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CARLSON,R.T. REGION 1, PHILADELPHIA, REACTOR CONSTRUCTION & ENGINEERI

SUBJECT: FOLLOWUP ON NOTIFICATIONS OF 780621 & 781122 RE POTENTIALLY REPORTABLE DEFICIENCIES IN CADWELD SLEEVES ON CONTAINMENT LINER KNUCKLE PLATE.FORWARDS DESCRIPTION,ANALYSIS & CORRECTIVE ACITON. 10 CFR 50.55(e)

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February 28, 1979

Office of Inspection and Enforcement
Region I
Attn: Mr. R. T. Carlson, Chief
Reactor Construction and Engineering
Support Branch
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Dear Mr. Carlson:

Re: Nine Mile Point Unit 2
Docket No. 50-410

On June 21, 1978, Mr. R. W. McDaughy of your staff was notified of a potentially reportable deficiency under 10CFR50.55(e) at the Nine Mile Point Unit 2 construction site. The condition concerned magnetic particle weld indications in the semi-automatically welded cadweld sleeves on the containment liner knuckle plate. Subsequent investigation of these indications revealed a second potentially reportable deficiency concerning lack of fusion along the J-bevel area of the cadweld sleeves. This second potentially significant deficiency was reported to Mr. L. Narrow of your staff on November 22, 1978.

Based on the further investigation and evaluation of this matter, we have determined that the June 21, 1978 occurrence did not have any adverse safety implications. The condition reported on November 22, 1978 could have been a safety hazard if left uncorrected.

Attached is a report providing a description of each of these conditions, an analysis of the safety implications for each, and the corrective action to be taken. This report is submitted in accordance with Title 10, Section 50.55(e) of the Code of Federal Regulations.

Very truly yours,
NIAGARA MOHAWK POWER CORPORATION

James Bartlett
James Bartlett
Executive Vice President

Attachment

Xc: Inspection & Enforcement Branch
Washington, D. C.

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I. INTRODUCTION

On June 21, 1978, the Nuclear Regulatory Commission was notified by the Niagara Mohawk Power Corporation that a potential reportable deficiency existed at the Nine Mile Point Nuclear Station Unit 2 construction site. This condition concerned magnetic particle indications, predominately in the toe area of the cadweld sleeve to the containment liner knuckle plate welds. Figure 1 shows the location of these sleeves with respect to the containment liner. Figure 2 shows the details of a typical weld joint.

The Nuclear Regulatory Commission was notified that there was a work stoppage at the Nine Mile Point Unit 2 construction site from June 20, 1978 until September 1, 1978. Therefore, the investigation of this condition was limited during this time.

During the subsequent ultrasonic testing investigation into these magnetic particle indications, a second potential reportable deficiency was discovered. This deficiency was characterized by entrapped slag and lack of fusion along the J-bevel area of some of the cadweld sleeves (see Figure 2). This condition was reported to the Nuclear Regulatory Commission in accordance with 10CFR50.55(e) on November 22, 1978. Extensive analyses and tests were performed to determine the extent of this welding deficiency.

II. DESCRIPTION OF DEFICIENCY

Magnetic particle weld indications in the cadweld sleeve to containment liner knuckle plate area welds were initially discovered while performing an magnetic particle inspection on base metal areas resulting from the removal of shop-installed temporary stiffeners. These indications were located predominately in the toe area of the welds (see Figure 2). These welds had been magnetic particle inspected by the containment liner fabricator, and the records showed that no significant indications were found. Further investigation resulted in 255 magnetic particle indications out of a total of 1824 cadwelds. This condition was then reported to the Nuclear Regulatory Commission on June 21, 1978 in accordance with 10CFR50.55(e).

A three-pronged investigation was initiated to examine the magnetic particle indications. Investigations were conducted on equivalent test sleeves, on a mockup portion of the containment liner, and on production items in the field.

Twenty-two equivalent test sleeve assemblies (44 cadwelds) of the same design were evaluated. The methods used were nondestructive examination (ultrasonic testing and magnetic particle testing), tensile testing, bend testing, sectioning for visual examination, and microstructure examination. The results of the equivalent test sleeve investigation were as follows:

1. Weld plate toe defects were not found in the equivalent test sleeve assemblies of the same design.

2. The microstructure was considered typical for a multiple pass weld joint and the materials involved.

3. The tensile and bend test assemblies broke in the area of the sleeves, i.e., the weld did not fail.

4. Visual examination of 90-degree sections did not reveal toe defects as were found in the field. However, it was observed that J-bevel defects were found in 90-degree sections of two equivalent test sleeve assemblies. At this time, the extent of these J-bevel defects was not known.

A mockup of the cadweld sleeve assembly was made to determine if the toe area magnetic particle defects could have been caused by welding procedure variables, plate surface cleanliness, or plate deflection. This investigation was stopped when it was discovered that the toe area magnetic particle defects were related to entrapped slag and possible lack of fusion.

The ultrasonic test investigation of the toe area magnetic particle defects revealed the second potential reportable deficiency. This was a lack of fusion along the J-bevel area of the cadweld sleeve (see Figure 2). Eighteen of the 255 welds with magnetic particle indications and 24 of the remaining welds without magnetic particle indications were selected randomly for investigation. Eleven of the 18 and six of the 24 revealed linear indications 1/4 inch and greater in the J-bevel area for circumferential lengths up to 360 degrees.

Four cadweld sleeve assemblies representing the worst-case ultrasonic test results were removed from the liner and tensile tested after having rebar stubs cadwelded at each end (see Figure 1). In all cases, the rebar failed and not the weld. Subsequent cross-sectioning confirmed the ultrasonic test results as accurate. Photographs of the cross-sections are provided as Figures 3 and 4. Two additional onsite sleeve welds were ground in the J-bevel area and also confirmed the accuracy of the ultrasonic testing results.

An additional 257 cadweld sleeve welds were ultrasonically investigated to obtain a larger sample size. Twenty-nine of these were identified to have J-bevel defects as extensive or greater than the four that were previously tensile tested. Ten of these twenty-nine were also tensile tested. All ten welds withstood more than 125 percent of the minimum rebar yield strength of 250 kips. Further testing was halted and the corrective action program described below was developed.

III. ANALYSIS OF SAFETY IMPLICATIONS

The welds are designed in the elastic range so that the reinforcing steel tensile load will not adversely affect the containment liner integrity. In order to ensure this, the welds have been designed to carry a design load of 180 kips, and an ultimate load of 280 kips.

The magnetic particle indications of the fillet weld toe area are considered to be a departure from the specification requirements; however, they are not considered to be a safety hazard. All design loads were investigated by analysis. It was determined that crack propagation either along the fillet fusion zone to the containment liner plate, into the plate, or into the fillet weld would not occur.

The second reported deficiency, the slag and lack of fusion along the cadweld sleeve J-bevel area in the containment liner knuckle plate is a departure from the specified technical requirements. This would be considered a potential safety hazard if it were to remain uncorrected. The design requirements for allowable stress in these welds and the containment liner plate could be exceeded with the type of J-bevel defects disclosed.

Due to the problem identified in the containment liner knuckle plate, further investigations were conducted relative to the cadweld sleeve to base plate welds at the junction of the reactor pedestal and the mat. Figure 5 shows the location of these welds. All 680 cadweld sleeve welds in this location had previously passed magnetic particle inspection. Of these, 625 cadweld sleeve welds were performed using a manual stick welding method, and tensile tests were conducted on equivalent test assemblies. All the test assemblies failed in the number 18 rebar at loads higher than 125 percent of the minimum rebar yield strength, and no failure occurred in the welds. The remaining 55 welds in this location were performed by the same welding method and procedure as the liner knuckle welds. The exact location of these 55 welds is not known except that 10 are in one 90-degree sector and 45 are in another 90-degree section of the pedestal-to-mat junction (see Figure 6).

An investigation into the structural integrity of the reactor pedestal was performed. Prior to June 1975 there was no provision in the design for a rigid structural connection of the drywell floor and the containment wall. In this configuration, inflatable seals were required between the floor and the primary containment wall to separate the drywell and wetwell atmospheres. Since that time, it was decided to change that configuration, and the drywell floor was rigidly connected to the primary containment wall. This design change was reported to the Nuclear Regulatory Commission in a letter dated July 29, 1976, from Mr. G. K. Rhode of Niagara Mohawk Power Corporation to Mr. D. B. Vassallo of the Nuclear Regulatory Commission. Because

of this design change, forces in the rebar at the base of the reactor pedestal are greatly reduced. Since the pedestal to mat reinforcing design details were not changed from the original, the re-inforcing is conservatively designed for the existing forces. Although there is no evidence that the cadweld sleeve to base plate welds at the pedestal base are unable to withstand required rebar forces, an analysis with conservative assumptions was performed. It was concluded that even if 55 welds are assumed to be in the worst possible location with no load carrying capability, the remaining rebar will not be overstressed and the overall stability and integrity of the structure is maintained.

Based on this analysis, there are no safety implications as a result of potentially deficient cadweld sleeve to base plate welds at the junction of the reactor pedestal and the mat.

The only other semi-automatically welded cadweld sleeve welds are those for the sparger ring support for the safety relief valve discharge devices. A structural analysis of the sparger ring support will be performed, when the Mark II Containment Program is completed and the loading criteria is determined.

IV. CONCLUSION AND CORRECTIVE ACTION

a. Magnetic Particle Indications

The magnetic particle indications reported to the Nuclear Regulatory Commission on June 21, 1978, are not considered to be a safety hazard. However, these indications will be removed as a result of the corrective action required by the J-bevel indications.

b. J-Bevel Indications

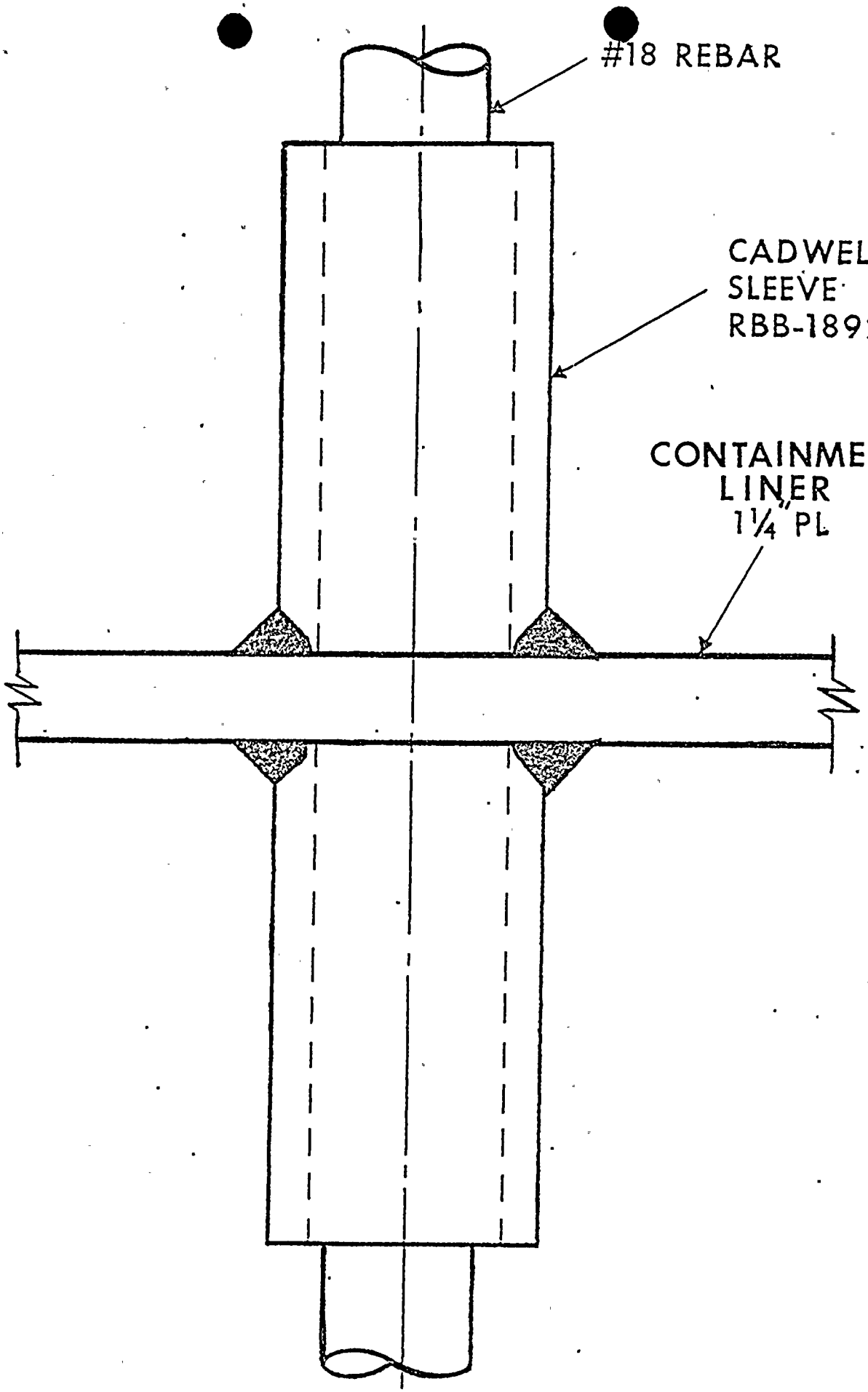
The J-Bevel indications were reported to the Nuclear Regulatory Commission on November 22, 1978. This condition is more severe than the magnetic particle indications and, if left uncorrected, could have affected the structural integrity of the containment liner for allowable stress distribution and the ability of the rebar to carry its design load.

A total of 1,824 cadwelds (less eight removed for testing) currently on the containment knuckle area will be removed, and new cadweld sleeves will be welded to the containment liner knuckle plate using a manual process.

b. J-Bevel Indications

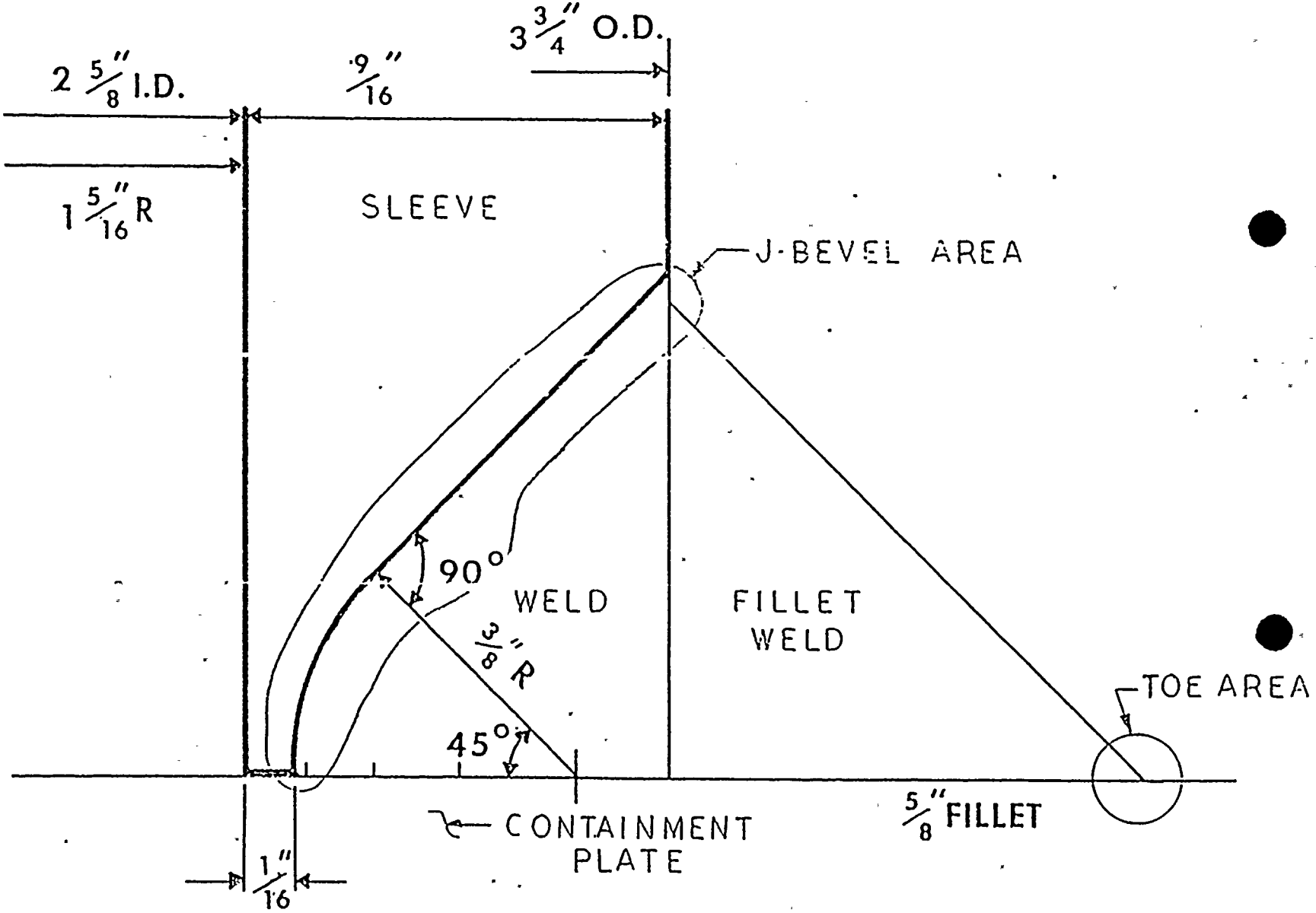
The 55 suspect welds in the junction of the base plate and reactor pedestal have no safety implications and require no corrective action as discussed in Section III above.

The welds in the sparger ring support will be studied and corrective action taken in the future, if required. The Nuclear Regulatory Commission will be informed of our evaluation of this matter.



CONTAINMENT LINER CADWELD SLEEVE DESIGN FIG. 1

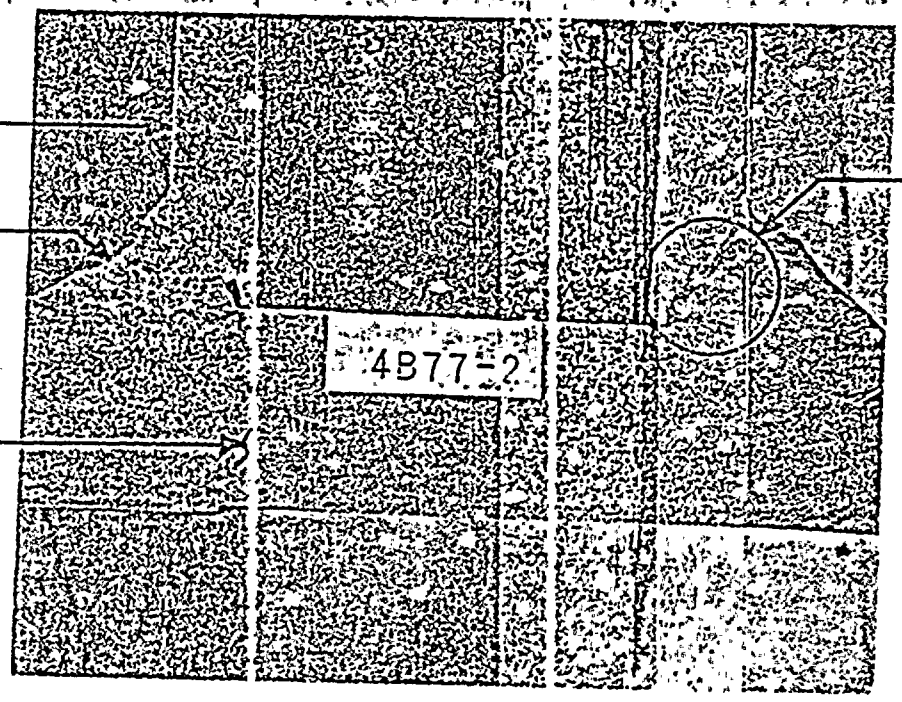
#18 RBB-1892 JA CADWELD



CADWELD JOINT DETAIL

FIG. 2

CROSS SECTION OF LINER CADWELD SLEEVE WELDS.



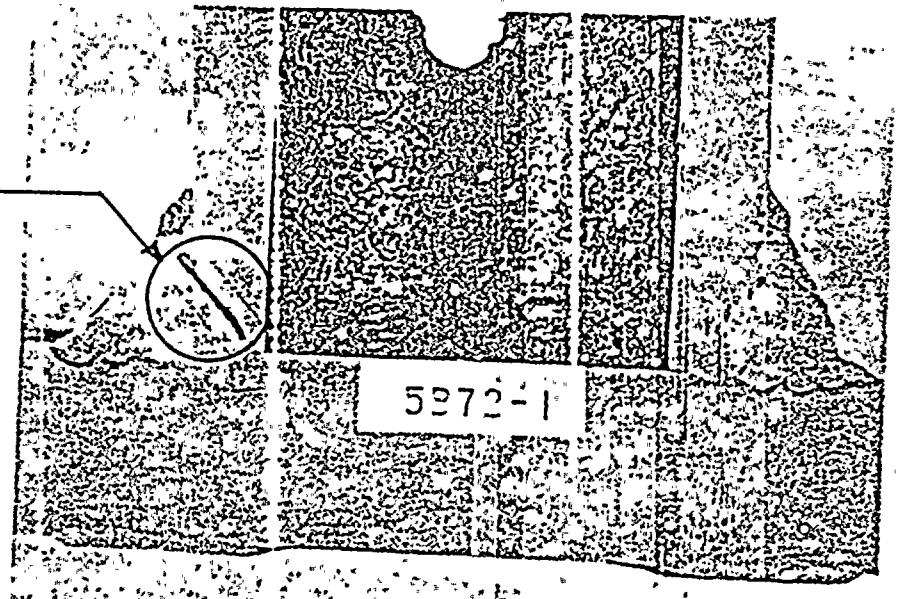
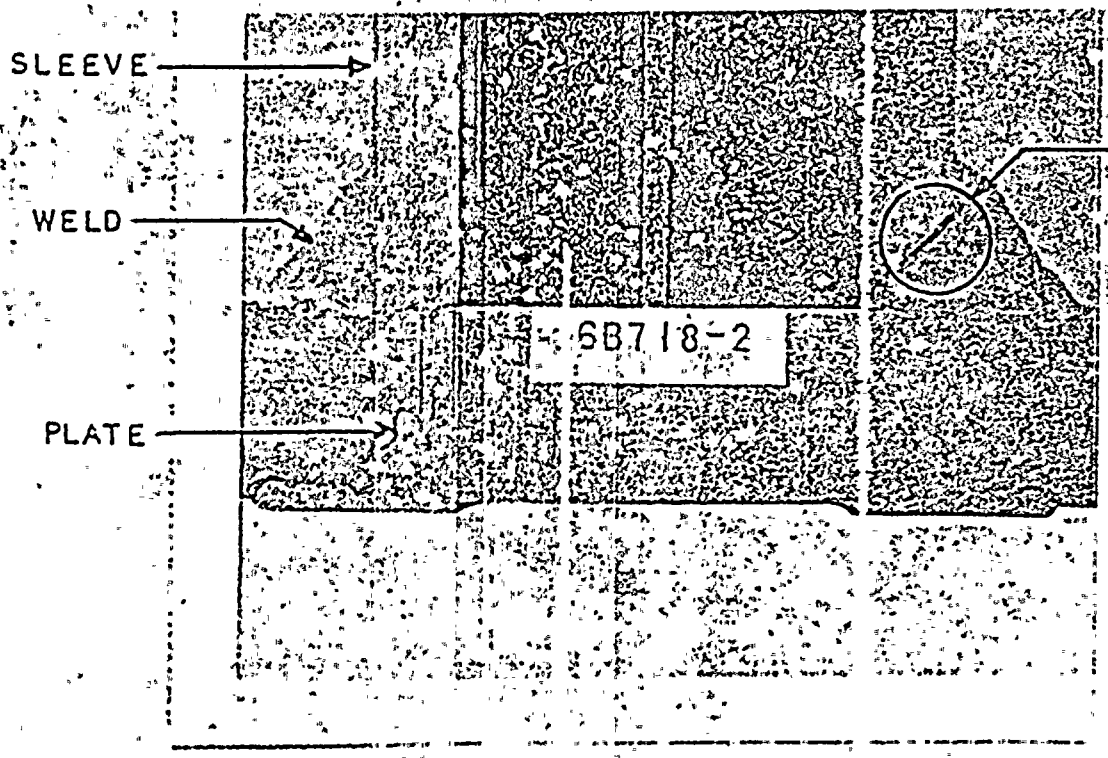


FIG. 3

CROSS SECTION OF LINER CADWELD SLEEVE WELDS



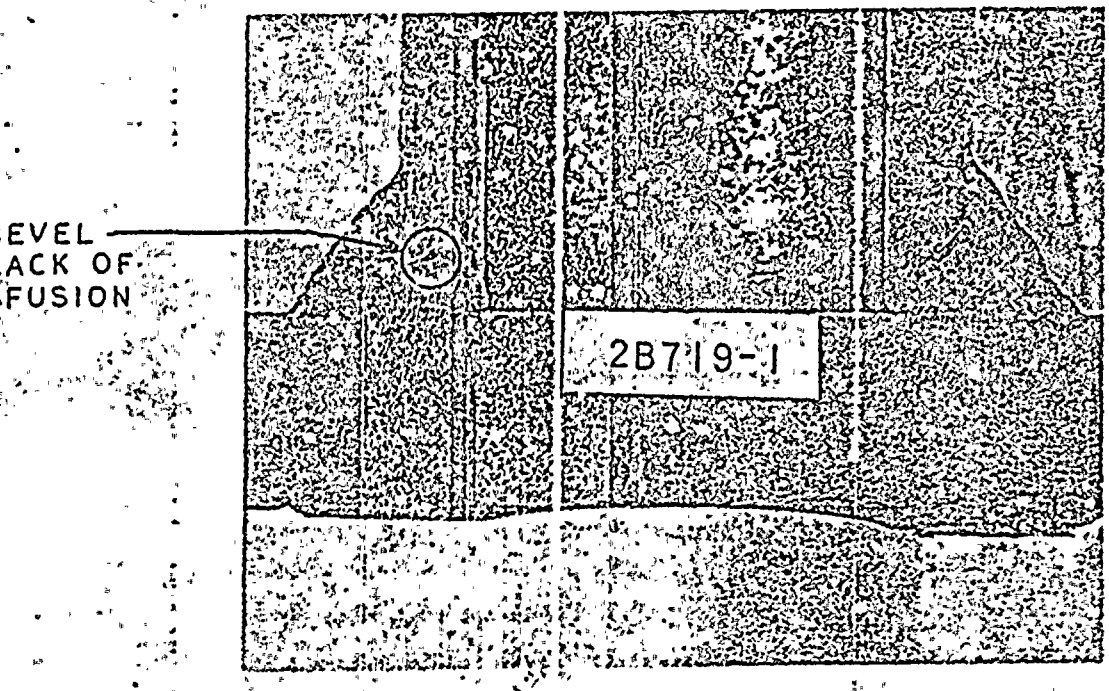


FIG.4

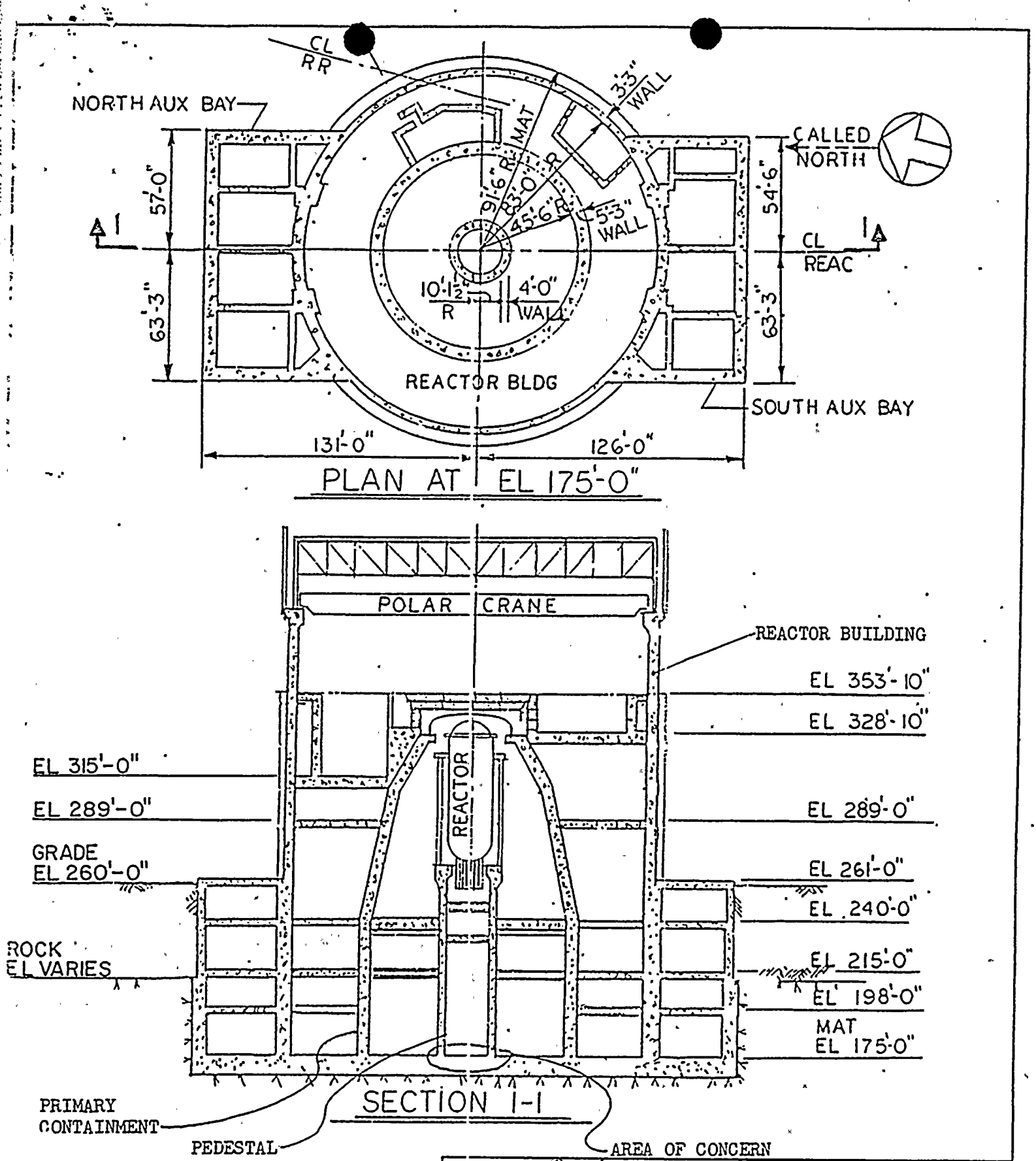
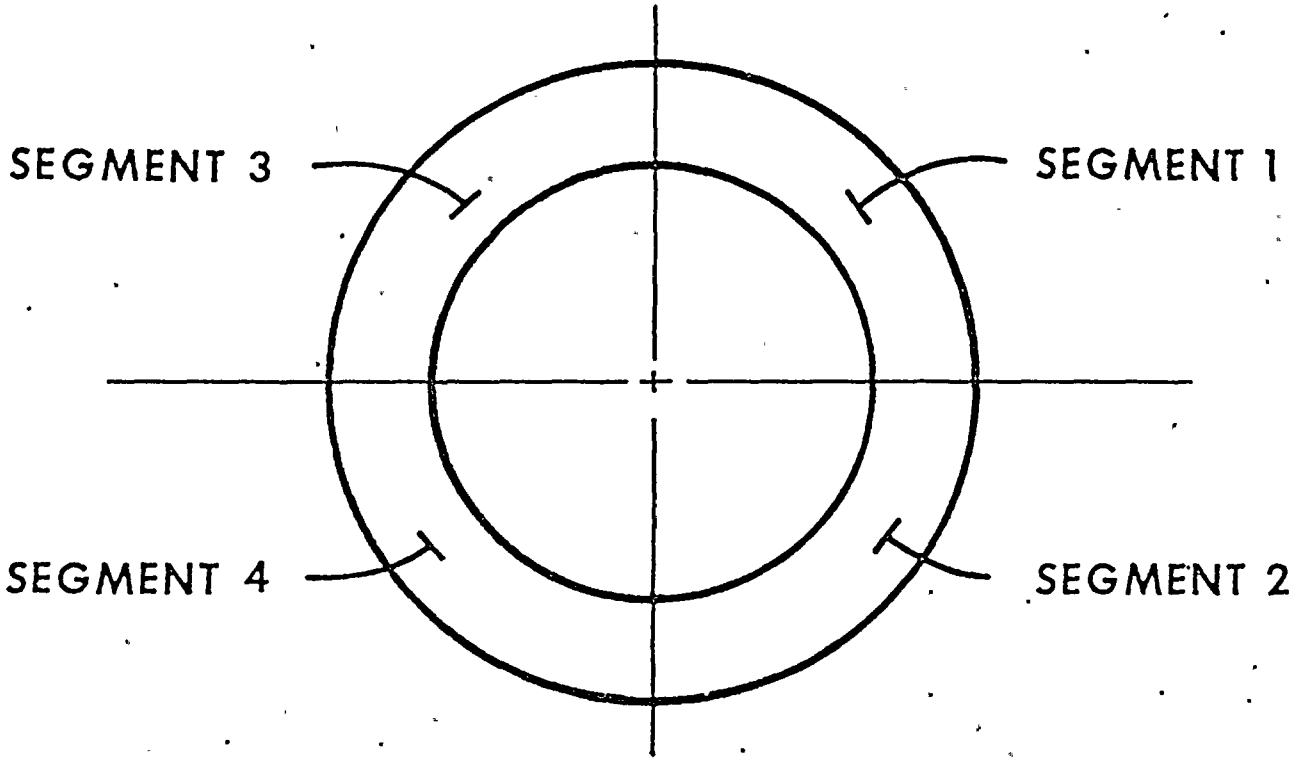


FIGURE 5

PLAN AND SECTION, REACTOR BUILDING AND AUXILLIARY BAYS

NINE MILE POINT NUCLEAR STATION, UNIT 2
NIAGARA MOHAWK POWER CORPORATION

SKETCH SHOWING 4 SEGMENTS OF PEDESTAL ASSEMBLY



SEGMENT 1 - SUSPECT 45 - B-SERIES CADWELD SLEEVES WERE WELDED USING SEMI-AUTOMATIC WELDING PROCEDURE

SEGMENT 2 - NONE

SEGMENT 3 - SUSPECT 10 - B-SERIES CADWELD SLEEVES WERE WELDED USING SEMI-AUTOMATIC WELDING PROCEDURE

SEGMENT 4 - NONE

FIGURE-6