Wisconsin Electric
POWER COMPANY

Point Beach Nuclear Plant
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(920) 755-2321

NPL 98-0239

10 CFR 50.55a(a)(3)

April 3, 1998

Document Control Desk
U. S. NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, DC 20555

Ladies/Gentlemen:

DOCKET 50-266
REQUEST FOR APPROVAL OF ALTERNATIVE
TO ASME CODE REQUIREMENTS
POINT BEACH NUCLEAR PLANT, UNIT 1

Our letter to the Nuclear Regulatory Commission dated March 23, 1998 summarized our plans for addressing the part-length control rod drive mechanism (CRDM) housing issue identified at Prairie Island Unit 2. Point Beach Nuclear Plant (PBNP) Unit 1 is currently in its twenty-fourth refueling outage. In response to this emerging industry issue we have decided to remove the part-length CRDM housings during our current Unit 1 refueling outage.

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The four part-length CRDMs are not used at PBNP Unit 1 and have been abandoned in place. Accordingly, it has been decided that part-length CRDMs at core locations I7, E7, G5, and G9 in Unit 1, will be permanently removed. The part-length CRDM locations are depicted in Attachment 3. Removal of the part-length CRDMs requires capping of the associated reactor vessel head penetrations. The preferred method for capping the penetrations is via installation of a cap that will be screwed onto the threaded end of the penetration and then seal welded.

Based on N-518.4 of the 1965 ASME Boiler and Pressure Vessel Code, a liquid penetrant examination of the seal weld is required. However, liquid penetrant examination of the seal weld would be difficult. The CRDM penetrations being repaired are located in a high radiation area, with radiation fields of approximately 1000 mr/hr. Additionally, access to the seal welds is difficult due because of the limited clearance between the adjacent control rod drive housings. The separation between the outer rod travel housings is approximately 7.2 inches. This is not an adequate clearance to gain complete access to the inner rod travel housings to perform the liquid penetrant examination of the seal welds. Final weld surface preparation, the liquid penetrant examination and the subsequent cleanup would be difficult and time consuming due to the limited access, and personnel performing these operations would incur substantial radiation exposure.

While the liquid penetrant examination specified by N-518.4 would provide indication of surface cracks, the processes used to perform the seal welds and visual examination of the welds provide the best measure of seal weld acceptability due to the limited accessibility and high radiation fields. The surface to be seal welded is examined with an 8X camera during weld surface preparation. The weld is deposited using a fully automatic tungsten inert gas (TIG) process. All welding parameters are controlled within the qualified range from a remote panel. The weld puddle/deposit is observed via an 8X camera during every phase of the welding. A final visual examination of the weld surface is completed using the same 8X camera. In addition, the leak test of the reactor coolant system will include a VT-2 inspection of the seal weld and CRDM penetration cap for leakage.

10 CFR Part 50, Section 50.55a(a)(3) allows the use of an alternative to the ASME Code requirements, when authorized by the Director of the Office of Nuclear Reactor Regulation, if it can be demonstrated that:

1. The proposed alternative would provide an acceptable level of quality and safety, or

2. Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

In accordance with the provisions of 10 CFR Part 50, Section 50.55a(a)(3), we are proposing the following alternatives to the liquid penetrant testing requirements of N-518.4 of the 1965 ASME Boiler and Pressure Vessel Code for the weld repairs described above:

1. Use of a controlled automatic welding process.

2. Observation of the weld puddle/deposit via a 8X camera during the welding process.

3. A final visual examination of the weld surface using the same 8X camera.

4. Performance of a VT-2 inspection of the seal weld and CRDM penetration cap for leakage during the RCS leak test. The RCS leak test is performed at 2085 psig, 100 psig above the normal operating pressure of 1985 psig.

5. Authorized Nuclear Inservice Inspector approval of alternative testing and NIS-2 acceptance.

A liquid penetrant examination would provide a more stringent verification of the final weld surface condition and therefore, afford an added measure of the quality and safety of the completed seal weld. However, the liquid penetrant examination does not provide a substantial increase in quality and safety above what is provided by the measures (controlled process, observation of weld process using 8X camera, final 8X visual inspection and leak test inspection) that have been and will be taken in lieu of the liquid penetrant examination. In addition, due to the time consuming nature of the examination process, personnel would incur substantial radiation exposure during the performance of liquid penetrant examinations.

An analysis was performed by Structural Integrity Associates to demonstrate that a through-wall flaw could be detected by visual examination with a flaw size that is sufficiently smaller than the critical flaw size, thus assuring sufficient safety margins. The analysis demonstrated that, under a variety of conservative assumptions, the critical flaw size predicted for the repair geometry is in all cases of significant length. It is likely that a much smaller flaw could be credibly detected by visual examination under 8X magnification. The analysis results are summarized in Attachment 1.

In order to confirm the detectable flaw size, tests were performed by Welding Services Incorporated to evaluate the capabilities of the camera system used in the performance of the weld repair. This test confirmed that the critical flaw sizes resulting from the Structural Integrity Associates analysis are detectable with margin by the visual inspection technique. A summary of the tests performed and the test results are provided as Attachment 2.

In conclusion, the proposed alternatives (automatic weld process observation of the process using 8X camera, final 8X visual examination and leak test inspection) to the liquid penetrant requirements of N-518.4 of the 1965 ASME Boiler and Pressure Vessel Code, provide an acceptable level of quality and safety for the seal welds on the part-length CRDM penetrations. Furthermore, compliance with the liquid penetrant examination requirements of N-518.4 of the 1965 ASME Boiler and Pressure Vessel Code would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

There are no new commitments contained in this letter. Please contact us is you have any questions related to this request.

Douglas F. Johnson
Manager,
Regulatory Service & Licensing

FAF/lad

Attachments: 1. Calculation Package: Design and ASME Code Section III Evaluation of CRDM Adapter Plug Fillet Weld at Point Beach Unit 1

2. Summary of Camera Testing

3. Control Rod Locations

cc: NRC Resident Inspector
NRC Regional Administrator
NRC Project Manager

ATTACHMENT 1

CALCULATION PACKAGE:

DESIGN AND ASME CODE SECTION III EVALUATION

OF CRDM ADAPTER PLUG FILLET WELD AT

POINT BEACH UNIT 1

STRUCTURAL INTEGRITY ASSOCIATES, INC.

Structural Integrity Associates, Inc.

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March 23, 1998
MLH-98-012

Mr. John Oswald
Wisconsin Electric Power Company
Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, WI 54241

Subject: Design and ASME Code Section III Evaluation of CRDM Adapter Plug Fillet Weld at Point Beach Unit 1

Dear Mr. Oswald:

Structural Integrity Associates has performed an evaluation of the fillet weld for the adapter plug to be applied to the CRDM at Point Beach Unit 1. This included an evaluation to demonstrate that the fillet weld design complies with all pertinent ASME Code requirements (1986 ASME Code Section III Edition). This evaluation was performed on the basis that the fillet weld serves solely as a leak barrier (seal weld per NB-3671.3), and does not contribute to the structural reinforcement of the piping joint. Due to the significant distance from the vessel to the location of the fillet weld, the fillet weld is considered as a fillet weld for a threaded joint in piping. In addition, an evaluation to determine the critical flaw size for the subject location was performed. The results of this evaluation can be used to demonstrate that the critical flaw size is significantly larger than the flaw size observable using visual inspection techniques. This can serve to eliminate the need to perform dye penetrant testing of the fillet weld. Lastly, a design reconciliation was also performed with the 1965 ASME Code Class A requirements.

Based on this classification of the fillet weld, the following calculations were performed to demonstrate the adequacy of the fillet weld design:

- Verify that the primary and secondary stress and fatigue limits are met according to the methods and requirements of ASME Code Section III, NB-3200, as allowed by NB-3611.2.

- Verify that the joint stress limits are met when the stresses in the weld resulting from the deflections of the adapter plug and penetration are included.

- Assure that the application of the fillet weld does not invalidate the existing structural evaluation of the adapter plug.

- Verify that the requirements of paragraph NB-4427 (Shape and Size of Fillet Welds) and NB-4428 (Seal Welds of Threaded Joints) is satisfied.

- Justify the use of visual examination of the fillet weld instead of dye penetrant as stated in paragraph NB-5271.

Figure 1 shows the dimensions of the fillet weld used in this ASME Code evaluation.

A finite element model was developed to determine the stresses in the joint for the appropriate pressure and thermal conditions. Results of this evaluation showed that the stress and fatigue requirements are satisfied. This same evaluation supports the conclusion that the fillet weld does not invalidate the existing adapter plug analysis.

In order to satisfy NB-4427, the angle of the 5/8" equal leg fillet weld (as shown by α in Figure 1) should be 45°. The fillet weld is applied at the end of the adapter plug where no threads are present. Thus, NB-4428 is also satisfied.

The evaluation to determine critical flaw sizes for the fillet weld location was performed using limit load methods since the material is ductile and the fluence at this location is below that needed to impact the material fracture toughness. The evaluation was performed assuming a through-wall axial flaw and a through-wall circumferential flaw. The stress in the fillet weld was assumed equal to the design stress intensity of the material (S_m). The S_m for the stainless steel at 650°F was used in this calculation (16.2 ksi). A safety factor of 1.0 was used since the critical flaw size is being calculated.

The calculations were performed by assuming a pipe with radius and thickness equal to that at the fillet weld location (0.265" equivalent thickness, mean radius =3.3 inches). The results for the critical flaw lengths (in terms of fraction of circumference and characteristic length parameter, fraction of $\sqrt{Rt}$) are independent of the pipe geometry since the stress is set to S_m. The critical flaw sizes were determined using the SI program, **pc-CRACK**.

The results of the evaluation are shown below.

Critical Through-Wall Axial Flaw Length: 4.17 inch
Critical Through-Wall Circumferential Flaw Length: 6.95 inch

It should be noted that this calculation was performed using an applied stress equivalent to the S_m for the stainless steel material, which is conservative. If the actual primary stress at this location were used, the critical flaw lengths are expected to be even larger.

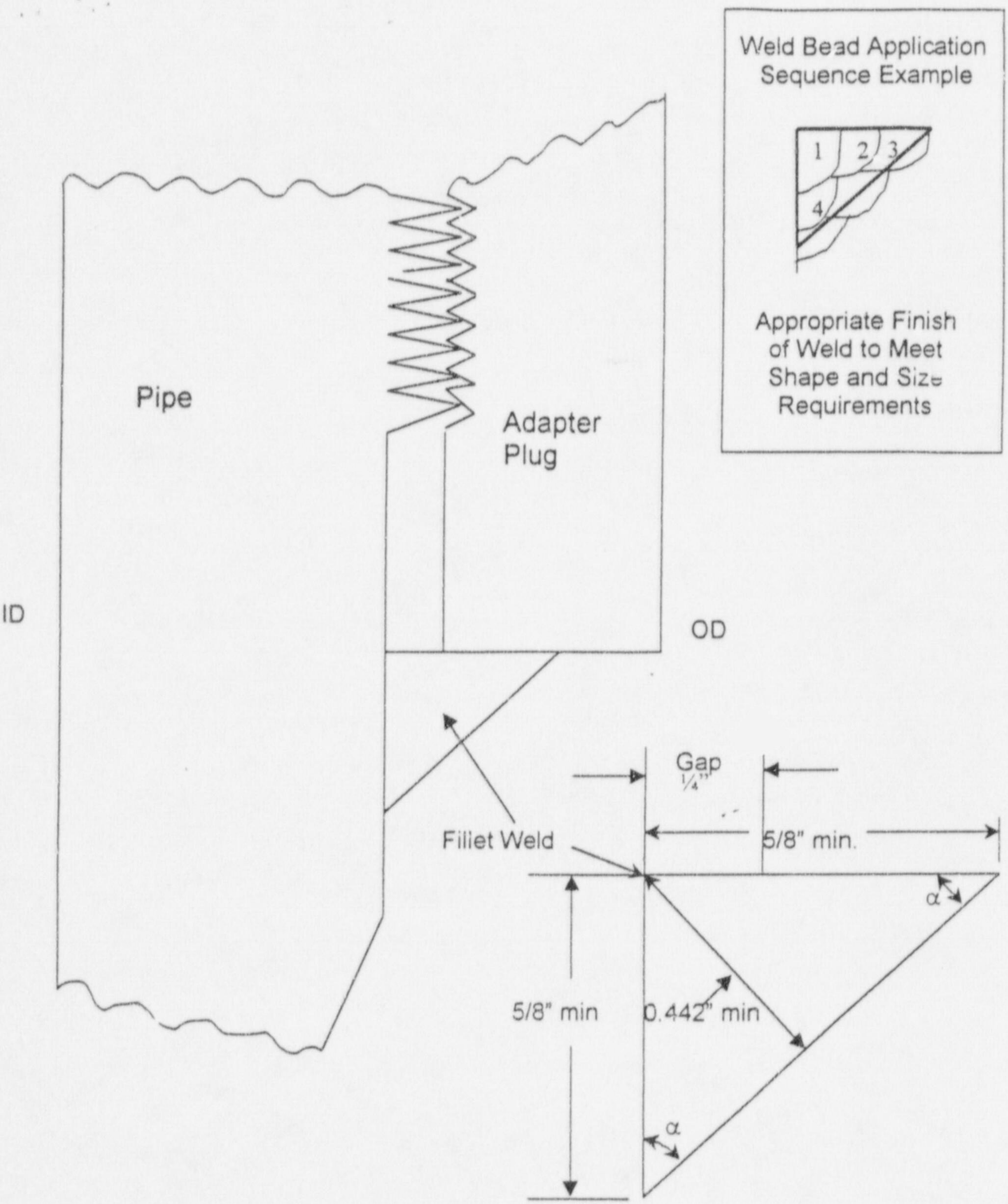


Figure 1: Fillet Weld Design for Point Beach Unit 1 CRDM Adapter Plug Repair

ATTACHMENT 2

SUMMARY OF CAMERA TESTING

WELDING SERVICES INCORPORATED

MEMORANDUM

DATE: 04/01/98

TO: John Oswald, Wisconsin Electric

FROM: Mark Stoutamire MSS

SUBJECT: Point Beach Video Magnification
For. Part Length Modification
Job Cost #38012

The video camera used in conjunction with the CRDM Remote Weld Repair tooling is a 12 mm diameter ELMO UN411E color CCD camera with a type TT2011 lens. The specification for the lens follows. Focal length: f = 11 mm. Angle of View (V x H): 18.8° x 24.9°.

The ratio of the size of the video monitor to the size of the viewing area at the object distance when in focus is approximately 8:1. This calculation was verified by viewing the graduations on a 6 inch scale located at the focal point of the weld puddle viewing camera (approx. 3/32" beyond the point of the tungsten electrode) and measuring the distance between graduations on the video monitor. In the field, a quick measurement of the width of the 1/8" diameter tungsten will verify that the correct camera is installed. At 8:1 magnification, the 1/8" diameter tungsten electrode will measure 1.0" wide.

It has been verified that this camera and lighting system meets or exceeds the visual examination requirements of paragraph 5.0 and 5.2 of WSI QAP 9.3 Rev. 9.

Witness:

Terry Forman
WSI QA Manager

MSS:ksm

cc: S. Burkhalter

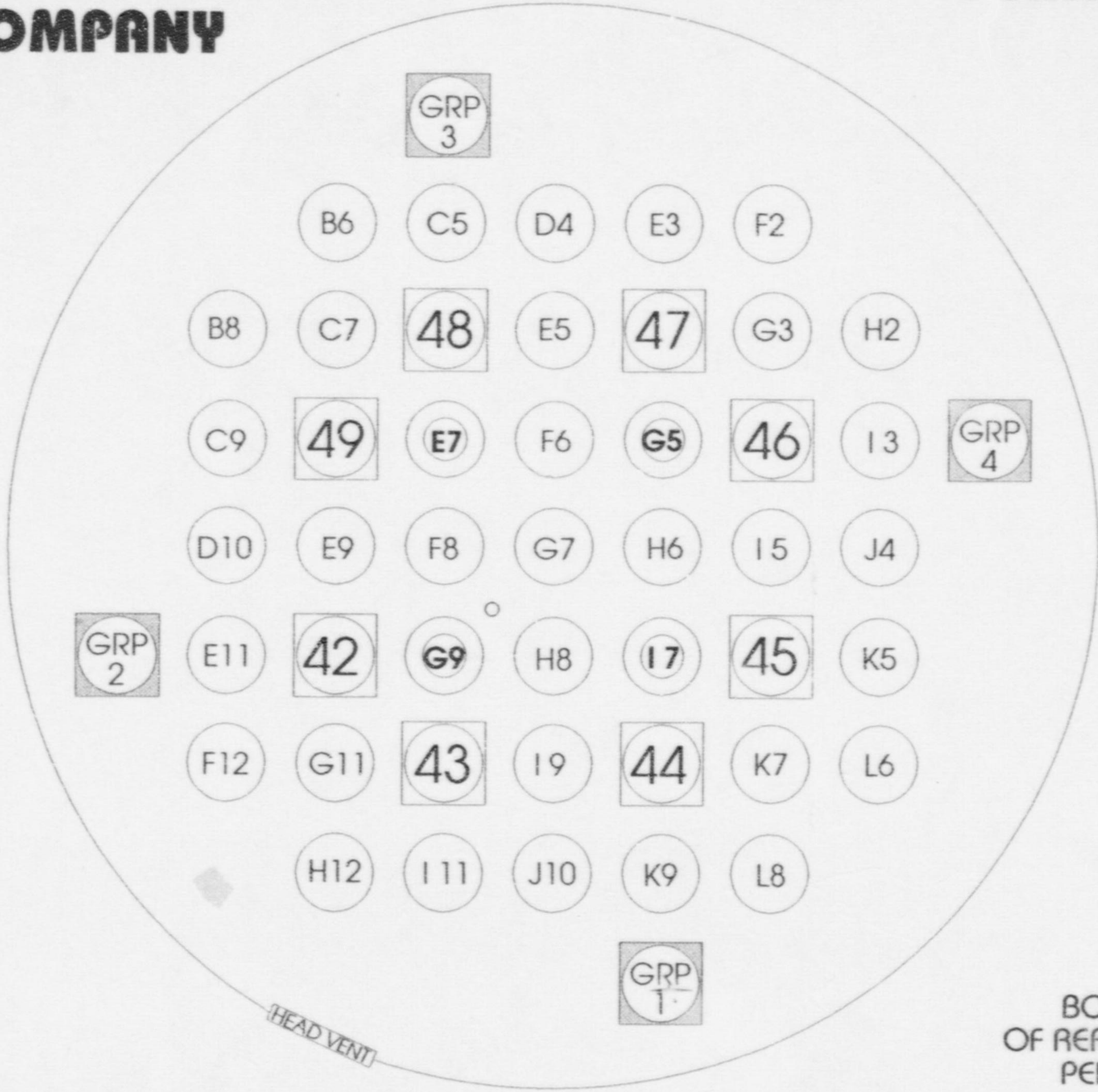
ATTACHMENT 3

POINT BEACH UNIT 1

CONTROL ROD LOCATIONS

WISCONSIN ELECTRIC POWER COMPANY

Point Beach Unit 1



BOTTOM VIEW OF REACTOR HEAD PENETRATIONS