. 20, 1983

JAE/mb

Enclosure

xc: H. C. Nix, Jr.
Senior Resident Inspector
J. P. O'Reilly, (NRC-Region II)

700775

ATTACHMENT 1

WELD EXAMINATION LISTING

STAINLESS STEEL PIPING UT EXAMINATION RESULTS

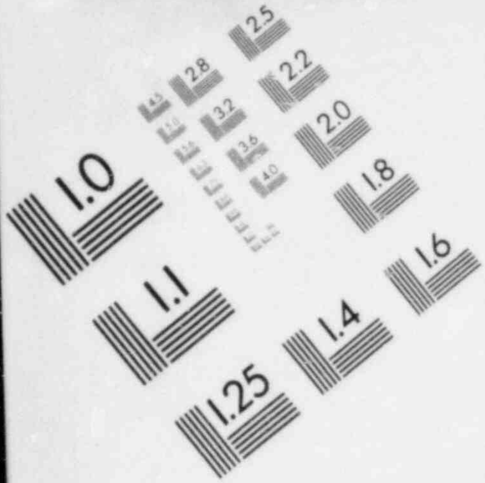
WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL (MAX)
RECIRCULATION SYSTEM						
2B31-1RC-12AR-F-1	BC-P	FW	1.11	.065	None	--
-2	P-E	SW	1.44	.065	360° Inter., Pipe Side	25%
-3	E-P	SW	1.53	.065	360° Inter., Pipe Side	10%
-4	P-SE	FW	1.30	.065	None	--
-5	SE-N	SW	--	--	Not Examined	--
2B31-1RC-12AR-G-1	BC-P	FW	1.11	.075	None	--
-2	P-E	SW	1.46	.075	360° Inter., Pipe Side	14%
-3	E-P	SW	1.56	.075	360° Inter., Pipe Side	15%
-4	P-SE	FW	1.33	.075	None	--
-5	SE-N	SW	--	--	Not Examined	--
2B31-1RC-12AR-H-1	Red-P	FW	1.15	.075	None	--
-2	P-E	SW	1.55	.075	360° Inter., Pipe Side	10%
-3	E-P	SW	1.65	.060	360° Inter., Pipe Side	30%
-4	P-SE	FW	1.46	.060	None	--
-5	SE-N	SW	--	--	Not Examined	--
2B31-1RC-12AR-J-1	BC-P	FW	1.07	.065	None	--
-2	P-E	SW	1.45	.065	360° Inter., Pipe Side	23%
-3	E-P	SW	1.56	.065	360° Inter., Pipe Side	20%
-4	P-SE	FW	1.30	.065	360° Inter., Pipe Side	28%
-5	SE-N	SW	--	--	Not Examined	--
2B31-1RC-12AR-K-1	BC-P	FW	1.05	.070	None	--
-2	P-E	SW	1.45	.070	360° Inter., Pipe Side	19%
-3	E-P	SW	1.45	.070	360° Inter., Elbow Side	6%
-4	P-SE	FW	1.27	.070	None	--
-5	SE-N	SW	--	--	Not Examined	--

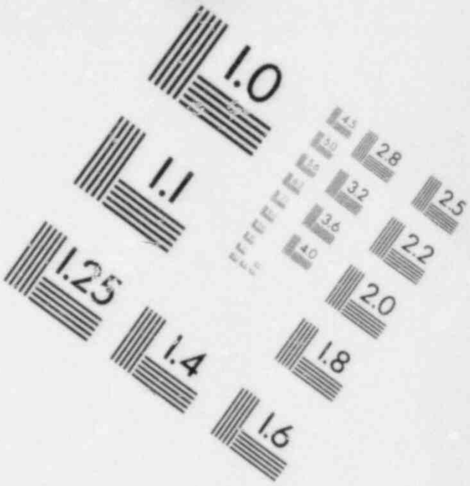
WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL(MAX)
RECIRCULATION SYSTEM	(Continued)					
2B31-1RC-12BR-A-1	BC-P	FW	1.04	.060	None	--
-2	P-E	SW	1.40	.060	None	--
-3	E-P	SW	1.44	.060	360° Inter., Pipe Side	25%
-4	P-SE	FW	1.21	.060	None	--
-5	SE-N	SW	--	--	None	--
2B31-1RC-12BR-B-1	BC-P	FW	1.06	.070	None	--
-2	P-E	SW	1.44	.070	360° Inter., Pipe Side	26%
-3	E-P	SW	1.51	.070	360° Inter., Pipe/Elbow Sides	22%
-4	P-SE	FW	1.26	.070	360° Inter., Pipe Side	23%
-5	SE-N	SW	--	--	None	--
2B31-1RC-12BR-C-1	Red-P	FW	1.15	.065	None	--
-2	P-E	SW	1.53	.065	360° Inter., Pipe Side	28%
-3	E-P	SW	1.60	.060	360° Inter., Pipe Side	30%
-4	P-SE	FW	1.38	.055	360° Inter., Pipe Side	32%
-5	SE-N	SW	--	--	None	--
2B31-1RC-12BR-D-1	BC-P	FW	1.10	.060	None	--
-2	P-E	SW	1.44	.060	360° Inter., Pipe Side	14%
-3	E-P	SW	1.53	.060	360° Inter., Pipe Side	17%
-4	P-SE	FW	1.31	.060	None	--
-5	SE-N	SW	--	--	None	--
2B31-1RC-12BR-E-1	BC-P	FW	1.11	.060	None	--
-2	P-E	SW	1.43	.060	None	--
-3	E-P	SW	1.49	.060	360° Inter., Pipe/Elbow Sides	22%
-3A	P-P	FW	Not Calc.	--	360° Inter., Pipe Side	21%

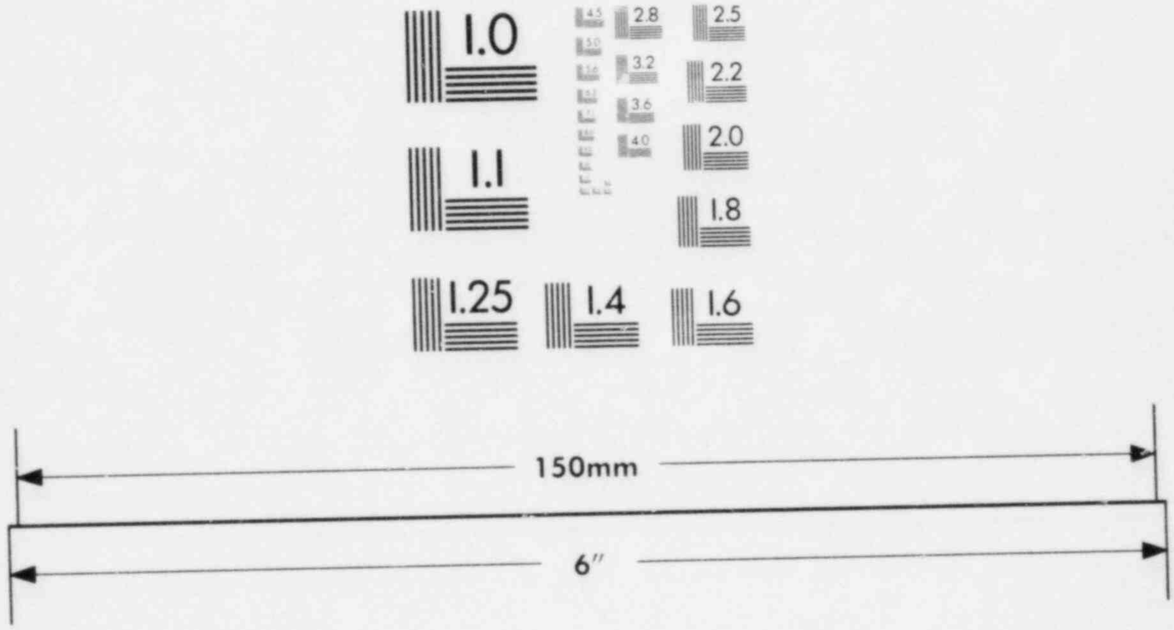
WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL(MAX)
RECIRCULATION SYSTEM (Continued)						
-4	P-SE	FW	1.29	.055	360° Inter., Pipe Side	18%
-5	SE-N	SW	--	--	None	--
2B31-1RC-22AM-1	C-P	SW	1.16	.048	Parallel to weld Cap 53"L & 7 1/2"L Pipe 25 1/2"L & 9"L	C-42% P-14%
-2	P-CR	SW	1.13	.056	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-3	CR-P	SW	1.07	.056	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-4	P-C	SW	0.96	054	Parallel to weld, Pipe 60"L.	19%
2B31-1RC-22BM-1	C-P	SW	0.96	048	Parallel to weld, Cap 25 1/2"L & 5 1/2"L, Pipe 27"L.	C-16% P-40%
2	P-CR	SW	1.13	.056	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-3	CR-P	SW	1.10	.056	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-4	P-C	SW	0.96	.048	360° Inter., Pipe/Cap Sides	P-37% C-30%
2B31-1RC-22AM-1BC-1	P-BC	SW	0.98	.060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--
-1BC-2	P-BC	SW	0.98	.060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--

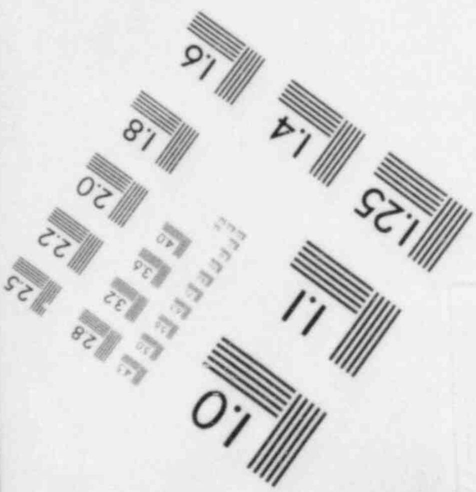
WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL(MAX)
RECIRCULATION SYSTEM (Continued)						
2B31-1RC-22AM-3BC-1	P-BC	SW	1.01	.060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--
3BC-2	P-BC	SW	1.01	.060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--
2B31-1RC-22BM-1BC-1	P-BC	SW	1.01	.060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--
1BC-2	P-BC	SW	1.06	.060	None	--
2B31-1RC-22BM-3BC-1	P-BC	SW	1.03	.060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--
3BC-2	P-BC	SW	1.02	060	Shallow indications outside the HAZ. GPC to re-examine next refueling outage.	--
2B31-1RC-28A-1	N-SE	SW	--	-	None	--
2	SE-P	FW	1.08	.045	None	--
-3	P-E	SW	1.46	.060	Parallel to weld, Elbow Side 5 1/4"L.	12%
4	E-P	SW	1.35	.060	360° Inter., Elbow Side	17%
-5	P-T	FW	0.96	.062	None	--
-6	T-P	SW	0.92	.062	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-7	P-E	SW	1.30	.057	360° Inter., Pipe/Elbow Sides	P-8% E-4%
-8	E-V	FW	1.03	.057	None	--
-9	V-P	FW	1.01	.045	None	--

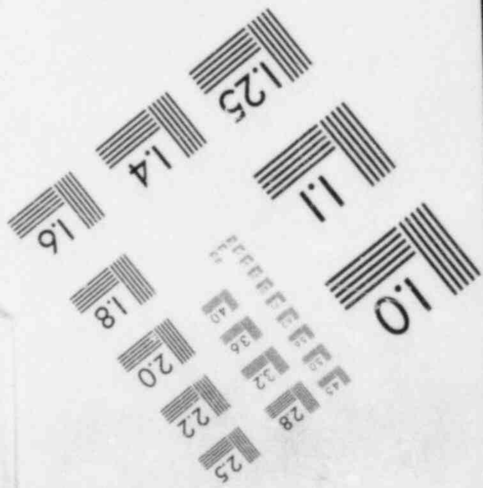
IMAGE EVALUATION TEST TARGET (MT-3)











WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL (MAX)
RECIRCULATION SYSTEM (Continued)						
2B31-1RC-28A-10	P-E	SW	1.46	.056	Parallel to weld, Pipe Side - 1 1/4"L	10%
-11	E-Pu	FW	1.03	.056	None	--
-12	Pu-P	FW	1.13	.041	None	--
-13	P-V	FW	1.03	.041	None	--
-14	V-E	FW	1.07	.058	None	--
-15	E-P	SW	1.40	.058	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-16	P-T	SW	1.24	.062	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-17	T-C	SW	1.09	.062	None	--
-18	CR-Red	SW	1.04	.063	None	--
2B31-1RC-28B-1	N-SE	SW	--	--	Not Examined	--
2	SE-P	FW	1.01	045	None	--
3	P-E	SW	1.28	.060	360° Inter., Pipe Side	15%
-4	E-P	SW	1.21	.060	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-5	P-P	FW	0.91	.045	None	--
-7	P-E	SW	1.29	.057	360° Inter., Pipe Side	18%
-8	E-V	FW	1.37	.057	360° Inter., Elbow Side	7%
-9	V-P	FW	1.01	.045	None	--
-10	P-E	SW	1.41	.056	360° Inter., Pipe/Elbow Sides	P-19% E-20%

WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL(MAX)
RECIRCULATION SYSTEM (Continued)						
-11	E-Pu	FW	1.02	.056	None	--
-12	Pu-P	FW	1.13	.041	None	--
-13	P-V	FW	1.03	.041	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-14	V-E	FW	1.05	.056	None	--
-15	E-P	SW	1.32	.056	360° Inter., Elbow Side	23%
-16	P-T	SW	1.24	.062	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-17	T-C	SW	1.08	.062	None	--
-18	C-Red	SW	1.03	.063	None	--
2B31-1RC-4AA-1	BC-C	FW(?)	--	-	None	--
-4AB-1	BC-C	FW(?)	--	--	None	--
-4BC-1	BC-C	FW(?)	--	--	None	--
-4BD-1	BC-C	FW(?)	--	--	None	--
2B31-1RC-6A-1	P-FL	FW(?)	--	--	None	--
-6B-1	P-FL	FW(?)	--	--	None	--
RHR SYSTEM						
2E11-1RHR-20-RS-1	T-P	FW	1.33	.062	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-2	P-E	FW	1.61	.056	360° Inter., Pipe Side	13%
-3	E-P	FW	1.56	.056	360° Inter., Elbow Side	14%
2E11-1RHR-24A-R-10	P-E	FW	2.57	.060	None	--

WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL(MAX)
RHR SYSTEM (Continued)						
2E11-1RHR-24A-R-11	E-P	FW	1.69	.062	None	--
-12	P-E	FW	1.70	.062	None	--
-13	E-T	FW	1.74	.060	None	--
2E11-1RHR-24B-R-10	P-E	FW	2.58	.060	None	--
-11	E-P	FW	1.68	.062	Parallel to weld, Elbow Side 1-5/8"L, 2-10 9/16"L.	13% 18%
-12	P-E	FW	1.70	.062	Shallow indications in the HAZ called inside geometry. GPC to re-examine next refueling outage.	--
-13	E-T	FW	1.74	.060	None	--
RWCU SYSTEM						
2G31-1RWCU-6-D-1	BC-P	--	1.24	.064	Not Examined	--
-2	P-E	--	1.92	.064	None	--
-3	E-P	--	1.82	.064	None	--
-4	P-P	--	1.22	.064	Not Examined	--
-5	P-E	--	1.80	.064	None	--
-6	E-P	--	1.98	.064	None	--
-7	P-V	--	1.68	.064	None	--
-8	V-P	--	1.58	.064	Not Examined	--
-9	P-E	--	1.42	.064	Not Examined	--
-10	E-P	--	1.40	.064	Not Examined	--
-11	P-P	--	1.02	.064	Not Examined	--
-12	P-E	--	1.44	.064	Not Examined	--
-13	E-P	--	1.46	.064	Not Examined	--
-14	P-E	--	1.34	.064	Not Examined	--
-15	E-P	--	1.33	.056	Not Examined	--

WELD NO.	WELD TYPE	WELD FAB.	SRI	% C	SIGNIFICANT INDICATIONS	% THRU-WALL(MAX)
RWCU SYSTEM (Continued)						
-16	P-V	--	1.28	.045	Not Examined	--
-17	V-P	--	1.31	.063	Not Examined	--
-17A	PX-P	--	1.30	.063	Not Examined	--
-18	P-V	--	1.11	.061	Not Examined	--

KEY

FW - Field Weld

SW - Shop Weld

P - Pipe

Pu - Pump

SE - Safe End

T - Tee

Red - Reducer

V - Valve

CR - Cross

PX - Penetration

N - Nozzle

E - Elbow

FL - Flange

BC - Branch Connection

C - Cap

Example: Under "Weld Type" column, P-E is the abbreviation for a pipe-to-elbow weld.

ATTACHMENT 2

CORRECTIVE ACTIONS
FOR
WELDS HAVING
UNACCEPTABLE INDICATIONS

Recirculation System	RHR System
22AM-1BC-1	20-RS-1
-1BC-2	24-B-R-12
-2	
-3	
-3BC-1	
-3BC-2	
22BM-1BC-1	
-2	
-3	
-3BC-1	
-3BC-2	
28A-6	
-15	
-16	
28B-4	
-13	
-16	

NOTE: As stated previously in this response to NRC I&E Bulletin 83-02, a separate report on the various analyses and repairs will be submitted under separate cover to NRC NRR. A copy of that report will be submitted to NRC Region II for review.

ATTACHMENT 3

ISOMETRIC DRAWINGS
FOR
RECIRCULATION, RHR, AND
RWCU SYSTEMS

PUMP A SUCTION
2 B31-IRC-6A
2 B31-IRC-28A #1-#11

REACTOR RECIRCULATION SYSTEM

CLASS I

PIPE	:	28"	28"
MAT.	:	SS	SS
SCH.	:	X	X
N. WALL	:	1.280"	1.80"
CAL BLOCK	:	28-SS-X-1.80-84-H	
		28-SS-X-1-280-48-H	
REF. P&ID	:	H-26003	
LOCATION	:	CONTAINMENT	

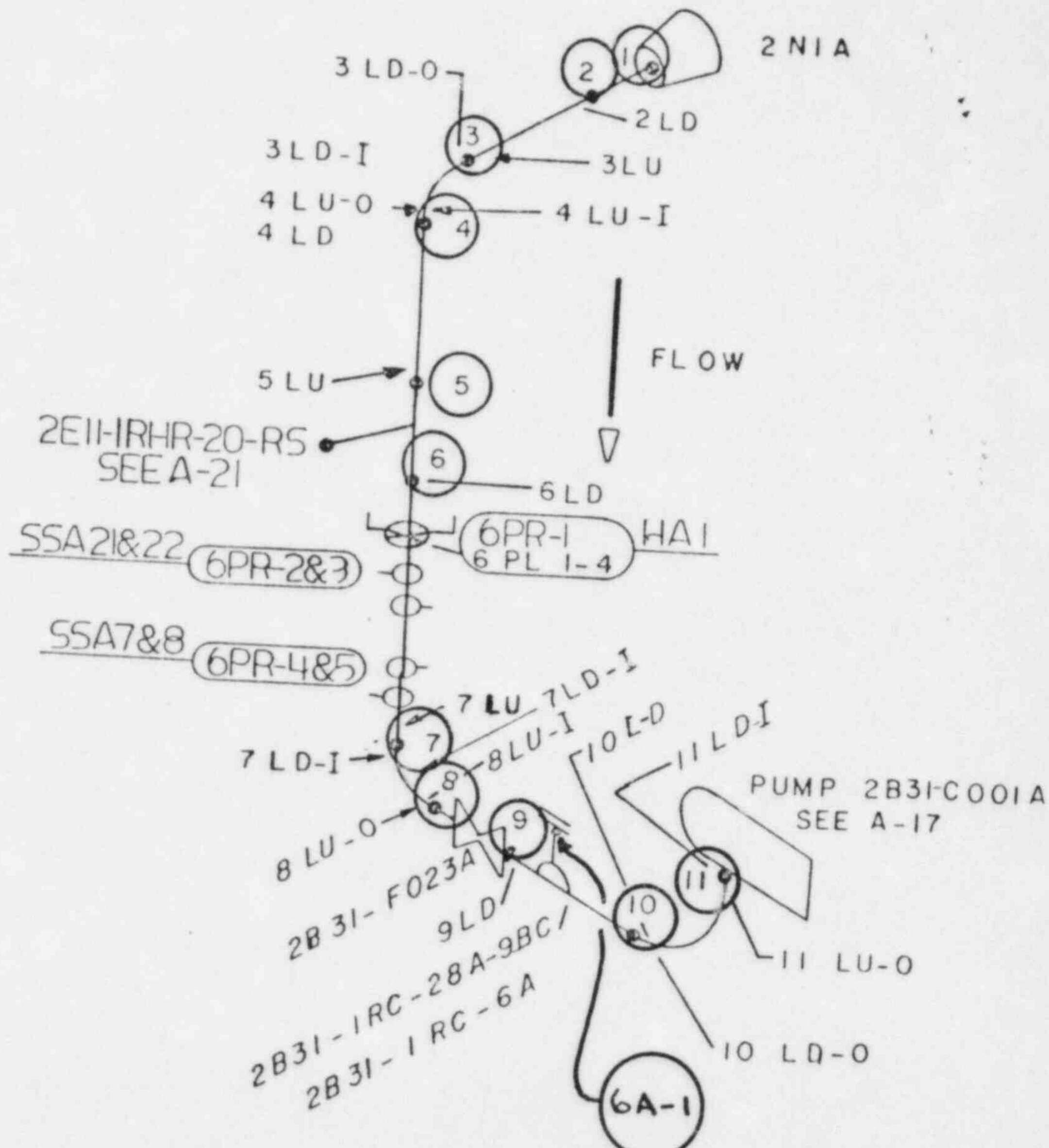


Figure A - 16

PUMPA DISCHARGE
2B31-IRC-4AA
2B31-IRC-4AB
2B31-IRC-28A
REACTOR RECIRCULATION SYSTEM
CLASS I

PIPE :	4"	28"	28"
MAT :	SS	SS	SS
SCH. :	80	X	X
N. WALL :	0.337"	1.280"	2.30"

CAL. BLOCKS : 4-SS-80-0.337-80-H
28-SS-X-1.280-48-H
28-SS-X-2.30-92-H
REF. P&ID : H-26003
LOCATION : CONTAINMENT

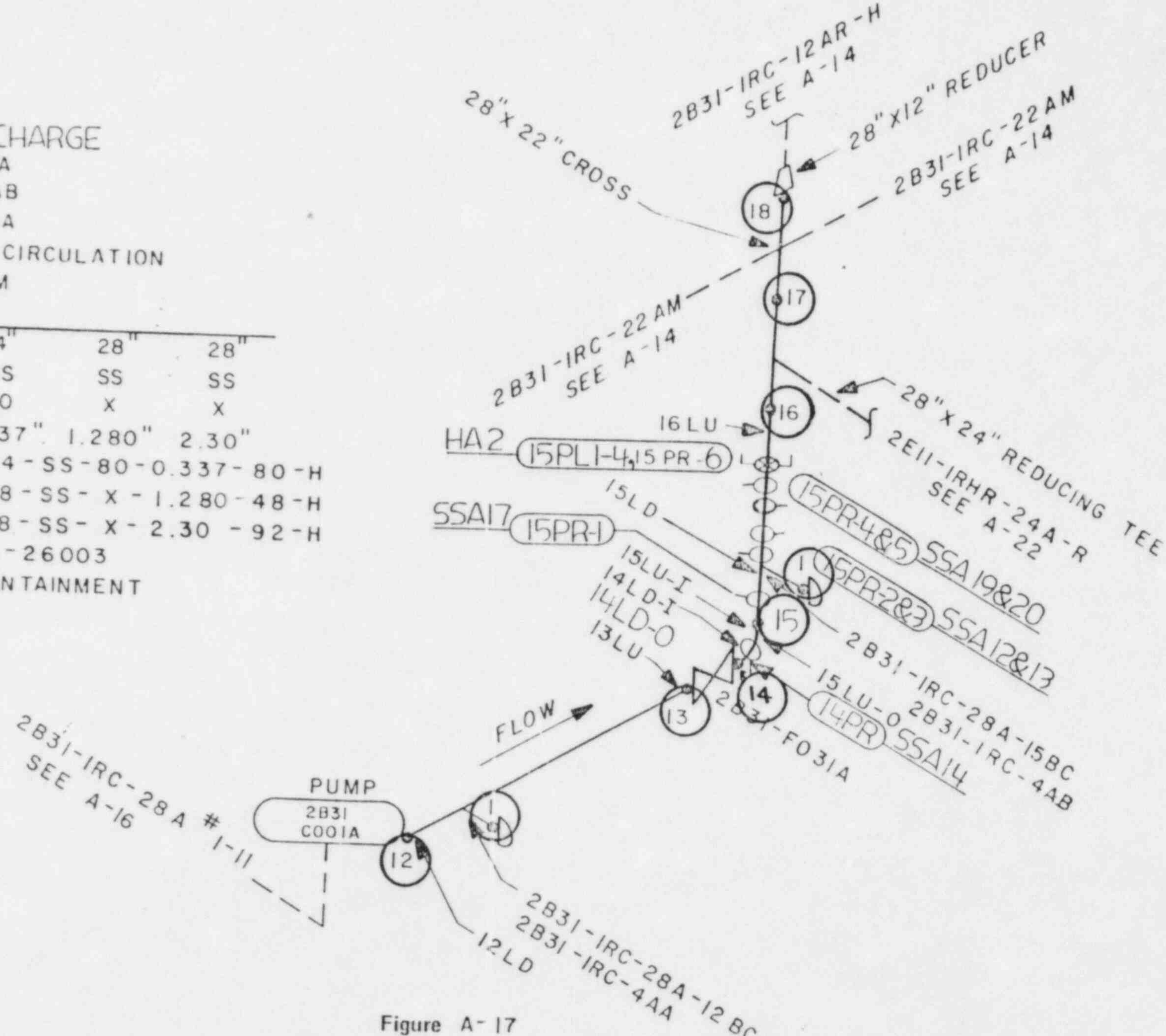


Figure A- 17

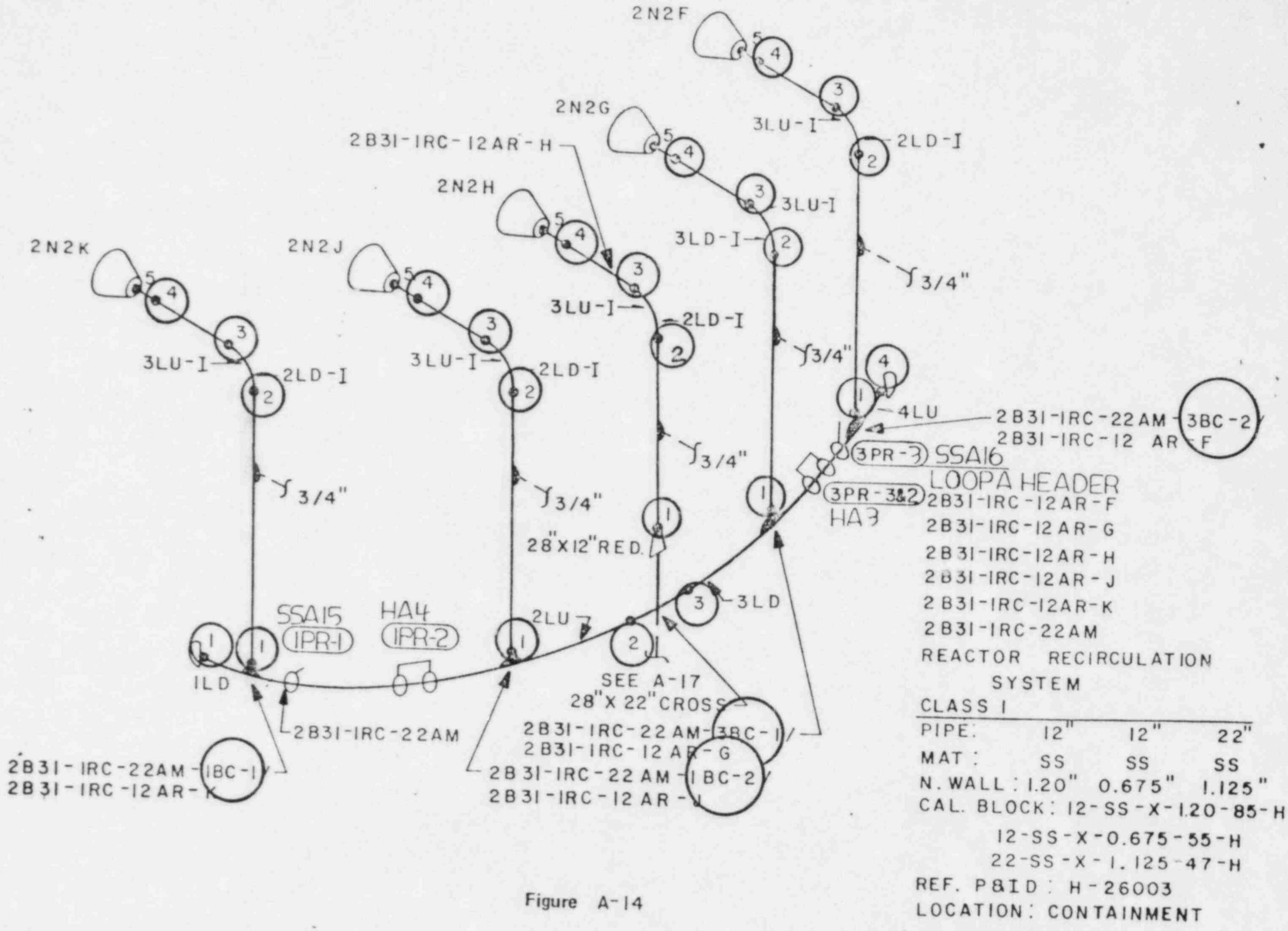

2N2F
2N2G
2N2H
2N2J
2N2K
2B31-IRC-12AR-H
3LU-I
2LD-I
3LD-I
3/4"
28"X12"RED.
4LU
2B31-IRC-22AM-3BC-2
2B31-IRC-12 AR-F
3PR-3 SSA16
LOOPA HEADER
3PR-3&2
HA3
3LD
2LU
SSA15
IPR-1
HA4
IPR-2
1LD
SEE A-17
28"X 22" CROSS
2B31-IRC-22AM
2B31-IRC-22AM-3BC-1
2B31-IRC-12 AR-G
2B31-IRC-22AM-1BC-1
2B31-IRC-12AR-K
2B31-IRC-22AM-1BC-2
2B31-IRC-12 AR-J
2B31-IRC-12AR-F
2B31-IRC-12AR-G
2B31-IRC-12AR-H
2B31-IRC-12AR-J
2B31-IRC-12AR-K
2B31-IRC-22AM
REACTOR RECIRCULATION SYSTEM
CLASS I
PIPE: 12" 12" 22"
MAT: SS SS SS
N. WALL: 1.20" 0.675" 1.125"
CAL. BLOCK: 12-SS-X-1.20-85-H
12-SS-X-0.675-55-H
22-SS-X-1.125-47-H
REF. P&ID: H-26003
LOCATION: CONTAINMENT

Figure A-14

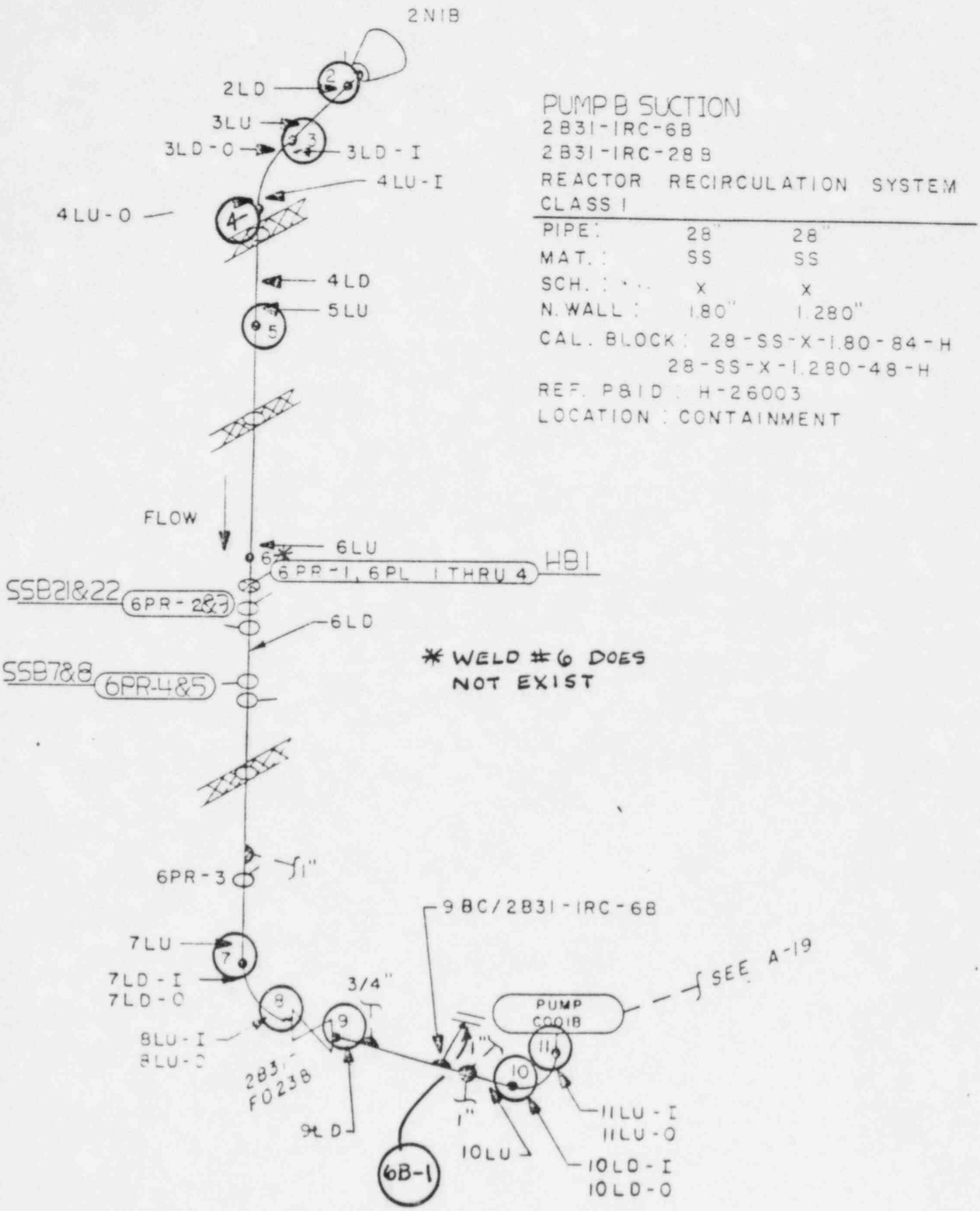

2NIB
2LD
3LU
3LD-O
3LD-I
4LU-I
4LU-O
4LD
5LU
PUMP B SUCTION
2B31-IRC-6B
2B31-IRC-28B
REACTOR RECIRCULATION SYSTEM
CLASS I
PIPE: 28" 28"
MAT.: SS SS
SCH.: X X
N. WALL: 1.80" 1.280"
CAL. BLOCK: 28-SS-X-1.80-84-H
28-SS-X-1.280-48-H
REF. P&ID: H-26003
LOCATION: CONTAINMENT
FLOW
6LU
6PR-1, 6PL 1 THRU 4
HB1
SSB21&22
6PR-2&3
6LD
* WELD #6 DOES NOT EXIST
SSB7&8
6PR-4&5
6PR-3
1"
9BC/2B31-IRC-6B
SEE A-19
PUMP C001B
7LU
7LD-I
7LD-O
3/4"
8LU-I
8LU-O
2B31-F023B
9LD
1"
1"
10LU
11LU-I
11LU-O
10LD-I
10LD-O
6B-1

Figure A-18

PUMP B DISCHARGE
2B31-1RC-4BC
2B31-1RC-4BD
2B31-1RC-28B

REACTOR RECIRCULATION SYSTEM
CLASS 1

PIPE:	4"	28"	28"
MAT:	SS	SS	SS
SCH:	80	X	X
N. WALL:	0.337"	1.280"	2.30"

CAL. BLOCKS:
4-SS-80-.337-80-H
28-SS-X-1280-48-H
28-SS-X-2.30-92-H
REF. P&ID: H-26003
LOCATION: CONTAINMENT

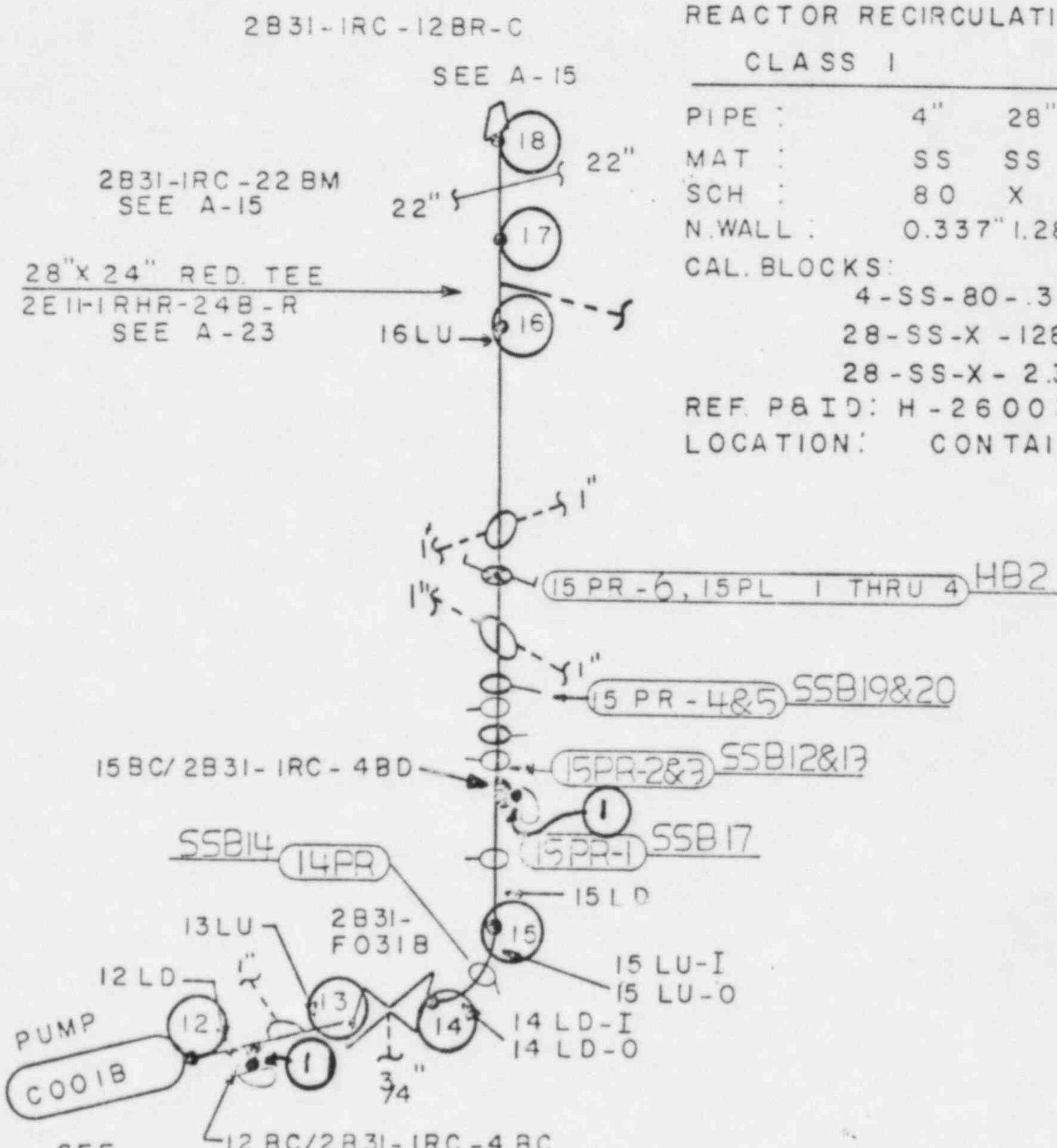


Figure A-19

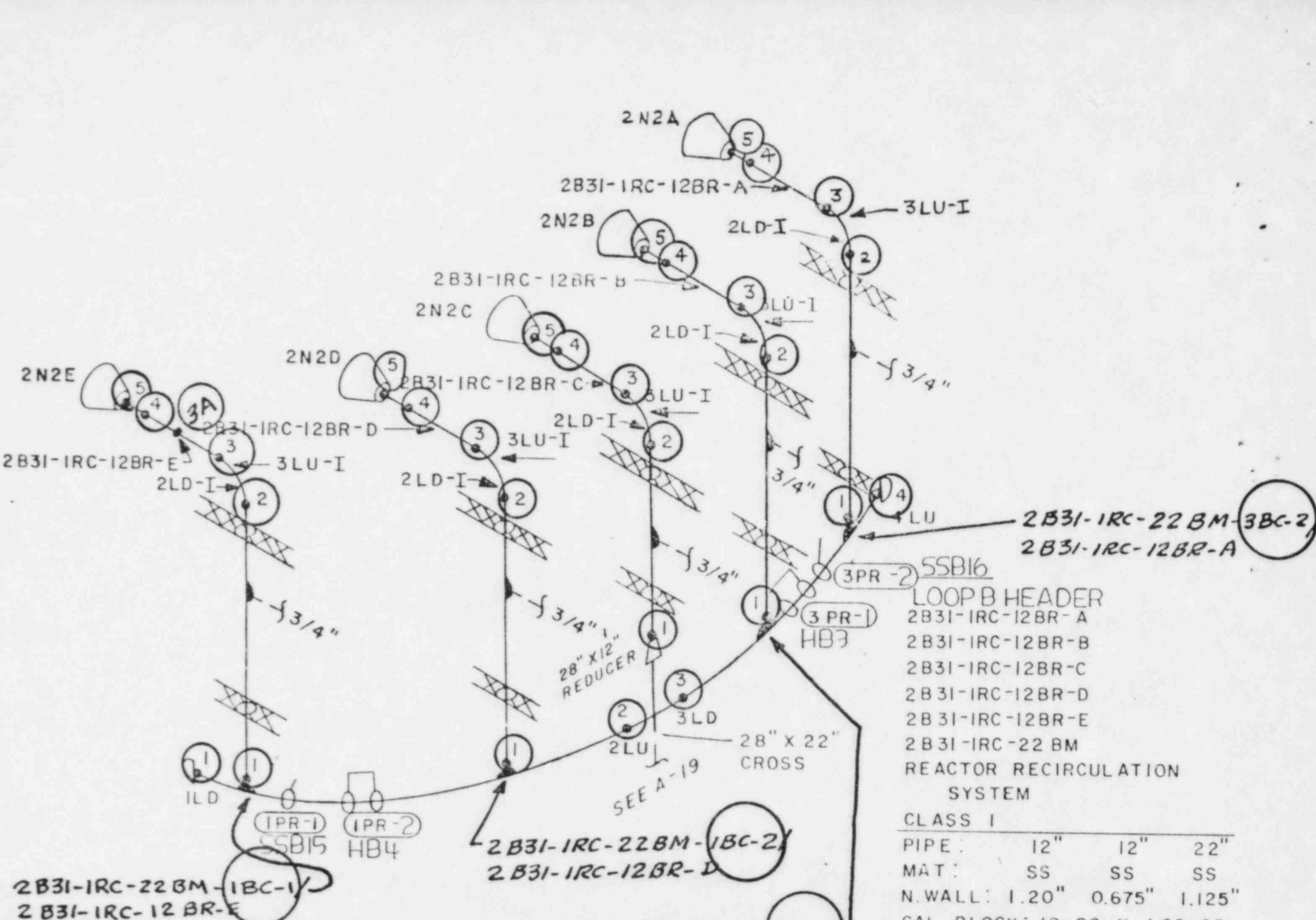
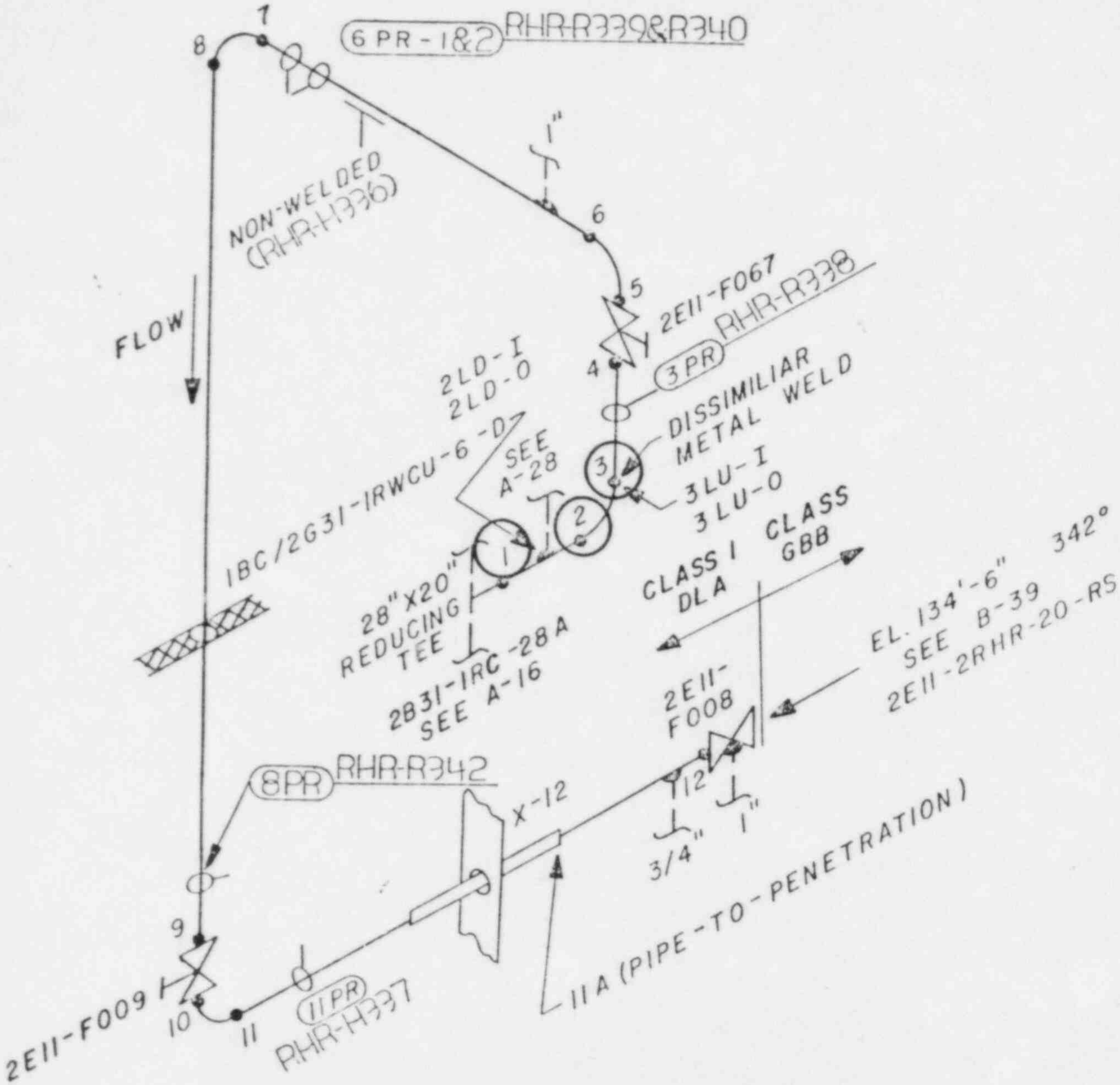


Figure A-15

LOOP B HEADER
2B31-IRC-12BR-A
2B31-IRC-12BR-B
2B31-IRC-12BR-C
2B31-IRC-12BR-D
2B31-IRC-12BR-E
2B31-IRC-22BM
REACTOR RECIRCULATION SYSTEM
CLASS 1

PIPE:	12"	12"	22"
MAT:	SS	SS	SS
N.WALL:	1.20"	0.675"	1.125"

CAL. BLOCK: 12-SS-X-1.20-85-H
12-SS-X-0.675-55-H
22-SS-X-1.125-47-H
REF. P&ID: H-26003
LOCATION: CONTAINMENT



SHUTDOWN COOLING SUCTION
2E11-1RHR-20-RS

RESIDUAL HEAT REMOVAL SYSTEM
CLASS 1

PIPE:	20"	20"
MAT:	SS	CS
SCH:	X	100
N. WALL:	1.031"	1.280"

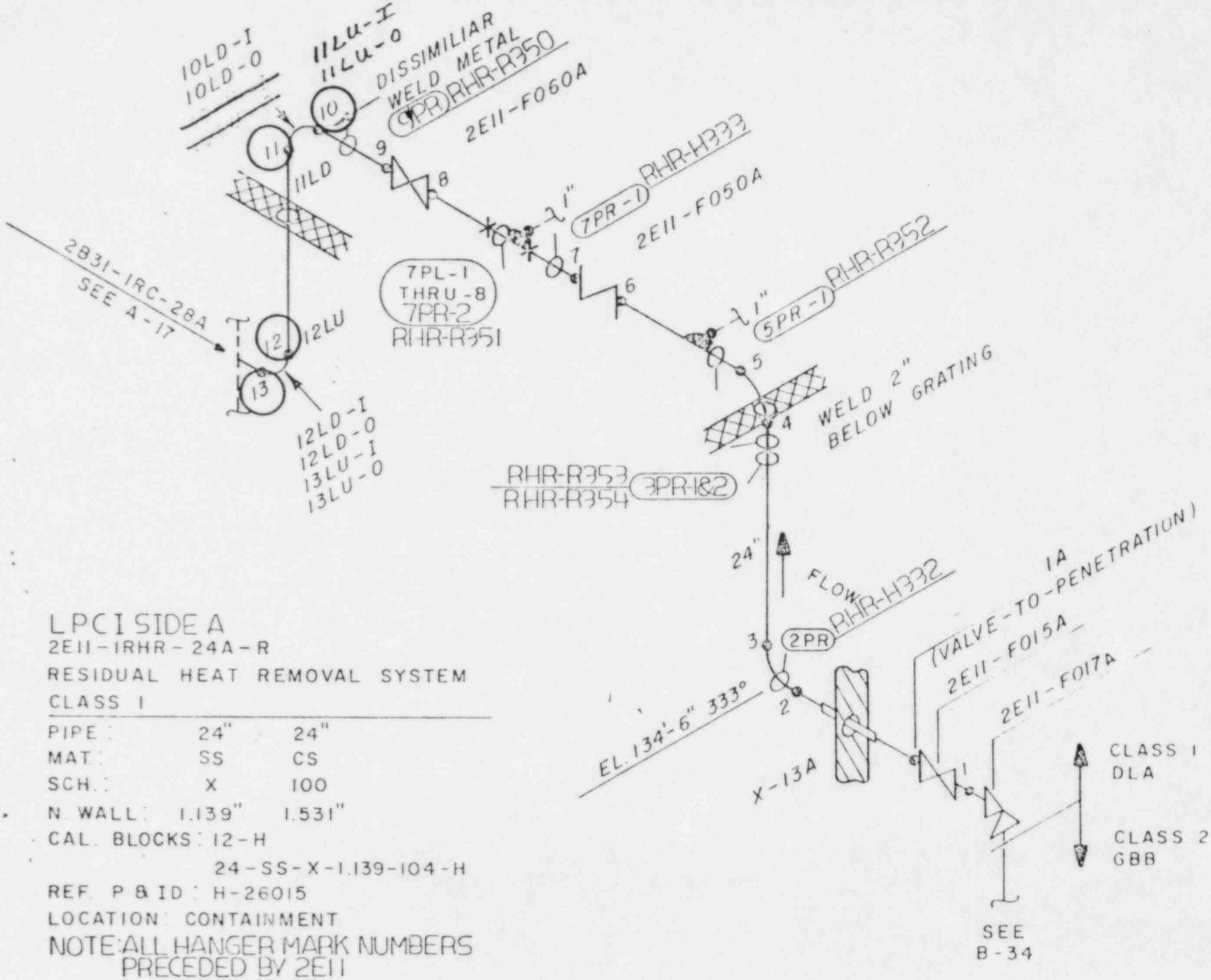
CAL. BLOCK: 20-SS-X-1.031-105-H;
20-CS-100-1.280-51-H

REF. P&ID: H-26015

LOCATION: CONTAINMENT

NOTE: ALL HANGER MARK NUMBERS PRECEDED BY 2E11

Figure A - 21

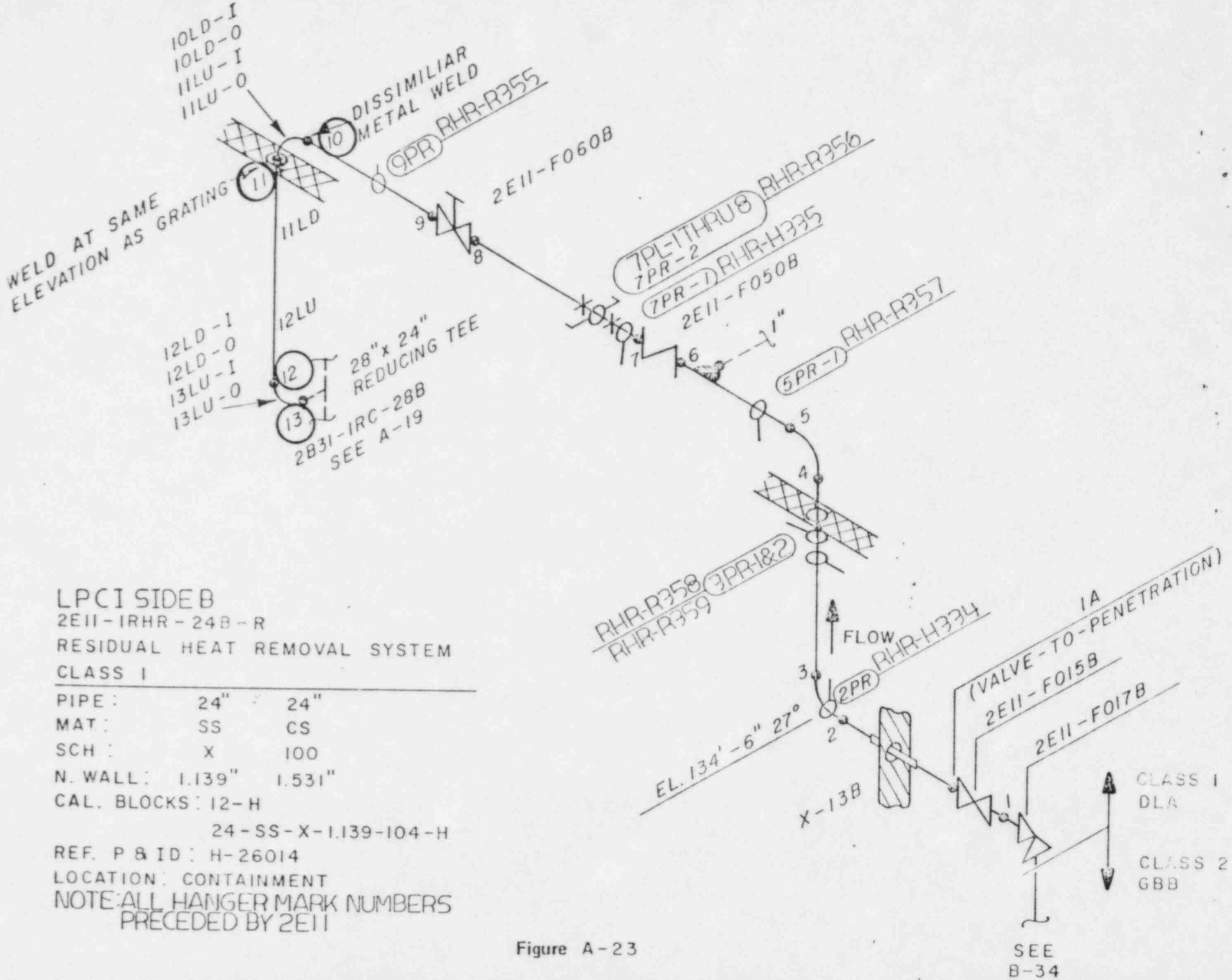


LPCI SIDE A
2E11-1RHR-24A-R
RESIDUAL HEAT REMOVAL SYSTEM
CLASS 1

PIPE:	24"	24"
MAT:	SS	CS
SCH.:	X	100
N. WALL:	1.139"	1.531"
CAL. BLOCKS:	12-H	
	24-SS-X-1.139-104-H	
REF. P & ID:	H-26015	
LOCATION:	CONTAINMENT	

NOTE: ALL HANGER MARK NUMBERS PRECEDED BY 2E11

Figure A-22



LPCI SIDE B

2E11-1RHR-24B-R

RESIDUAL HEAT REMOVAL SYSTEM

CLASS 1

PIPE:	24"	24"
MAT:	SS	CS
SCH:	X	100
N. WALL:	1.139"	1.531"

CAL. BLOCKS: 12-H

24-SS-X-1.139-104-H

REF. P & ID: H-26014

LOCATION: CONTAINMENT

NOTE: ALL HANGER MARK NUMBERS PRECEDED BY 2E11

Figure A-23

RWCU PUMP SUCTION
2G31-1RWCU-6-D
REACTOR WATER
CLEAN-UP SYSTEM
CLASS 1

PIPE : 6"
MAT : SS
SCH. : 80
N.WALL : 0.432"
CAL.BLOCK : 2-H
REF. P&ID : H-26036
LOCATION : CONTAINMENT

NOTE ALL HANGER MARK NUMBERS PRECEDED BY 2G31

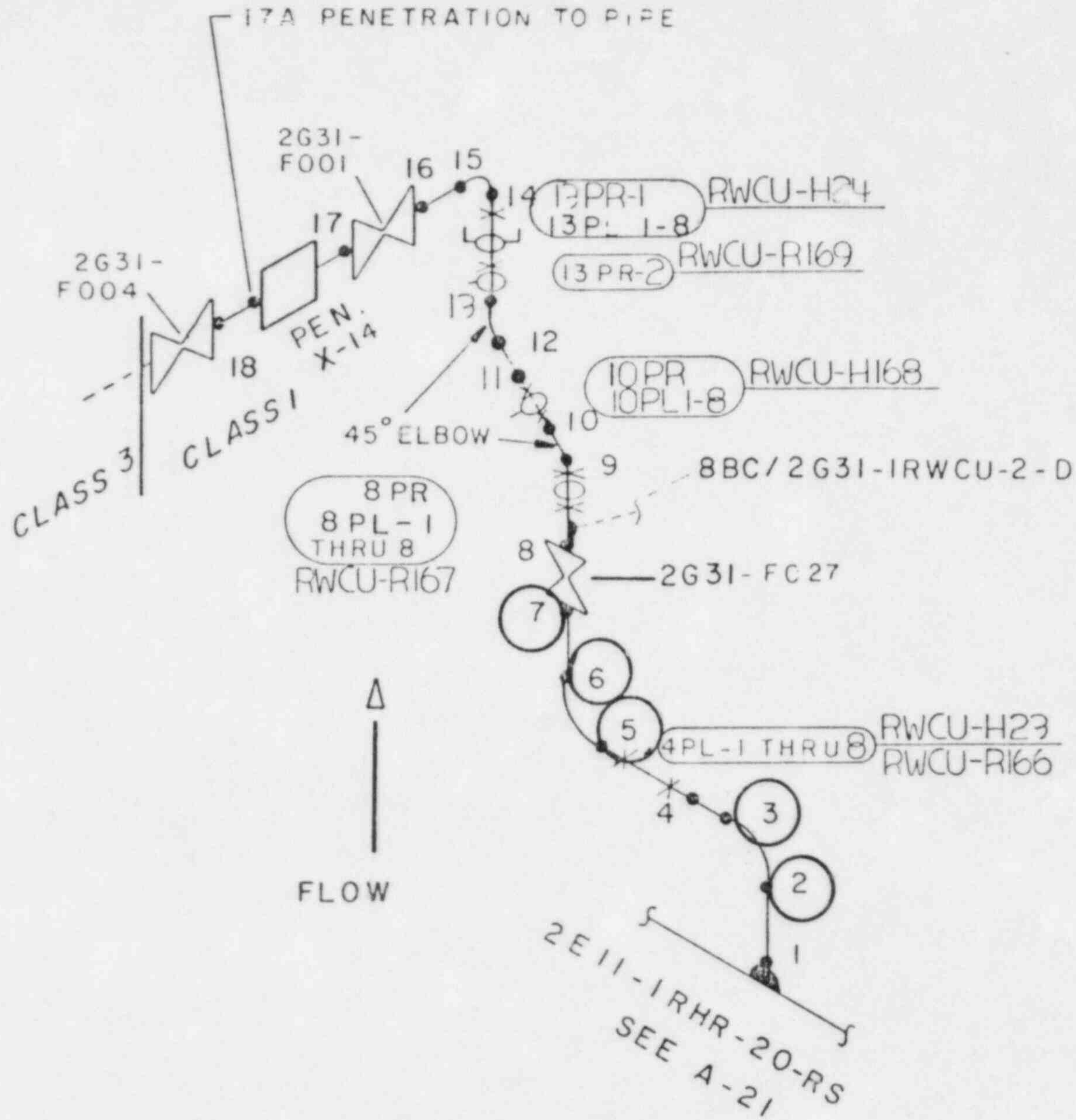


Figure A - 28

ATTACHMENT 2

nutech
ENGINEERS
6835 VIA DEL ORO • SAN JOSE, CALIFORNIA 95119 • PHONE (408) 629-9800 • TELEX 352062

May 20, 1983
GPC-07-011

Mr. J. A. Edwards
Georgia Power Company
Post Office Box 4545
333 Piedmont Avenue (N.E.)
Atlanta, Georgia 30302

Subject: Evaluation of Welds with UT Indications in the Hatch 2 Large Bore Recirculation System Piping

Dear Mr. Edwards:

The purpose of this letter is to transmit the preliminary results of the NUTECH evaluation of the two largest UT indications in the large bore Recirculation System piping at Plant Hatch Unit 2. The approach used in this evaluation was to perform a very conservative crack growth analysis based on the flaw characterization provided by Georgia Power Company. The results are shown in Figures 1 and 2 for the indications in welds 28B-15 and 28B-10, respectively. Examination of Figures 1 and 2 will show that the as-characterized UT indications will not grow to the Code allowable size for at least 26 months. An alternate way of assessing the margin is that the current allowable crack size is at least 1.25 times the largest actual crack size (28B-15).

Discussion

The allowable end of fuel cycle crack size was determined based on Reference 1. The loads used in the determination of allowable crack size are design pressure, dead weight and OBE seismic. The resulting stresses at each specific crack location were obtained from the original Stress Report for the Hatch 2 Recirculation System (Reference 2). The allowable crack size is plotted as a dashed line in Figures 1 and 2.

The predicted growth of the existing UT indications requires several inputs:

1) Steady state applied stress
2) Weld residual stress
3) Flaw characterization
4) Crack growth model
5) Crack growth law

The approach used was to use conservative input for applied stress, residual stress, crack growth model and crack growth law. Thus, the result of the analysis is a very conservative prediction of crack size versus time.

The steady state loads at each crack location due to operating pressure, dead weight and thermal expansion were obtained from Reference 2. The steady state stresses were then calculated based on design minimum wall thickness at each specific location.

The weld residual stress was obtained from a set of NUTECH standard residual stress curves (Reference 3). The residual axial stress curve for large bore piping from Reference 3 is shown in Figure 3.

The flaw sizes were obtained from Reference 4 and are shown in Table 1 for both welds 28B-10 and 28B-15 which contain the largest flaws in the large bore piping. It was conservatively assumed that the crack was full depth for the entire circumference.

The crack growth model is an edge cracked plate. The growth rate predicted through the use of a cracked cylinder model would be much slower. Figure 4 uses the same input as Figure 1 except for use of the cracked cylinder model instead of the edge cracked plate. Figure 4 shows a growth rate less than one tenth of Figure 1. Figure 4 is not strictly applicable to the Recirculation System piping as the thickness to radius ratio of the Recirculation System piping is slightly less than 0.1. However, Figure 4 does indicate the magnitude of conservatism in Figures 1 and 2.

The crack growth law is the upper bound law from Reference 5 and is given below:

$$\frac{da}{dT} = 4.116 \times 10^{-12} K^{4.615}$$

da = Differential crack size

dT = Differential time

K = Applied stress intensity factor

Inspection of Figures 1 and 2 will show that crack growth rates of up to 2×10^{-4} inch per hour are predicted in the final month before the allowable crack depth is reached. The validity of the crack growth law applied to large flaws is based on linear extrapolation of measured crack growth rates versus crack tip stress intensity factor. Such high growth rates (2×10^{-4} inch per hour) have not been observed in realistic laboratory or field situations. It is likely that a realistic upper bound weld sensitized IGSCC crack growth rate in an operating BWR is less than 2×10^{-4} inch per hour.

The results of the crack growth evaluations are given in Figures 1 and 2 for welds 28B-15 and 28B-10, respectively. The initial crack size of 23% of the wall thickness for weld 28B-15 will grow to the allowable size of 63% in approximately 26 months or about one and one half 18 month fuel cycles. Another way of expressing the same margin is to determine the crack size that would grow to the allowable crack size in the next 18 month fuel cycle. From Figure 1 for weld 28B-15, a crack size of 29% would grow to the allowable of 63% in 18 months. Thus, the currently allowable crack size is 29%, which is 1.25 times the largest measured crack size.

<u>Summary</u>

Very conservative crack growth evaluations have been performed which show that the UT indications in the large bore Recirculation piping at Plant Hatch Unit 2 will not grow to the Code (Reference 1) allowable size for at least 26 months. Or stated another way, the currently allowable crack size is at least 1.25 times the largest measured crack size.

If you have any questions or comments regarding the information presented herein, please do not hesitate to contact Jim Charnley.

Very truly yours,

J E Charnley

J. E. Charnley, P.E.
Project Engineer

Norman Eng

N. Eng
Project Manager

JEC:NE/gmm

Attachments

cc: H. C. Nix, Jr. (Baxley)
JEC-83-013
NE-83-126

nutech ENGINEERS

REFERENCES

1. ASME Boiler and Pressure Vessel Code Section XI, Paragraph IWB-3640 (proposed), "Acceptance Criteria for Austenitic Stainless Steel Piping"

2. General Electric Report 22A4264AA, Revision 0

3. NUTECH Internal Memo PCR-83-003, March 4, 1983, "Weld Residual Stresses for IGSCC Crack Growth Evaluations"

4. Indication Notification Forms

   I83H2015 Rev. 0 (28B-10) April 28, 1983
   I83H2016 Rev. 0 (28B-15) April 28, 1983

5. EPRI-2423-LD, "Stress Corrosion Cracking of Type 304 Stainless Steel in High Purity Water - A Compilation of Crack Growth Rates," June 1982

TABLE 1

UT CHARACTERIZATION

Weld Number	Crack Orientation	Characterization Length	Maximum Depth
2B31-1RC-28B-10	Circumferential	Essentially 360°	20%
2B31-1RC-28B-15	Circumferential	Essentially 360°	23%

AFQAKMC 83/05/20 08.23.35

IGSCC GROWTH ANALYSIS (CIR. CRACK)
P-EL WELD (ISI WELD ID : B15) (OD=28. IN, T=1.384 IN) (ELBOW SIDE)

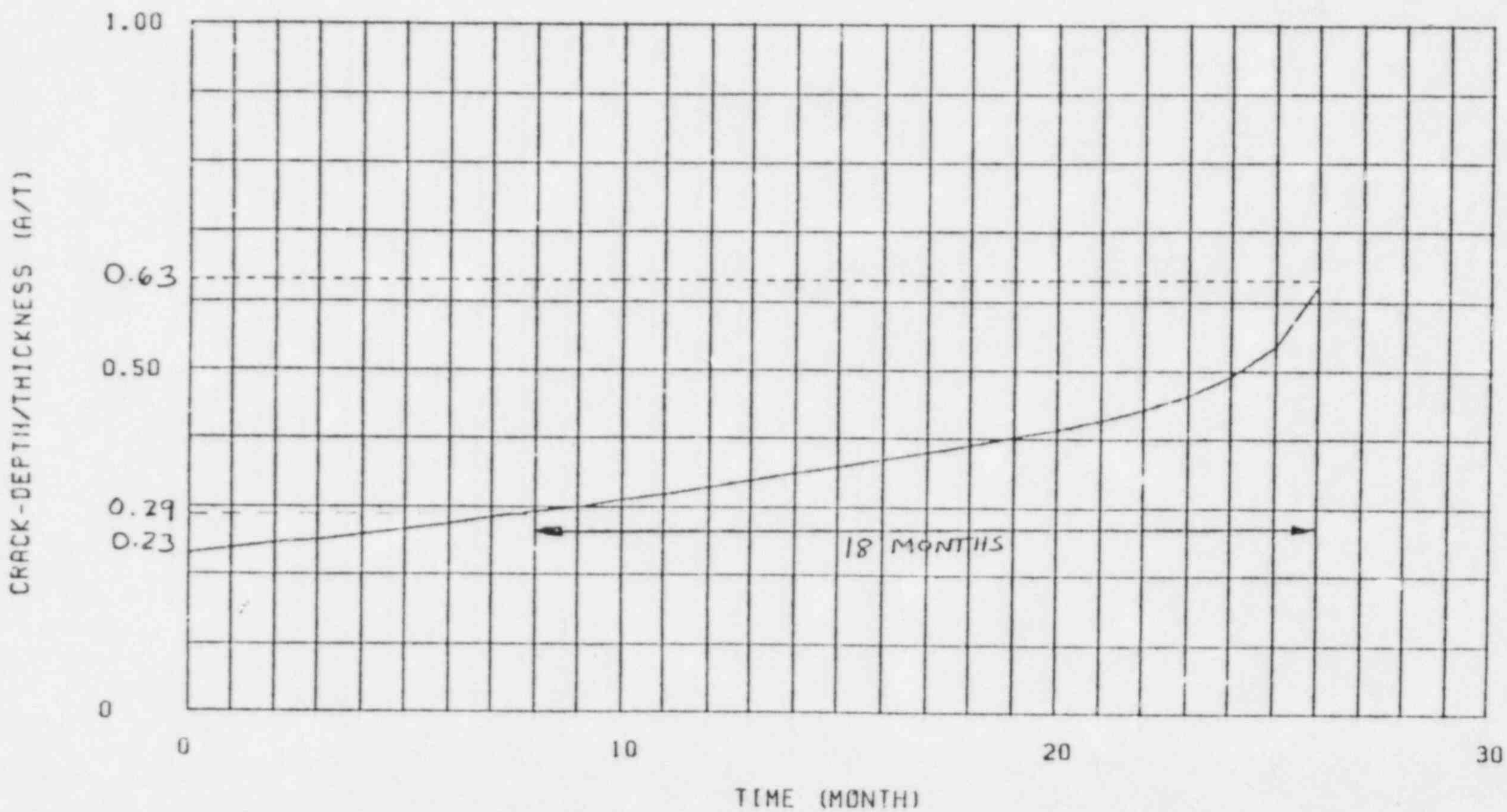


FIGURE 1

———— NUTCRAK FUN1 (REF. AFQAKJG)
- - - - - - - ALLOWABLE A/T AT THE END OF FUEL CYCLE

AFQAKKV 83/05/20 08.09.24

IGSCC GROWTH ANALYSIS (CIR. CRACK)
P-EL WELD (ISI WELD ID : B10) (OD=28. IN, T=1.089 IN)

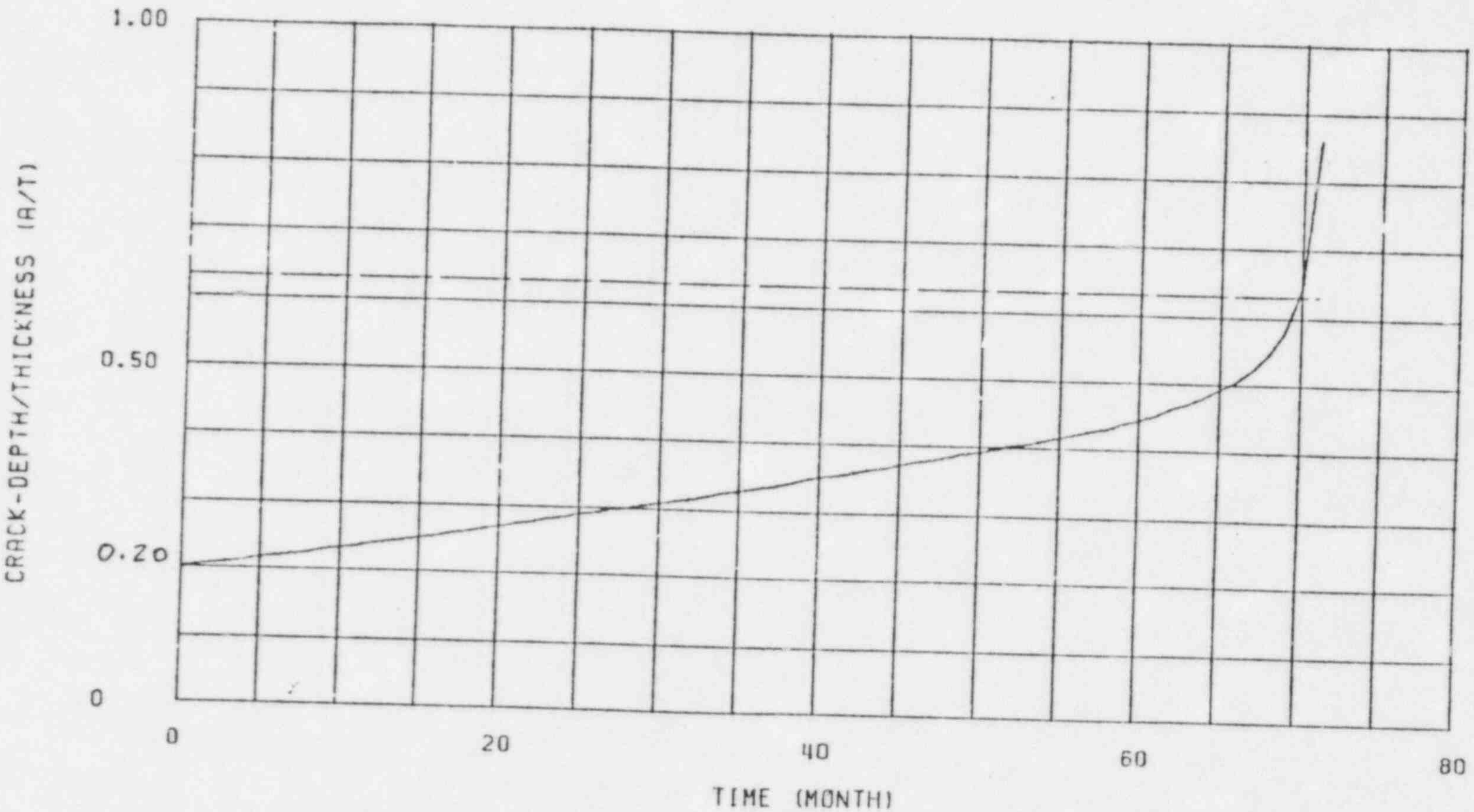
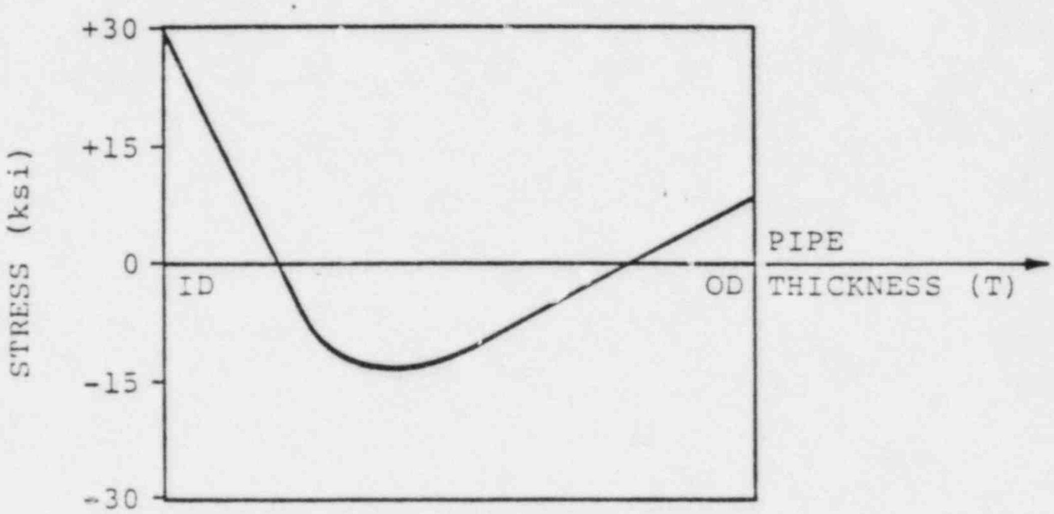


FIGURE 2

———— NUTCRAK FUNi (REF. AFQAKII)
- - - - - - - - ALLOWABLE A/T AT THE END OF FUEL CYCLE



T%	STRESS (ksi)
0	+30.0
19	0.0
25	- 9.9
39	-14.2
50	-12.0
81	0.0
100	+ 8.1

FGPC83.02

Figure 3

AXIAL RESIDUAL STRESS

PIPE DIAMETER OF 20" TO 28"

IGSCC GROWTH ANALYSIS (CIR. CRACK)
P-EL WELD (ISI WELD ID : B15) (OD=28. IN, T=1.384 IN) (ELBOW SIDE)

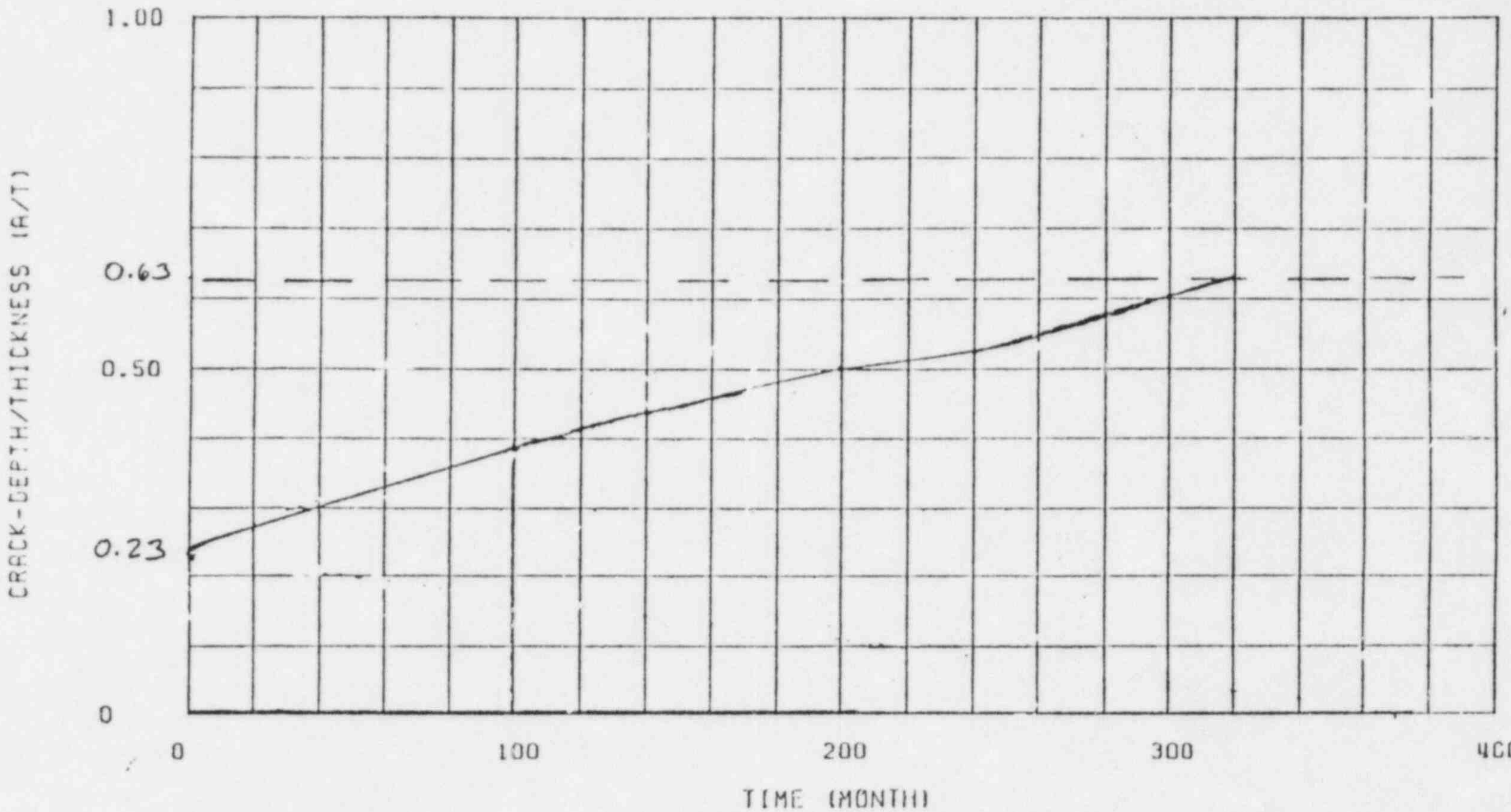


FIGURE 4

——— NUTCRAK FUN2 (REF. AFJALBR)
------- ALLOWABLE A/T AT THE END OF FUEL CYCLE

ATTACHMENT 3

nutech ENGINEERS

6835 VIA DEL ORO • SAN JOSE, CALIFORNIA 95119 • PHONE (408) 629-9800 • TELEX 352062

May 23, 1983
GPC-07-012

Mr. J. A. Edwards
Georgia Power Company
Post Office Box 4545
333 Piedmont Avenue (N.E.)
Atlanta, Georgia 30302

Subject: Stress Intensity as a Function of Crack Depth for Weld 28B15

Reference: NUTECH Letter GPC-07-011, J. E. Charnley and N. Eng to J. A. Edwards, dated May 20, 1983

Dear Mr. Edwards:

The attached four (4) tables give the stress intensity as a function of crack depth for both applied and residual stress for Weld 28B15. The first two (2) tables apply to an edge cracked plate model (Figure 1 of the reference). The last two (2) tables apply to an I.D. cracked cylinder model (Figure 4 of the reference).

If you have any questions or comments regarding the information presented herein, please do not hesitate to contact Jim Charnley.

Very truly yours,

J. E. Charnley

J. E. Charnley, P.E.
Project Engineer

Norman Eng

N. Eng
Project Manager

JEC:NE/gmm

Attachments

cc: W. Hazelton (NRC)
H. C. Nix, Jr. (Baxley)
JEC-83-014
NE-83-128

ERR**2 = .11621E+02 STD-ERR = .19682E+01

MAX. CRACK DEPTH OF 1.409 INCH; PLATE THICKNESS OF 1.566 INCH

CRACK DEPTH	KI STRESS INTENSITY
.0100	5.59612
.0413	10.42685
.0726	12.61257
.1040	13.69314
.1353	14.09141
.1666	14.18126
.1979	14.30501
.2292	14.17939
.2606	13.84446
.2919	13.32949
.3232	12.71356
.3545	12.05923
.3858	11.25143
.4172	10.30613
.4485	9.23890
.4798	8.08938
.5111	6.81954
.5424	5.34304
.5738	3.66554
.6051	1.79328
.6364	.16860
.6677	-.65884
.6990	-1.57407
.7304	-2.55462
.7617	-3.57702
.7930	-4.48700
.8243	-5.19603
.8556	-5.99783
.8870	-6.86486
.9183	-7.76898
.9496	-8.87967
.9809	-10.67525
1.0122	-12.85623
1.0436	-15.40106
1.0749	-18.28874
1.1062	-22.28564
1.1375	-28.52150
1.1688	-35.38248
1.2002	-42.78405
1.2315	-50.64327
1.2628	-53.55429
1.2941	-56.15144
1.3254	-58.44660
1.3568	-60.45320
1.3881	-62.18616

WELD 28B15

RESIDUAL STRESS

EDGE CRACKED PLATE

INITIAL $\frac{DA}{DN} = .129 \times 10^{-4} \frac{\text{inches}}{\text{hour}}$

TABLE 1

ERR**2 = .51699E-25 STD-ERR = .22737E-12

MAX. CRACK DEPTH OF 1.409 INCH; PLATE THICKNESS OF 1.500 INCH

WELD 28 BIS

APPLIED STRESS

EDGE CRACKED PLATE

CRACK DEPTH	KI STRESS INTENSITY
.0100	1.66890
.0413	3.43955
.0726	4.62296
.1040	5.60526
.1353	6.47937
.1666	7.34546
.1979	8.31562
.2292	9.28243
.2606	10.25126
.2919	11.22566
.3232	12.26410
.3545	13.44277
.3858	14.64804
.4172	15.87982
.4485	17.13794
.4798	18.52469
.5111	20.16948
.5424	21.85967
.5738	23.59409
.6051	25.37164
.6364	27.42754
.6677	30.05193
.6990	32.75163
.7304	35.52464
.7617	38.36913
.7930	41.61297
.8243	45.65428
.8556	49.80177
.8870	54.05294
.9183	58.40550
.9496	63.67477
.9809	70.83938
1.0122	78.18145
1.0436	85.69729
1.0749	93.38339
1.1062	103.72776
1.1375	119.69214
1.1688	136.03327
1.2002	152.74404
1.2315	169.81767
1.2628	171.96358
1.2941	174.08304
1.3254	176.17701
1.3568	178.24638
1.3881	180.29200

TABLE 2

ERR**2 = .11621E+02 STD-ERR = .19682E+01

MAX. CRACK DEPTH OF 1.409 INCH; PLATE THICKNESS OF 1.566 INCH

CRACK DEPTH	KI STRESS INTENSITY
.0100	5.74346
.0413	10.67709
.0726	12.89139
.1040	13.97581
.1353	14.36759
.1666	14.32161
.1979	14.00890
.2292	13.41013
.2606	12.57973
.2919	11.53923
.3232	10.41552
.3545	9.20739
.3858	7.88107
.4172	6.45551
.4485	4.94760
.4798	3.48823
.5111	2.23062
.5424	.94530
.5738	-.35578
.6051	-1.66127
.6364	-2.96123
.6677	-4.25826
.6990	-5.54812
.7304	-6.82285
.7617	-8.07494
.7930	-9.35912
.8243	-10.75895
.8556	-12.14695
.8870	-13.51734
.9183	-14.86483
.9496	-15.91292
.9809	-16.30195
1.0122	-16.58133
1.0436	-16.74609
1.0749	-16.79188
1.1062	-17.16487
1.1375	-18.41279
1.1688	-19.59218
1.2002	-20.69680
1.2315	-21.72120
1.2628	-21.58737
1.2941	-21.34096
1.3254	-20.98946
1.3568	-20.54097
1.3881	-20.00413

WELD 28B15

RESIDUAL STRESS

I.D. CRACKED CYLINDER

INITIAL $\frac{DA}{DN} = .479 \times 10^{-5} \frac{inch}{hour}$

TABLE 3

ERR**2 = .51699E-25 STD-ERR = .22737E-12

MAX. CRACK DEPTH OF 1.409 INCH; PLATE THICKNESS OF 1.566 INCH

WELD 28B15

APPLIED STRESS

I. D. CRACKED CYLINDER

CRACK DEPTH	KI STRESS INTENSITY
.0100	1.70971
.0413	3.49498
.0726	4.65996
.1040	5.60587
.1353	6.43027
.1666	7.19627
.1979	7.95815
.2292	8.68799
.2606	9.39393
.2919	10.08162
.3232	10.77852
.3545	11.51876
.3858	12.25682
.4172	12.99414
.4485	13.73187
.4798	14.52083
.5111	15.42484
.5424	16.34119
.5738	17.26994
.6051	18.21113
.6364	19.18107
.6677	20.19981
.6990	21.23335
.7304	22.28156
.7617	23.34430
.7930	24.44894
.8243	25.62871
.8556	26.82589
.8870	28.04025
.9183	29.27157
.9496	30.54974
.9809	31.91066
1.0122	33.29094
1.0436	34.69033
1.0749	36.10857
1.1062	37.58859
1.1375	39.18156
1.1688	40.79642
1.2002	42.43287
1.2315	44.09063
1.2628	44.64778
1.2941	45.19807
1.3254	45.74173
1.3568	46.27901
1.3881	46.81013

TABLE 4