U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report Nos. 50-277/88-08
50-278/88-08

Docket Nos. 50-277
50-278

License Nos. DPR-44
DPR-56

Licensee: Philadelphia Electric Company
2301 Market Street
Philadelphia, Pennsylvania 19101

Facility Name: Peach Bottom Atomic Power Station, Units 2 and 3

Inspection At: Delta, Pennsylvania

Inspection Conducted: March 14-18, 1988

Inspectors: E. H. Gray — 4/19/88
E. H. Gray, Senior Reactor Engineer — date
M&PS, DRS

H. J. Kaplan — 4/21/88
H. J. Kaplan, Senior Reactor Engineer — date
M&PS, DRS

Approved by: Jack Strosnider — 4/21/88
J. R. Strosnider, Chief, Materials and Processes Section, EB, DRS — date

Inspection Summary: Inspection on March 14-18, 1988 (Report Nos. 50-277/88-08 and 50-278/88-08

Areas Inspected: An unannounced inspection of the following areas was conducted: (1) replacement of recirculation system piping on Unit 3, (2) evaluation of NDE indications on RHR containment penetration piping removed from Unit 3, (3) detection of IGSCC in shroud support access cover plates of Unit 3, (4) Emergency Service Water (ESW) piping replacement work in progress on Unit 2 and (5) open item 85-08-04 regarding hydraulic control unit valves.

Results: One violation was identified in that ESW pipe segments were being fabricated using sketches that were not part of the drawing control system and did not have indication of appropriate review and approval. It addition, a potential deficiency in surveillance test procedure ST 10.15 was identified as part of the review of open item 85-08-04.

1.0 Persons Contacted

1.1 Philadelphia Electric Company (PECo)

D. Anders, Nuclear Engineering Department
T. Bazzani, Project Manager
*F. Cook, Engineer
*J. Franz, Plant Manager
*J. Gallagher, Compliance Group
T. Geyer, Maintenance Engineer (HCU Valves)
*G. Lipsey, PBAPS Projects
*M. Pratt, PBAPS Manager of Quality
E. Sawchuk, Engineer (ESW System)
*J. Stanley, ISI Coordinator
T. Sisson, PECo QC, Radiographer
*D. Smith, Vice President, Nuclear

1.2 Chicago Bridge and Iron (CBI)

M. Jennings, Welding, QA Supervisor

1.3 Nuclear Regulatory Commission

*L. Meyers, Resident Inspector
*H. Williams, Project Engineer
*R. Urban, Resident Inspector

*Indicates presence at exit meeting on March 18, 1988.

2.0 Licensee Action on Previously Identified Items

(Open) Inspector Follow Item (277/85-08-04, 278/85-08-04) IGSCC of control rod drive (CRD) hydraulic unit (HCU) Scram Outlet Isolation Valves (GE SIL 419). (Reference Report 277/86-14)

During inspection 88-08, the inspector noted PECo plans to examine a sample of Unit 3 Number 112 HCU valves made by Vogt. The internals of similar HCU valves manufactured by Hancock and installed in Unit 2 were previously examined and replaced.

In review of the safety significance, operation, maintenance and testing of these valves, it was found that the valve could potentially fail in the closed condition with the gate in the seat but the stem turned to the open position. PECo Surveillance Test Procedure ST 10.13 provides for CRD scram insertion timing after maintenance where a 112 valve was closed and then opened. Surveillance Test Procedure ST 10.15 provides for closing and opening the 112 valve as part of a test sequence but does not provide confirmation that the valve did open. This item remains open pending results of examination of Unit 3 HCU valves, evaluation of Unit 2 HCU valves for long-term reliability and PECo review of the surveillance test procedures for possible revision if failure of an HCU isolation valve remains a possibility.

3.0 Unit 3 Pipe Replacement Program

In Inspection Report No. 50-277/87-33 covering the period between November 16-20, 1987, the inspector conducted an overview of the licensee's preproduction activities involving the replacement of the old type 304 stainless steel pipe with nuclear grade, low carbon type 316 stainless steel in the recirculation and residual heat removal (RHR) piping systems. As mentioned in Inspection Report 87-33, the inspector reviewed several key areas involving materials, welding and QA. He concluded that the licensee and principal contractors (CBI and GE) had prepared technically acceptable detailed procedures and instructions, and were well prepared for the impending program. In addition, the new materials had been manufactured to strict metallurgical controls to assure optimum corrosion resistance as well as utilization of automatic welding procedures to control heat input.

The purpose of this Inspection (88-08) was to verify that the initial production activities were being performed in accordance with ASME Section XI, 1980 Edition through Winter 1981 Addenda and CBIs approved procedures and instructions.

At the time of the inspector's arrival, the piping systems had been decontaminated and the old pipe removed downstream from the existing reactor vessel (RV) nozzle safe ends. The operations involving ten inlet nozzles (N2) and two outlet nozzles (N1) were in various stages, namely, parting away the old safe ends, machining, and I.D. cladding and, in some cases, welding the new safe end to the newly buttered RV nozzle. Sketches of the new N1 and N2 safe end assemblies are enclosed.

The inspector visually inspected a partially completed new safe end to reactor vessel (RV) nozzle weld identified as N2J located in loop A at 300° azimuth. The weld metal was deposited using the automatic Tungsten Inert Gas (TIG) process in accordance with qualified weld procedure WPS-ER82A, Revision 2. The qualification record for this procedure and other procedures had been previously reviewed and found to conform to ASME IX requirements as reported in Inspection Report 50-278/87-33. The weld which was deposited with Inconel (ER82) filler wire appeared to be smooth, with good fusion along the side walls. The root had been made by fusing an Inconel (IN82) "K" insert.

The inspector subsequently reviewed the task work package (traveler) up through sequence 54 for N2J and concluded that CB&I, the installer, had performed all of the precise cutting, dimensioning, etching, welding/buttering and inspection steps specified in Special Instruction (SI) RN2, Revision 4. These steps had been verified by CB&I Project Supervision and/or QA personnel. It is noted that prior to initiating the new safe end to RV nozzle weld, the old safe end (transition piece between the RV nozzle and pipe) and the old recirculation pipe had been parted from the RV nozzle and the existing Inconel 182 weld butter liquid penetrant inspected and radiographed to assure sound metal. The inspector reviewed the subject radiographs with a licensee Level 2 radiographer and confirmed the absence of indications. This step was followed by a weld buildup of the nozzle ID with Inconel (ER-82) and machining of the weld prep to accommodate the new nozzle to safe end weld. The inspector noted that the N2J traveler contained five dimensional reports, two radiographic reports, eight liquid penetrant reports, one UT report, seven visual examination reports and two cleanliness reports as specified in SI-RN2.

The material certification package for the new N2J safe-end (identified as #1420) was reviewed by the inspector. The safe-end was fabricated by Ametek, Straza Division, from two low carbon type 316 stainless steel forgings. The reported chemistry and mechanical results conformed to SA182 type 316L requirements. The heat treatment consisted of solution annealing at 1950°F followed by water quenching below 800°F in less than 3 minutes, the optimum treatment to minimize sensitization (carbide sensitization). The materials package included radiographic, ultrasonic, liquid penetrant, corrosion testing and dimensional reports in accordance with GE Specification B50YP267. The N2 safe ends were fabricated with two welds: (1) the 308L stainless steel thermal sleeve extension butt weld and (2) the Inconel (ER NiCr-3) butter of one end of the safe end to accommodate the RV nozzle installation weld. The inspector also reviewed the material requisition sheets, the traveler sequence and certified test reports to verify that the weld inserts and filler wire of proper chemistry were used in welding the new safe end to the existing nozzle butter and thermal sleeve welds. For the safe end to RV nozzle weld an Inconel (IN82) insert - heat NX4629DK, and Inconel (ER NiCr-3) filler wire - heat NX5177D were identified; for the thermal sleeve welds, a 308L stainless insert-heat 5628T and filler wire - heat 6758 were identified. CB&I also presented records to show that welders engaged in production welding had previously qualified on special mockups in accordance with CBI procedure SI-MUN2.

The inspector also witnessed the tacking of the insert in nozzle N2D in preparation of joining the new thermal sleeve extension to the existing sleeve. This operation was viewed remotely by video outside the drywell. Welding of the internal thermal sleeve is accomplished with the video and welding control console located outside the drywell and the camera attached to the welding head. The operator inside the drywell is positioned at the nozzle and maintains communication with the operator outside the drywell. The latter observes the video, and in concert with the other operator, makes adjustments as needed. This setup also is employed for external welds in areas where the radiation dose rates are high to minimize personnel exposure. It is noted that the thermal sleeve extension was fabricated in the shop (Ametek) by welding it to an integral projection of the safe end (see "Shop Weld" in Figure 1). The integral thermal sleeve is a new design that avoids welding directly to the safe end and eliminates a crevice condition that has been found to be a site for IGSCC.

The inspector also reviewed work package (traveler) NIA up through sequence 20 for the replacement of the safe end in loop A in a similar manner as was done for safe end N2J and found it to comply with S1-RN1, Revision 4. It is noted that the N1 outlet safe ends do not contain thermal sleeves.

The inspector reviewed the proposed disposition of an axially oriented crack-like indication found in the existing N1B nozzle joint during the replacement of the safe end (see Figure 2). The defect which was revealed by visual, radiographic and liquid penetrant inspection was located on the I.D. surface at the 4 o'clock position. The defect traversed both the RV nozzle to safe end weld and the adjoining nozzle butter. Both the nozzle weld and butter were made of Inconel (alloy 182) weld deposited metal. The defect which was determined to be .287" long was completely removed after grinding to a depth of 5/8". The inspector confirmed the location and physical dimensions of the cavity by visual examination. The cavity was subsequently enlarged to provide 31° and 38° bevels for welding accessibility. The cavity as prepared for weld repair extended into the 308 stainless nozzle cladding and terminated at the interface of the adjoining SA 508 Class 2 alloy steel (Ni-Mn-Mo) nozzle as shown by etching.

The inspector reviewed the proposed Weld Repair Procedure E182 HBR and found it to agree with the temper bead repair technique provided by ASME XI - Article IEB 4000. The procedure employs the manual metal arc process with the half bead technique (removal of 1/2 of the first deposited layer prior to depositing the second layer), a 300°F preheat, and a low temperature (500°F) stress relief after welding. The electrode used for the repair in this instance is Inconel 182 which is compatible with the existing materials, i.e., Inconel weld and butter, type 308 cladding and (Ni-Mn-Mo) alloy steel. The preheat and stress relief are intended to protect the alloy steel nozzle. The preheat removes hydrogen and retards the formation of brittle martensite. The stress relief provides a tempering (softening) effect if martensite were to form.

The inspector verified that the proposed weld repair procedure and the associated Work Package conformed to the procedural and qualification requirements of ASME XI, Article IEB 4000. The latter included both bend and impact testing and special welder training. The weld repair was initiated on March 16, 1987 and completed on March 17, 1987. The traveler indicated that the repaired area will be subject to liquid penetrant, radiographic and ultrasonic inspection 48 hours after the repair is completed. It should be noted that the repair procedure qualification test assembly is far more conservative than the actual repair. The former consisted of a 1" deep cavity in a 6" thick alloy steel test assembly compared to the condition in the nozzle in which the cavity just barely penetrated the base metal at the nozzle/cladding interface. It should also be noted at this time that of the twelve recirculation nozzles (2-N1s and 10 N2s) being refurbished, only one nozzle (N1B) has been found to exhibit any significant indications in the existing nozzle Inconel (182) butter; thus, permitting use of the existing weld butter in the installation of the new safe ends without complete removal and rebuttering of the existing RV nozzles.

The licensee reported that prior to preparing for the installation of the new GE supplied N2 safe ends, a review of radiographs by the PECo Level 2 radiographer revealed unacceptable root conditions (lack of penetration and/or lack of fusion) in five of twelve thermal sleeve extension butt welds (figure #1). As noted previously, the safe ends were manufactured by Ametek, Straza Division, in 1985 under GE P.O. No. 205-854-142. The inspector reviewed the rejectable radiographs and confirmed the root indications, although in some cases the condition could be considered marginal and possibly related to root concavity. A review of the Ametek packages indicated that the radiographs had been reviewed by both GE and the Authorized Inspector. Even though the thermal sleeve welds are not pressure boundary welds, GE had imposed ASME III NB requirements. The rejected safe ends, identified as SN's 1414, 1415, 1417, 1418 and 1424, were returned to GE in Philadelphia for repair and reradiography along with safe ends 1411 and 1413 for which the Ametek radiographs were not located.

4.0 Quality Assurance

The inspector reviewed six PECo audit reports and six PECo surveillance reports of CB&I site activities associated with the recirculation project. The audit reports covered site procurement (OP-388g-1), welding procedure and welder/operator performance qualifications (OP-388e) and chemical decontamination (OP-388a). The surveillance reports covered pipe storage (ZZ-05), nondestructive examination of welding, operator performance qualification test coupons (ZZ-00-04), RPV bottom head drain line replacement (ZZ-00-02) and overlay cladding of RV nozzles (ZZ-06). The inspector found the reports to be in depth and well written. No significant findings were reported. All findings were reported closed and corrective action taken to preclude recurrence. PE concluded that CB&I was in general compliance with the referenced documents, procedures and standards in the areas covered. The inspector noted, in particular, that surveillance report ZZ-06 covering the overlay cladding of four N2 nozzles between February 22, 1988 and March 15, 1988 described six attributes in great detail. These included dimensional checks of nozzles after counterbore, PECo's review of the cladding procedure, welder's qualifications, filler metal issuance, welding, twelve welding parameters and NDE examinations.

5.0 Residual Heat Removal (RHR) Penetration Piping, Examination for IGSCC. (Reference IR 278/88-02, Part 4.4.2.1)

The RHR Systems in Unit 2 and Unit 3 each have two return lines and one suction line that penetrate the containment. For Unit 2, this piping was examined for Intergranular Stress Corrosion (IGSCC) but not replaced when the Unit 2 recirculation piping was repaired. For Unit 3, the recirculation piping replacement work includes replacement of the three RHR containment penetration piping assemblies. The U2 RHR penetration piping contains welds that are inaccessible for Inservice inspection. To better understand the possibility of IGSCC in these welds in Unit 2, PECo conducted nondestructive and destructive examinations on the RHR penetration piping welds removed from Unit 3. The NRC inspector reviewed the March 11, 1988 memorandum (L. B. Pyrih to J. F. Franz) and attached test results which indicate the presence of no IGSCC in these Unit 3 RHR welds. Details of proposed subsequent testing of the Unit 2 RHR pipe penetration welds should be included in the response to Generic Letter 88-01 which is due in July 1988.

6.0 Shroud Support Access Hole Cover Weld Cracks

As part of the General Electric Company (GE) recommended reactor vessel internals inspection, PECo had ultrasonic inspection performed on the shroud access hole cover plate weld area of Unit 3. This examination found the presence of cracking in the weld heat affected zone. The GE safety evaluation (EAS-09-0188) determined that continued operation for the next fuel cycle is justified. Subsequent to finding this cracking, NRC Information Notice IN 88-03 was issued to boiling water reactor licensees describing the findings and related concerns of the Peach Bottom Examination.

The NRC inspector reviewed the UT Operator Qualifications, Examination Summary Sheet, GE Safety Analysis and PECo memorandum dated March 3, 1988 (L. B. Pyrih to J. F. Franz). The UT examinations of the access cover welds were performed by personnel who developed this special procedure, one of whom presently holds an EPRI IGSCC planer flaw sizing qualification. The March 3, 1988 memorandum recommends that the Unit 3 covers be repaired during the current outage. Specific details of the proposed repair method were not finalized during this inspection. On the basis of the GE safety analysis, ultrasonic examination of the unit 2 shroud access cover plates is planned for the next unit 2 refuel outage. The timing of examination of the unit 2 cover plates is under review by NRR.

No violations were identified.

7.0 Emergency Service Water (ESW) System, Units 2 and 3

As followup to inspection 277/86-14, 278/86-15, the inspector reviewed ESW system activities. The licensee has been monitoring ESW flow rates to various plant areas including the Unit 2 and 3 core spray, HPCI, and RHR rooms. Segments of ESW piping in Unit 2 are in the process of being replaced or cleaned internally. The ESW piping for Unit 3 is scheduled for replacement during the June-July 1988 time period. The problem has been a continuation of sedimentation and pipe corrosion with resulting deposits on the inside of the piping which is accented by intermittent ESW flow. In addition to pipe replacement or cleaning, corrective actions include a corrosion inhibitor addition, bypass to maintain system flow around normally closed air operated valves, increase in diameter of portions of header piping and provision of additional cleanout/inspection openings.

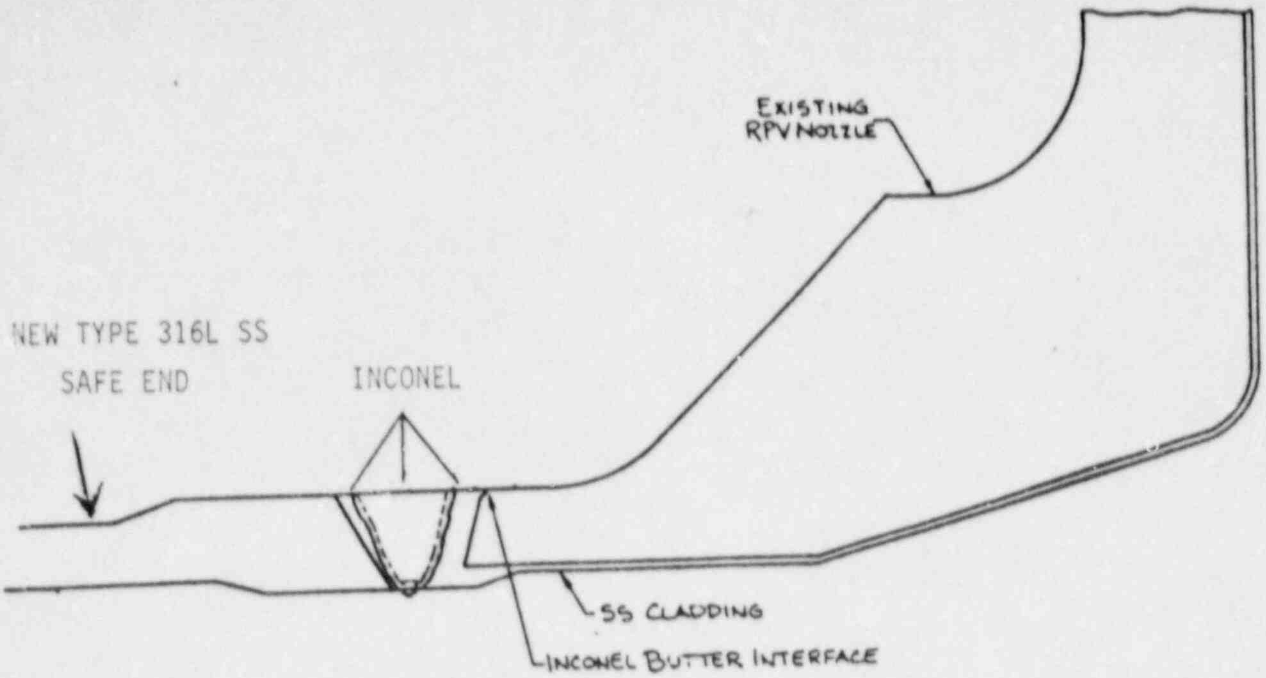
The inspector observed cut portions of piping on Unit 2 including the type of corrosion product in the pipe before and after hydrolyzing. Field fabrication of pipe subassemblies was observed and controls on welding including the maximum interpass temperature permitted on Tufline (plastic seated) valves were discussed with craftsmen and supervision. The welding, all GTAW, was of good visual quality and care was being taken to protect sensitive valves from excess heat. Weld identifications including the welder stencil were noted to be near each weld.

In the area of drawing controls, the inspector identified the practice of building the piping subassemblies to sketches made from a controlled drawing rather than from the controlled drawing itself. Although the controlled drawings were detailed, revisions of plant original construction isometrics made them difficult to read such that the practice of preparing individual sketches provided the craftsmen with clearer direction of subassembly dimensions and component identification. However, the fabrication sketches were not marked to indicate the preparer or checker. The construction procedure CD 5.2, Revision 3, requires the use of applicable drawings for pipe installation but does not clarify what is an applicable (approved) drawing and does not indicate how fabrication sketches, if used, should be controlled to assure accuracy and provide for drawing revision. The NRC inspector noted an error on one fabrication sketch. A later engineering review of all prepared ESW sketches found and corrected additional differences between the sketches and the controlled isometric drawings.

The above conditions are a violation, as noted in Appendix A to this report, of 10 CFR 50 Appendix B, Criterion V (Instructions, Procedures and Drawings) and Criterion VI (Document Control). The fabrication sketches available for use were reviewed by engineering prior to the close of this inspection. However, this violation remains an open item pending NRC review of corrective actions taken by the licensee to clarify procedural requirements for drawing control, issue and use. (50-277/88-08-01)

8.0 Exit Interview

The inspectors met with licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on March 18, 1988. The purpose, scope and findings of the inspection were summarized and discussed. At no time during the inspection was written material provided to the licensee by the inspectors.



N1 NOZZLE

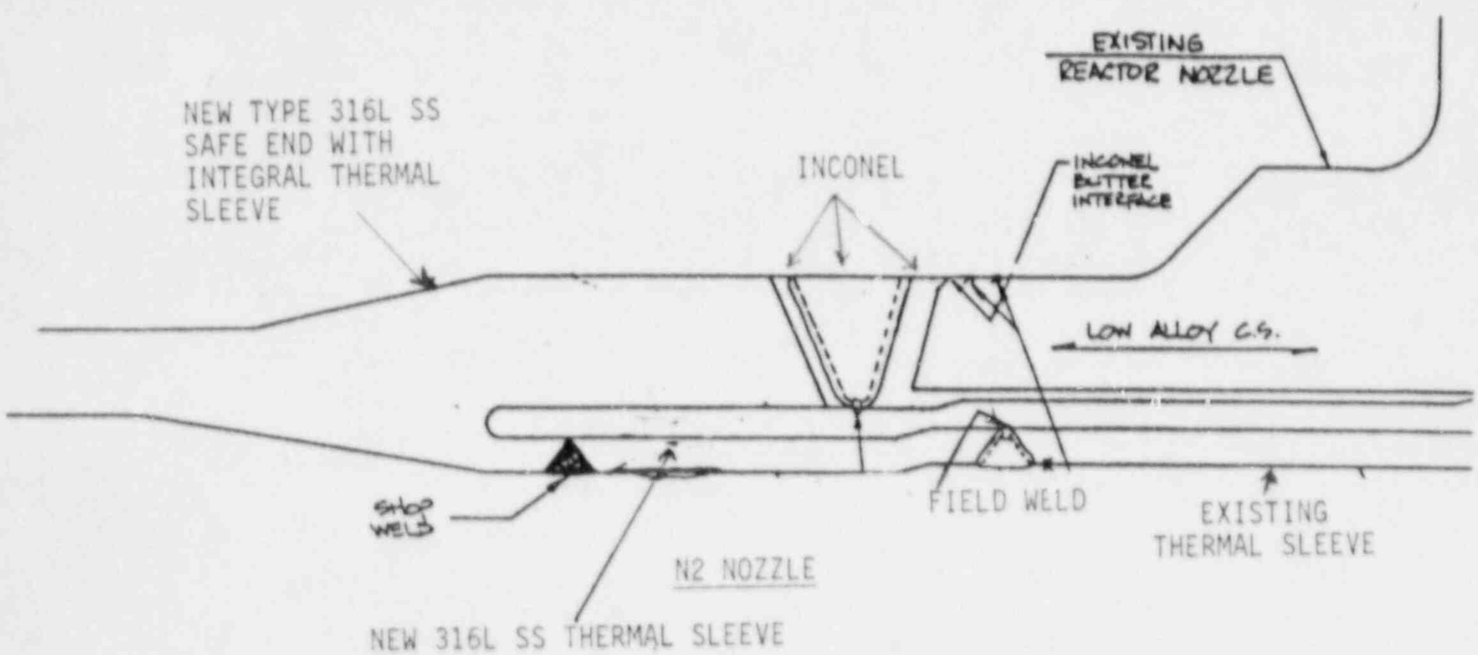
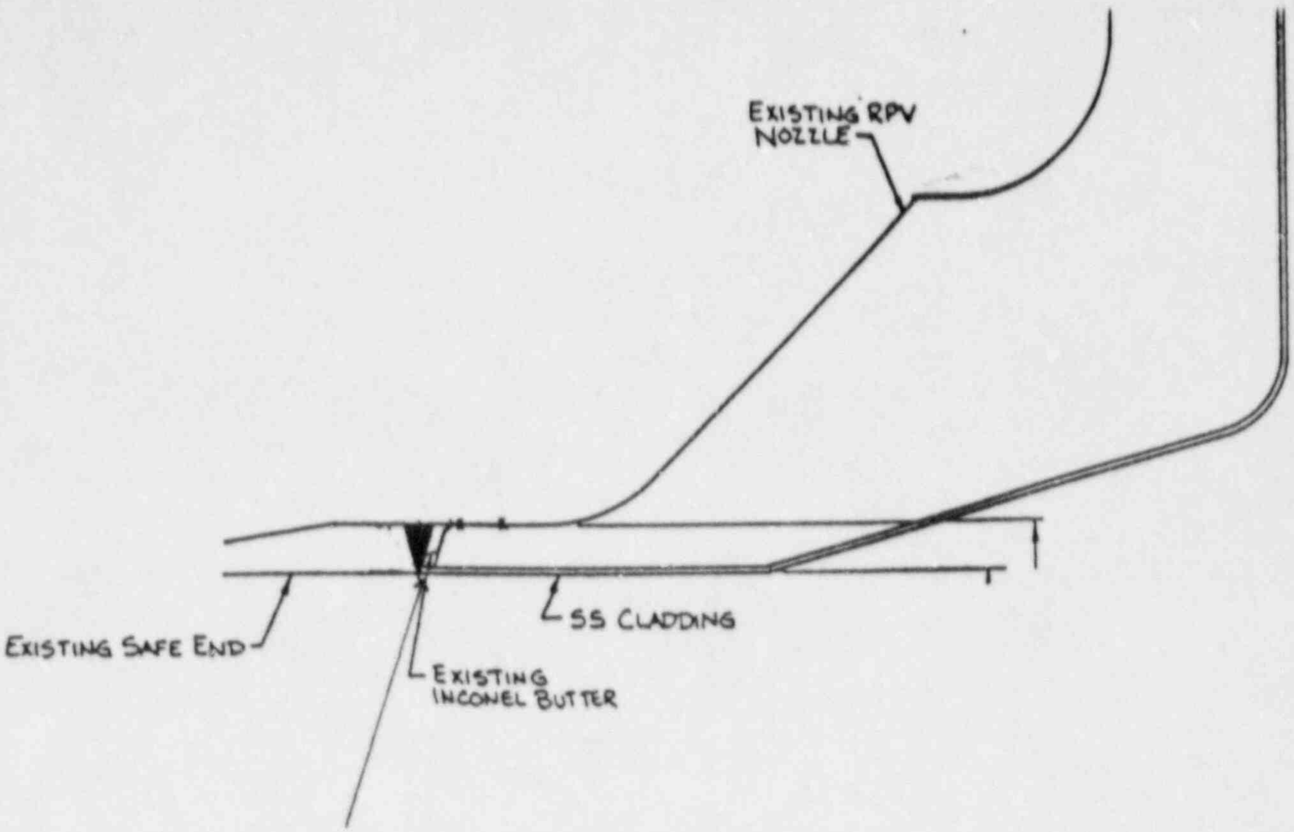
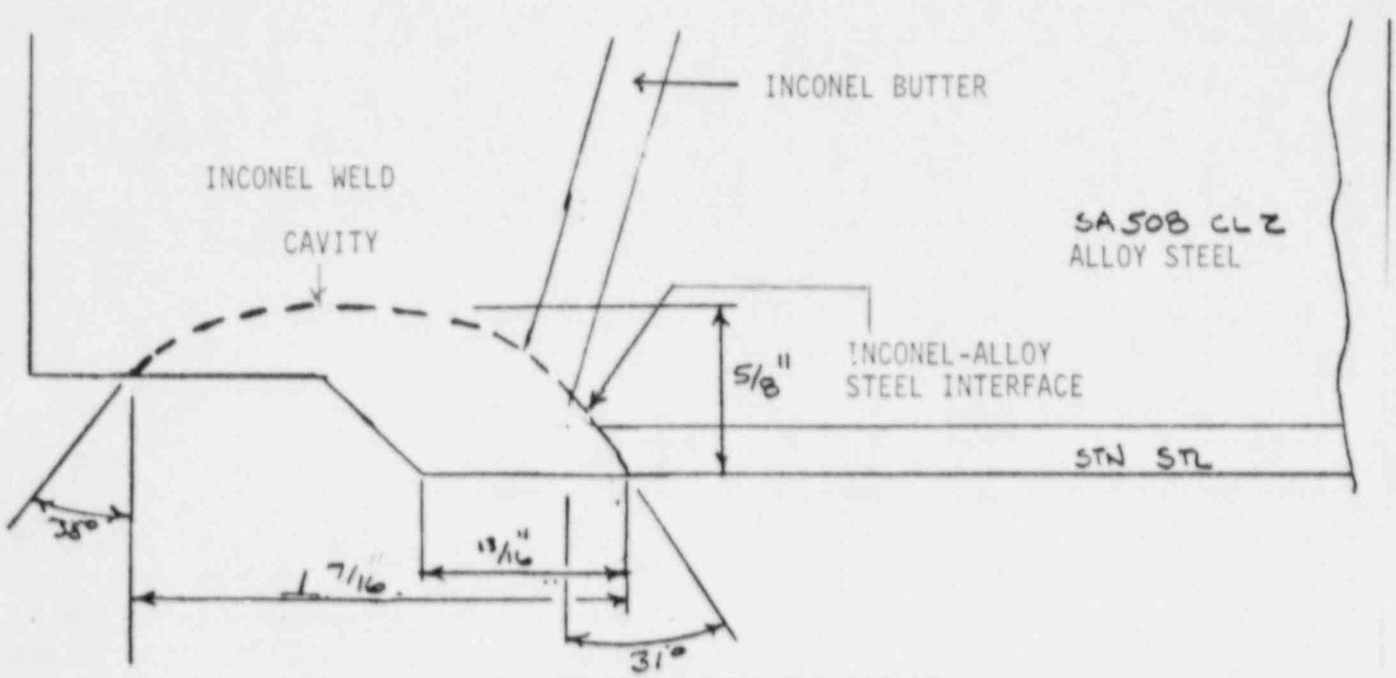


FIGURE 1 SHOWS N1 (OUTLET) + N2 (INLET) RECIRCULATION NOZZLES WITH NEW SAFE ENDS



LOCATION OF DEFECT - DEFECT LOCATED ON ID SURFACE AND ORIENTED IN AXIAL DIRECTION. SEE ENLARGED VIEW BELOW AFTER REMOVAL AND PREPARATION FOR WELD REPAIR.



CAVITY AFTER REMOVING DEFECT

FIGURE 2 SHOWS DEFECT IN NOZZLE N1B