



Boston Edison

Pilgrim Nuclear Power Station
Rocky Hill Road
Plymouth, Massachusetts 02360

10CFR50.55a(a)(3)

E. T. Boulette, PhD

Senior Vice President — Nuclear

December 12, 1996

BECo Ltr. #96-105

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Docket No. 50-293
License No. DPR-35

Pilgrim Refueling Outage #11 ISI Relief from
(a) ASME, Section XI Inspections and (b) Generic Letter 88-01 IGSCC Inspections

Summary

Boston Edison Company (BECo) informed the NRC in BECo Letter No. 96-091, dated October 30, 1996, "Refueling Outage (RFO) 11 Inservice Inspection (ISI) Plan", that a plant shutdown in September 1996 revealed a significant increase in recirculation piping dose rates in the drywell and we were evaluating the RFO#11 ISI inspection schedule to identify the need for relief due to these elevated radiation dose levels. Our evaluation concluded approximately 60 man-rem exposure can be averted by deferring certain drywell ISI examinations to RFO#12 and by performing them after the chemical decontamination of the recirculation system, which is planned for RFO#12. Therefore, we seek specific relief from RFO#11 ISI requirements.

The scope of the relief request (as specified in section A of this letter) applies to (i) ASME Section XI inspections related to nozzle-to-reactor pressure vessel welds, (ii) ASME Class I piping welds, and (iii) Generic Letter 88-01 IGSCC related examinations. Deferral of ASME Section XI required inspections would be for nine months from the first to the second ISI period, and IGSCC susceptible weld inspections would be deferred for one cycle (2 years).

The relief request is submitted pursuant to 10 CFR 50.55a(a)(3)(ii) because compliance with the RFO#11 schedule would result in a radiological exposure hardship to NDE examination and craft personnel without a compensating increase in the level of quality and safety. Details of the radiological hardship are provided in section B of this letter.

The granting of relief does not increase the risk to the public health and safety and is necessary to achieve 10 CFR 20 "as-low-as-reasonably-achievable" (ALARA) requirements for examination and craft personnel. Quality and safety considerations are presented in section C of this letter.

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We request NRC review and approval of our relief requests in time to support RFO#11 which is currently scheduled for February 1, 1997.

A. Scope of Relief Requests:

Relief Request #1: (Nozzle-to-Vessel Welds and Radii).

Relief from ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D for full penetration nozzle welds in reactor vessel is requested. This section requires volumetric examination of all nozzle welds and inside radii (Items B3.90 and B3.100) within each ten-year interval. As shown in Enclosure A, examinations of N1A, N2A, and N2B nozzle-to-vessel welds and N1A, N2A, and N2B nozzle-to-vessel inner radii are currently scheduled for RFO#11. BECo seeks relief from these RFO#11 examinations to defer them to RFO#12.

Relief Request #2: (Piping Welds).

Relief is requested from ASME Section XI, Table IWB-2500-1, Examination Category B-J (Items B9.10 through B9.40) for pressure retaining welds in pipes, which requires surface and/or volumetric examination of a 25% sample population within each ten-year interval. Category B-F for dissimilar metal welds requires 100% examination every 10 years. Category B-K-1 integral attachment weld examinations (Item B10.10) are not code-required during the Third and Fourth Ten-Year ISI intervals; however, the NRC has required that an augmented 10% sample be examined at Pilgrim during the current Third interval. Additionally, most of these piping welds fall under Generic Letter 88-01 (IGSCC) Category A augmented inspection requirements. GL 88-01 Category A requirements are coincidentally the same as Category B-J of the code (25% every 10 years).

BECo has scheduled inspections of a portion of all B-J, B-F and B-K-1 welds during RFO#11 to comply with code and augmented examination requirements. A significant number of piping welds and lugs are scheduled for this inspection. BECO seeks relief from a portion of these RFO#11 weld examinations (listed below) by deferring them to RFO#12.

<u>Pilgrim Weld No.</u>	<u>ASME Code Category</u>	<u>System</u>	<u>GL 88-01 Category</u>	<u>Comments</u>
2R-N1B-10	B-J	RECIRC	A	
2R-N1B-11	B-J	RECIRC	A	
2R-NiB-9BC-1	B-J	RECIRC	A	
2R-N1B-14HL2(4)	B-K-1	RECIRC	N/A	
RPV-N-16A-R-1	B-F	RWL	N/A	
1-A-9	B-J	MS	N/A	
1-A-7	B-J	MS	N/A	
1-A-8	B-J	MS	N/A	
1-A-8HL1(8)	B-K-1	MS	N/A	
10R-0-12	B-J	RHR	A	H.S.*
10R-0-6	B-J	RHR	A	H.S.
10R-0-7	B-J	RHR	A	
10R-0-8	B-J	RHR	A	H.S.
10R-0-9	B-J	RHR	A	H.S.

** Note: High Stress Welds (H.S.) are also deferred to RFO#12. ASME Section XI, Table IWB-2500-1, Examination Category B-J (Item B9.11 thru B9.40) are pressure retaining pipe welds at terminal ends or where the stress level exceeds 2.4Sm or usage factor exceeds 0.4.*

The above listed examinations, if deferred from the first to the second period of the Third Ten-year interval, would require relief from two sections of the ASME XI code. Paragraph IWB-2420(a) requires that the sequence of examinations be repeated during each interval. Additionally, paragraph IWB-2412(a) states (via Table IWB-2412-1) that at least 16% but not more than 34% of the scheduled ISI program examinations for each category must be completed by the end of the first 40 month inspection period of each interval. Upon approval of relief, the Category B-J and B-K-1 examinations will be 12% and 0% at the end of the first period.

BECO proposes to complete the above examinations during RFO#12. RFO#12 represents 4 years of operation for the present ISI interval and is nine months into the second inspection period. Since this operational period is only slightly longer than the specified inspection period of 3 years, the intent of the code, if not the precise time period, is satisfied.

Relief Request #3: (IGSCC Welds)

Relief from the NRC Generic Letter 88-01 commitment to inspect Category D welds is requested. This commitment falls within the scope of PNPS Operating License Amendment No. 75, Long Term Program Plan, Schedule B requirements.

GL 88-01 requires examination of all Category D recirculation pipe safe-end welds every two refueling outages. Six recirculation safe-end welds (5 Category D and one Category A) are scheduled for examination during RFO#11. BECO seeks one-time relief from the examination of two Category D (N2A and N2B) and one Category A (N1A) safe-end weld during RFO#11. BECO proposes completing these examinations during RFO#12. However, these welds may be subject to a reduction of Category D weld examination requirements if authorized by the NRC in response to BECO Letter # 94-111, dated October 13, 1994, and BWR Owners Group (BWROG) resolution of NRC Safety Evaluation Report (SER) findings concerning BWROG Topical Report NEDC-319151P.

The attached isometric drawings (Enclosure C) indicate welds included in the above relief requests.

B. Reason for the Relief Requests - Radiological Exposure Hardship

Pilgrim is committed to keeping personnel radiation exposure as-low-as-reasonably-achievable (ALARA) to comply with 10 CFR 20.

During our September 1996 outage, containment (drywell) dose-rate data was gathered and used to update our ISI ALARA assessments. This data indicated dose rates in the drywell were significantly higher than expected. We attribute the elevated dose-rates to the use of hydrogen water chemistry (HWC) that we employ to mitigate potential IGSCC in susceptible stainless steel components.

We reassessed the expected RFO#11 personnel exposure rates based on our September 1996 containment dose rate data. The expected dose-rates for certain ISI examinations are significantly higher than our previous estimate. Hence, proceeding with the examinations

during RFO#11 is inconsistent with ALARA goals and presents a radiological exposure hardship to NDE and craft personnel performing these examinations.

To reduce personnel exposure, chemical decontamination of the recirculation system will be necessary. Implementation of chemical decontamination during RFO#11 is not practical because there is not enough time to evaluate the outage sequence impact, understand industry experience to maximize the effectiveness of decontamination, and plan and execute dose reduction strategies. Accordingly, we will perform chemical decontamination in RFO#12.

The attached Table A provides a breakdown of the original and revised exposure rates associated with each examination for which we are requesting relief. A summary of the combined exposures follows:

RFO#11 estimates for inspections included in Relief Request #1 and 3	= 40.40 Rem
RFO#11 estimates for inspections included in Relief Request #2	= 26.38 Rem
Total RFO#11 dose estimates	= 66.78 Rem

If we defer these examinations to RFO#12, we will have time to implement a dose reduction strategy that includes chemical decontamination of the recirculation system. This strategy should produce significant savings in personnel exposure (see attached Table B) as summarized below:

RFO#12 dose from Relief Request # 1 and 3	= 1.80	Rem
RFO#12 dose from Relief Request # 2	= 4.64	Rem
Total RFO#12 dose	= 6.44	Rem

We estimate that granting the requested relief, when combined with chemical decontamination, will reduce exposure by approximately 60 man-rem. In addition, we are in the process of implementing depleted zinc injection which may provide further dose reduction.

Therefore, we request the above specified ISI relief, which would allow time to implement strategies to mitigate personnel exposure when the deferred examinations are performed.

C. Quality and Safety Considerations in Support of Relief Requests

The following technical considerations support our RFO#11 ISI examination relief requests:

1. Justification for Relief Requests # 1 and 3
 - (a) Mechanics and Operating Experience.

The purpose of the inspection program is to identify flaw indications or conditions that, when evaluated in accordance with the requirements of the Code, will assure the component is acceptable for continued service. The N1A, N2A and N2B nozzles were inspected in 1984 (see Enclosure A, ISI N1 and N2 Nozzle Inspection Schedule), and no relevant indications were found.

In 1995 (RFO#10) the reactor vessel shell and beltline welds were inspected in compliance with the NRC's augmented examination requirement for reactor pressure vessels. These welds had been exposed to service induced loads and neutron fluence that was more severe than the nozzle welds. The probability of flaw initiation is, therefore, greater in this

region, yet no flaws were discovered during this inspection. Thus, based on the inspection history, there is high confidence these welds are absent of flaws, and these nozzle inspections can be deferred by one cycle.

However, if a flaw of detectable size was assumed to develop in a nozzle shortly after the 1984 inspection and grew at stable growth rates until the next inspection interval (i.e., RFO#12), the final flaw size would not compromise the integrity of the nozzle. Maximum stress cycles were assumed together with existing nozzle analyses to confirm stable crack growth is assured. Thus, the structural integrity for all normal, emergency and faulted conditions would be maintained.

In the unlikely event that a flaw propagated through-wall during this time, crack growth is stable, and catastrophic failure would not occur. Therefore, the affected line would not completely sever, and extensive leakage would occur before failure. Any amount of leakage, however small, would be identified by the drywell leak detection system in time to take corrective action.

(b) Hydrogen Water Chemistry (HWC).

NRC Generic Letter 88-01 requires that all nozzle safe-end welds made of non-IGSCC resistant materials be inspected every 2 refueling outages. These welds are defined as "Category D" in GL 88-01. The Pilgrim reactor vessel Category D nozzle safe-ends have material which is susceptible to intergranular stress corrosion attack; however, Pilgrim has employed Hydrogen Water Chemistry (HWC) since 1989. Hydrogen injection provides protection against IGSCC development and will arrest crack growth.

The N2A and N2B nozzles, currently scheduled for inspection during RFO#11, were previously inspected in 1993 after the HWC system had been operating for four years. No evidence of IGSCC was found during this inspection. Therefore, deferral of the nozzle safe-end inspection for one additional cycle is technically justifiable. Should a nozzle safe-end IGSCC related flaw develop and propagate through-wall during this time, any leakage would be identified by the drywell leak detection system in time for corrective action to be taken.

PNPS requests a deferral of three safe-end weld inspections based on the technical reasons specified above and the fact that HWC was in operation during cycles 9, 10, and 11. The HWC effectiveness is presented in Enclosure B. HWC will continue to be implemented during cycle 12 reducing potential crack growth that might occur without HWC. Pilgrim employs HWC and practices reactor coolant chemistry techniques that mitigate IGSCC. In addition, past inspections of the subject components have identified no indications, and crack propagation rates are sufficiently slow to minimize the risk of component failure prior to the proposed RFO#12 examinations. Therefore, granting a deferral of the specified examinations to RFO#12 to reduce personnel radiation exposure does not represent a increase in risk to the public health and safety.

Based on the known fracture toughness of the nozzle-to-vessel welds and the mitigating actions taken to arrest crack growth in IGSCC susceptible welds, a one cycle deferral of the inspections will not affect the integrity of the vessel nozzles or the capability of the nozzles to perform their intended function; therefore, such deferral will not decrease the level of quality or safety of the affected components.

2. Justification for Relief Request #2 only: Operating Experience.

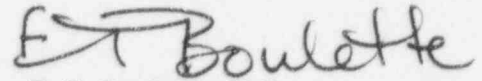
The impact of deferring the selected pipe weld inspections for one additional cycle is inconsequential based on operating history and the lack of indications found during previous inspections. We have requested relief for fourteen welds. Nine of the listed welds were replaced in 1984 with IGSCC-resistant materials and have experienced five operating cycles since replacement. Four welds have been in service for ten operating cycles and are in their third inspection interval. One was replaced in 1987 and has seen four operating cycles. All the welds were previously inspected at least once, (and in some instances more than once) after having experienced a significant number of operating transients. Thus, a one cycle deferral of the inspections will not affect the integrity of the welds or the capability of the system to perform its intended function and, therefore, such deferral will not decrease the level of quality or safety of the affected components.

D. Commitments:

This letter contains the following commitments:

1. Implementation of a dose reduction strategy (chemical decontamination) during RFO#12 prior to performing the deferred inspections.
2. Inspections of deferred nozzle-to-vessel welds and radii during RFO#12.
3. Inspection of deferred piping welds during RFO#12.
4. Inspection of deferred GL 88-01 Category D recirculation safe-end welds during RFO#12 or reduced inspections of Category D welds if authorized by the NRC in accordance with BECo letter No. 94-111, dated October 13, 1994.

Should you wish further information on this request, please contact Walter Lobo at (508) 830-7940.


E. T. Boulette, PhD

WGL/dmc/rfoisir3

Attachments:

- Table A: Dose Estimates for Relief Requests.
- Table B: Dose Savings due to Dose Reduction Strategies.
- Enclosure A: Pilgrim ISI N1 and N2 Nozzle Inspection Schedule.
- Enclosure B: Pilgrim Hydrogen Water Chemistry.
- Enclosure C: Isometric Drawings (ISII10-1A, ISII1-1SHT 1, ISII54-1, ISII54-4, & ISII2RA)

cc:

Project Manager

Division of Reactor Projects - I/II

Mail Stop: 14D1

U. S. Nuclear Regulatory Commission

1 White Flint North

11555 Rockville Pike

Rockville, MD 20852

U.S. Nuclear Regulatory Commission

Region I

475 Allendale Road

King of Prussia, PA 19406

Senior Resident Inspector

Pilgrim Nuclear Power Station

TABLE A: RFO#11 DOSE ESTIMATES ASSOCIATED WITH RELIEF REQUESTS

Dose Estimate for Relief Requests #1 and 3
(N1A, N2A and N2B nozzle-to-vessel, inner radii and safe end weld examinations)

<u>Nozzle</u>	<u>Original Dose Estimate</u>	<u>New Dose Estimate</u>	<u>Increase</u>
	<u>Rem</u>	<u>Rem</u>	<u>Rem</u>
N1A	6.60	13.20	6.60
N2A	4.32	13.60	9.30
N2B	4.32	13.60	9.30
<u>Total Est. Rem</u>	<u>15.24 Rem</u>	<u>40.40 Rem</u>	<u>25.2 Rem</u>

Dose Estimate for Relief Request #2

<u>Weld</u>	<u>Original Dose Estimate</u>	<u>New Dose Estimate</u>	<u>Increase</u>
	<u>Rem</u>	<u>Rem</u>	<u>Rem</u>
2R-N1B-10	0.82	2.05	1.23
2R-N1B-11	0.82	2.05	1.23
2R-N1B-9BC-1	0.82	2.05	1.23
2R-N1B-14HL2(4)	0.82	2.05	1.23
RPV--N-16A-R-1	1.58	1.90	0.32
1-A-7	0.27	1.00	0.73
1-A-8	0.27	1.00	0.73
1-A-9	0.32	1.28	0.96
1-A-8HL1(8)	0.27	1.00	0.73
10R-0-12	1.60	2.40	0.80
10R-0-6	1.60	2.40	0.80
10R-0-7	1.60	2.40	0.80
10R-0-8	1.60	2.40	0.80
10R-0-9	1.60	2.40	0.80
<u>Total Est. Rem</u>	<u>13.99 Rem</u>	<u>26.38 Rem</u>	<u>12.39 Rem</u>

Total New Dose Estimate for Relief Request #1, 2 and 3 = 40.40+26.38 = 66.78 Rem

Total Increase in Dose for Relief Request #1, 2 and 3 = 25.20+12.39 = 37.59 Rem

TABLE B. RFO#12 DOSE ESTIMATES ASSOCIATED WITH RELIEF REQUESTS

Dose Estimate for Relief Requests #1 and 3
(N1A, N2A and N2B nozzle-to-vessel, inner radii and safe end weld examinations)

<u>Nozzle</u>	<u>New Dose Estimate</u> <u>Rem</u>	<u>Dose Estimate Following</u> <u>Decon*</u> <u>Rem</u>
N1A	13.20	.566
N2A	13.60	.616
N2B	13.60	.616
Total Est. Rem	<u>40.40 Rem</u>	<u>1.80 Rem</u>

Dose Estimate for Relief Request #2

<u>Weld</u>	<u>New Dose Estimate</u> <u>Rem</u>	<u>Dose Estimate Following</u> <u>Decon*</u> <u>Rem</u>
2R-N1B-10	2.05	0.255
2R-N1B-11	2.05	0.255
2R-N1B-9BC-1	2.05	0.255
2R-N1B-14HL2(4)	2.05	0.255
RPV--N-16A-R-1	1.90	1.540
1-A-7	1.00	0.125
1-A-8	1.00	0.125
1-A-9	1.28	0.160
1-A-8HL1(8)	1.00	0.125
10R-0-12	2.40	0.300
10R-0-6	2.40	0.300
10R-0-7	2.40	0.300
10R-0-8	2.40	0.300
10R-0-9	2.40	0.300
Total Est. Rem	<u>26.38 Rem</u>	<u>4.640 Rem</u>

The above estimate is based on a dose reduction factor of 8.0.

Total Estimated Exposure for RFO#12 = 1.80 + 4.64 = 6.44 Rem

Total Estimated Savings for Relief Request #1, 2 and 3 = 66.78 - 6.44 = 60.34 Rem

PILGRIM ISI N1 & N2 NOZZLE INSPECTION SCHEDULE

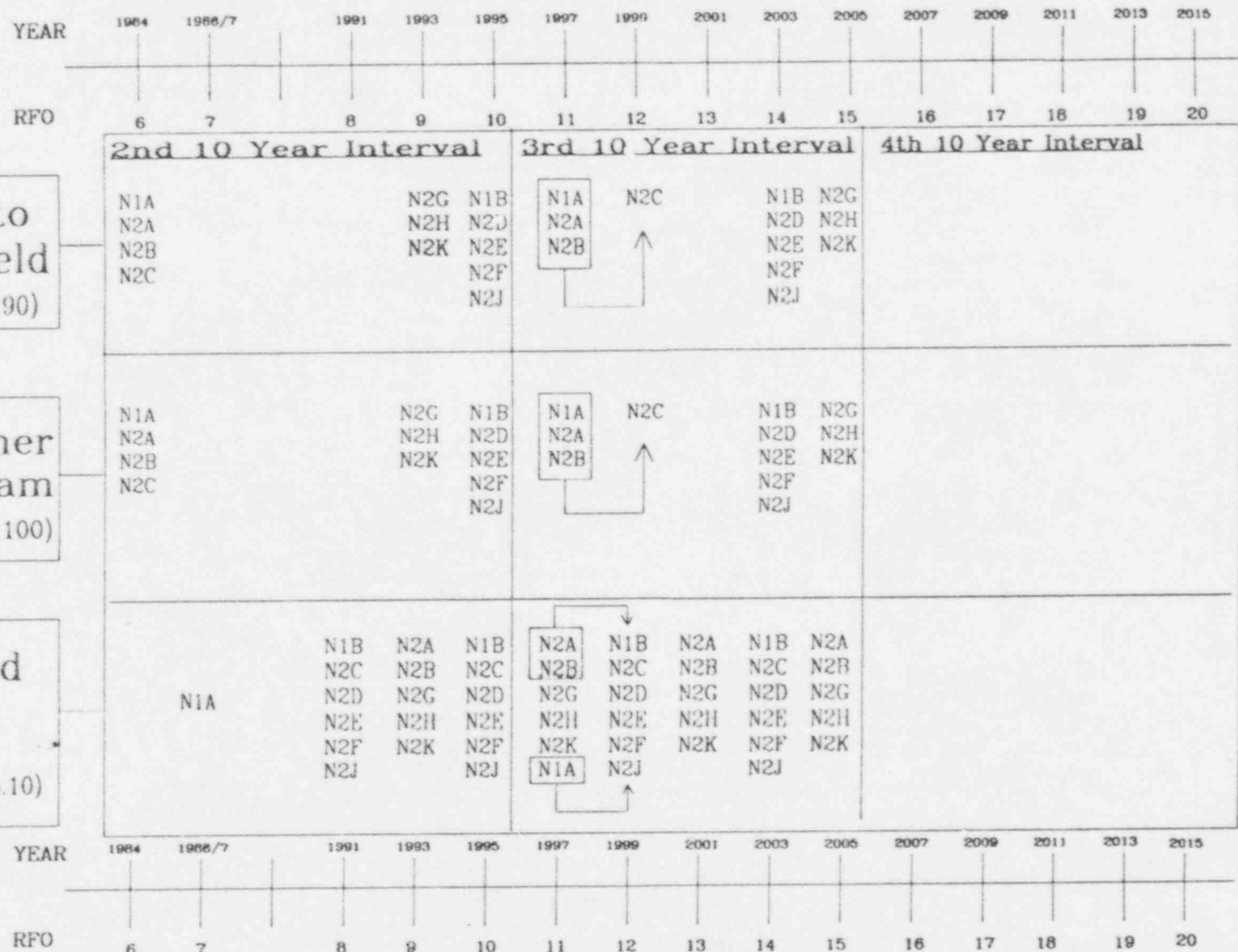
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nozzle to
vessel weld
(code item B3.90)

nozzle inner
radius exam
(code item B3.100)

safe end
welds
(GL88-01 &
code item B5.10)



ENCLOSURE A

ENCLOSURE B
Pilgrim Hydrogen Water Chemistry

The current inspection schedule requirements for reactor recirculation piping category "D" welds in accordance with NUREG 0313 are 100% every two cycles. This schedule allows for some potential crack growth bounded by NUREG 0313. However, no credit is taken for HWC, which is recognized as a mitigator of stress corrosion cracking in stainless steel at an Electrochemical Corrosion Potential (ECP) of $< -230\text{mV}$.

It is also recognized HWC is more effective if reactor water conductivity is maintained far below $0.3\mu\text{S/cm}$.

PNPS requests a deferral of three safe-end weld inspections based on both the mechanical reasons (Relief Request #1 justifications) and the fact that HWC was implemented in cycles 9, 10 and 11. HWC will continue to be implemented in cycle 12 to reduce the potential crack growth that otherwise might occur without HWC. An estimate of that reduced crack growth is based on the BWRVIP crack growth model as submitted to the staff in BWRVIP-14, "Evaluation of Crack Growth in BWR Stainless Steel RPV internals".

HWC was started at PNPS in 1989 during cycle 8. The following table summarizes chemistry conditions in the reactor recirculation piping since 1991:

Table 1

Cycle	% HWC Availability	Avg. Reactor Water Cond ($\mu\text{S/cm}$)
9	~56%	~10
10	~75%	~15
11	~85%	~0.13

% HWC Availability is defined as:

$$\frac{\text{Hours ECP} < -230 \text{ mV}}{\text{Hours service temp} > 200^{\circ}\text{F}}$$

The reactor water conductivity was averaged from monthly time-weighted averages. To add some conservatism, a $0.2\mu\text{S/cm}$ conductivity was assumed along with an ECP of -230 mV . In actuality, reactor water conductivity was much less and ECP, on average, was generally in the range of -400 to -500 mV . This simplifies the discussion when utilizing information in BWRVIP-14. The following table summarizes the relative crack growth at $0.2 \mu\text{S/cm}$ and approximates the reduction in crack growth at varying ECPs and HWC availability:

Table 2

ECP (mV)	200 (NWC Condition)	-230	-360	-500
Crack Growth (Inches/Hr)	4.5×10^{-6}	9×10^{-7}	6×10^{-7}	3.5×10^{-7}
Crack Growth Reduction @ 100% Availability	--	5 X	7.5X	13X
Crack Growth Reduction 50% Availability	--	2.5X	3.75X	6.5X

If a worst case condition is assumed (ECP is at -230 mV for 50% of the time and conductivity at $0.2\mu\text{S}/\text{cm}$) then a crack growth reduction of ~ 2.5 times is realized under HWC conditions as compared to normal water chemistry (NWC) conditions. As can be seen from the above table, much higher crack growth reductions are realized if HWC availability is higher and ECP is maintained less than -230 mV. This has been the trend at PNPS. Since cracks have not yet been observed in the safe-end welds of concern, the current practices should serve to continue to mitigate potential cracking.

Based on these chemistry mitigating actions taken to arrest crack growth in IGSCC susceptible welds, a one cycle deferral of the inspections will not affect the integrity of the vessel nozzles or the capability of the nozzles to perform their intended function; therefore, such deferral will not decrease the level of quality or the safety function of the affected components.

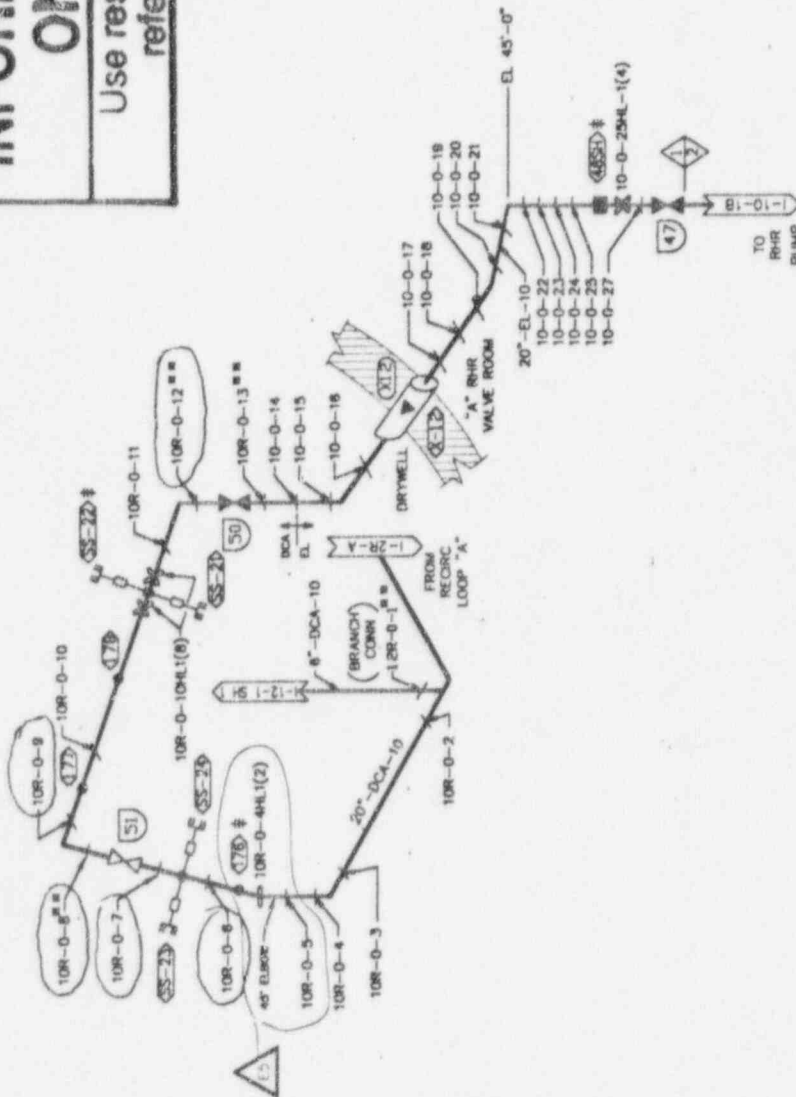
ENCLOSURE C

Isometric Drawings
(ISII10-1A, ISII1-1SHT 1, ISII54-1, ISII54-4, & ISII2RA)

ONLY

PIPE DATA

ID	DCA10	EL10
MATL	SS	CS
NPS	20	
NWT	786	1.037
NC	64	



3. A MAJORITY OF THE WELDS SHOWN ON THESE DRAWINGS WERE ASSIGNED ALTERNATE NUMBERS BY G.E. THESE NUMBERS ARE DOCUMENTED IN THE RS DATA BASE AND PREVIOUS REVISIONS OF THE RS DRAWING.

SEEKING NEW STAFFS AND EMPLOYERS

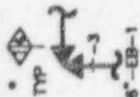
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DATE 10-24-14 15:57

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INFORMATION ONLY

Use restricted to reference



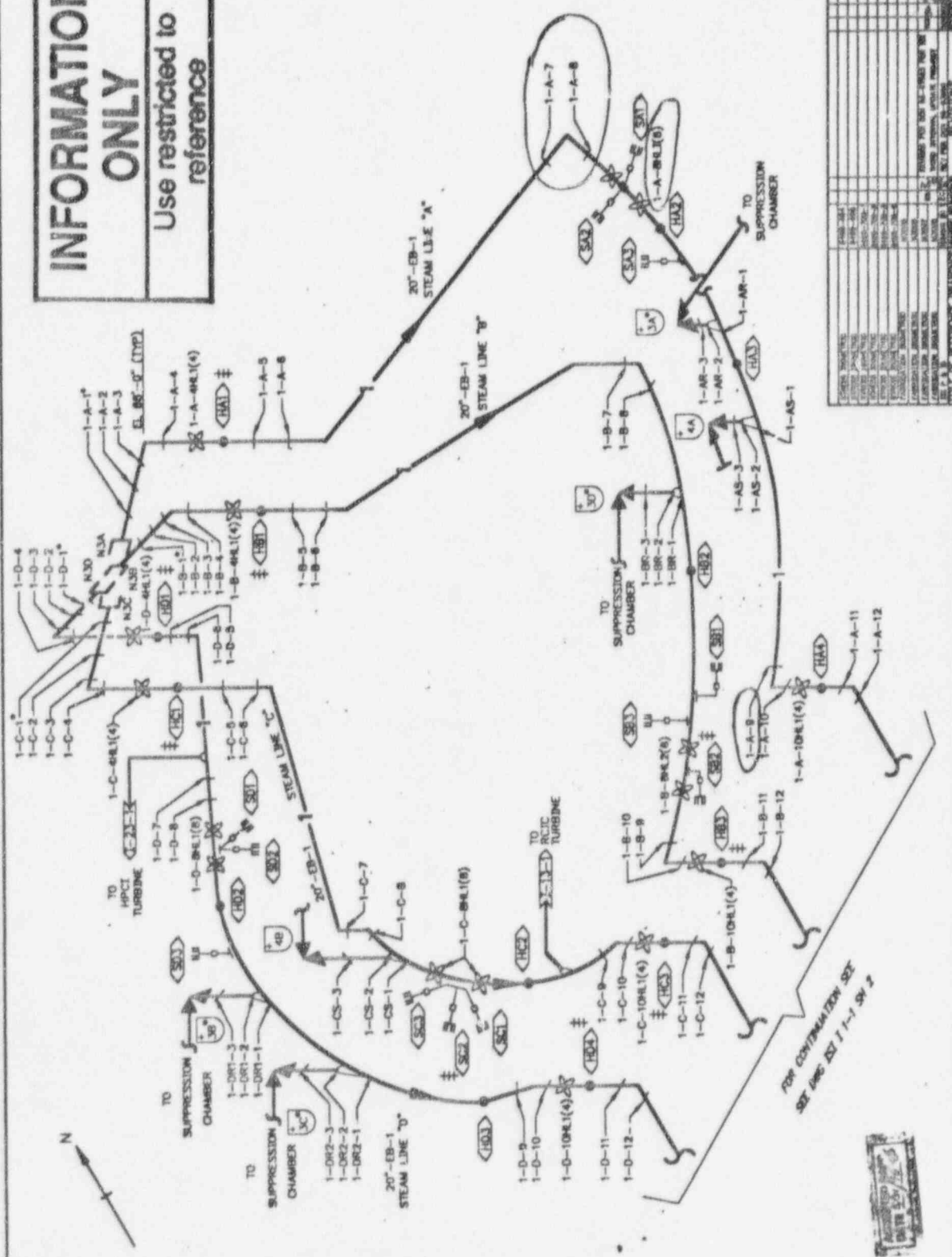
PIPE DATA

ID	EB-1
MATL	CS
NP'S	20
NWT	1.037 4.32
NC	84 21

VALVE PREFIX 203

NOTES

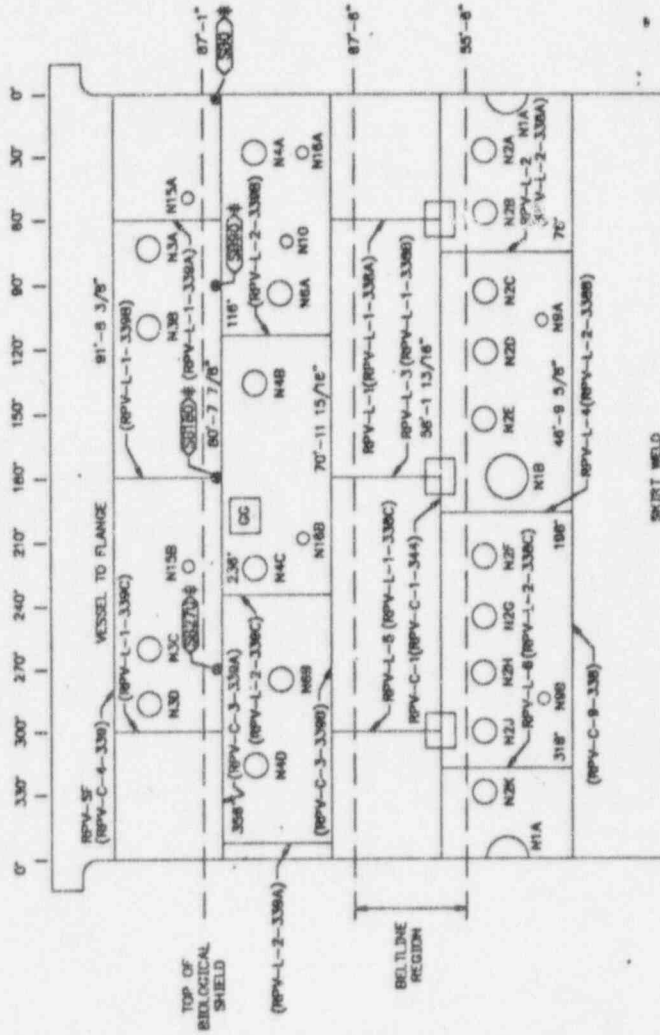
1. * DISSEMBLAR METAL WELD.



DATE	11/11/11	BY	SH 1-1
REVISION	1	DESCRIPTION	MAIN STEAM SYSTEM
DESIGNED BY	SH 1-1	CHECKED BY	SH 1-1
APPROVED BY	SH 1-1	DATE	11/11/11
MAIN STEAM & DRAIN MANIFOLD PIPING			
WELD MAP			
41600-3902			

Use restricted to
reference

NOTES:
1. CONSTRUCTION WELD DESIGNATIONS SHOWN
IN PARENTHESES.

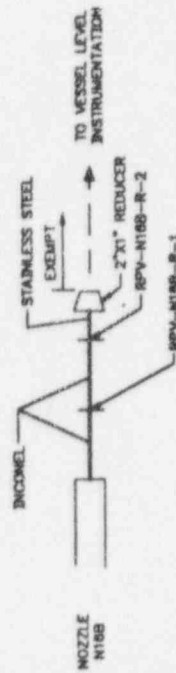
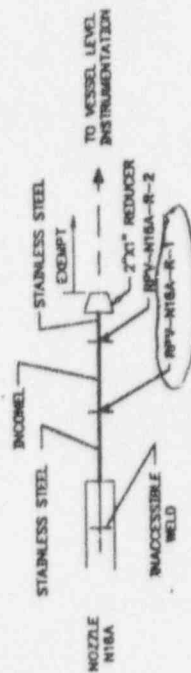
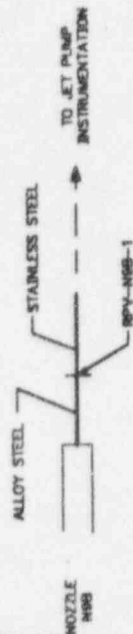
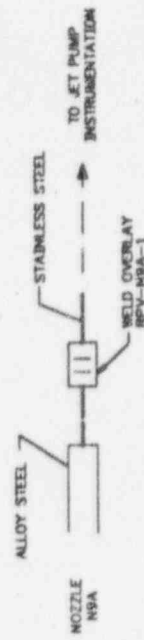
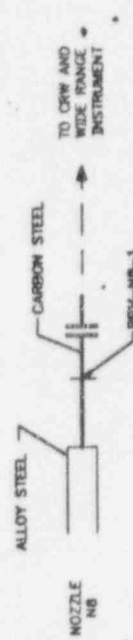
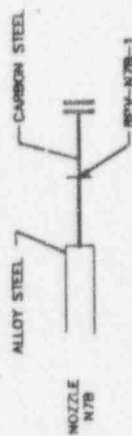
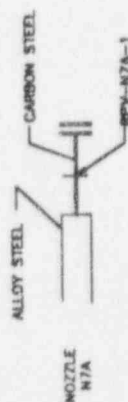


NEW YORK, N.Y.

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