

Washington Public Power Supply System

P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000
Docket No. 50-397

September 9, 1983
G02-83-820

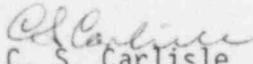
Mr. J. B. Martin
Regional Administrator
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, California 94596

Subject: NUCLEAR PROJECT NO. 2
10CFR50.55(e) REPORTABLE CONDITION #269
BECHTEL POWER CORPORATION REPAIR OF WRONG WELD AREA

References: 1) Telecon QA2-83-129, dated July 5, 1983, C.S. Carlisle
to J. Elin.
2) Letter #G02-83-671, dated July 28, 1983, C.S. Carlisle
to J.B. Martin, same subject.

In accordance with the provisions of 10CFR50.55(e), your office was informed, by telephone, of the above subject condition on July 5, 1983. The attachment provides the Project's final report on this condition. Please note that this report also responds to item of noncompliance 397/83-38-08 of the same subject.

If you have any questions, please contact Roger Johnson, WNP-2 Project QA Manager at (509) 377-2501, extension 2712.


C. S. Carlisle
Program Director, WNP-2

LCF/kd

Attachment: As stated

cc: W.S. Chin, BPA
N.D. Lewis, EFSEC
A. Toth, NRC Resident Inspector
Document Control Desk, NRC

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 2
DOCKET NO. 50-397
LICENSE NO. CPPR-93
10CFR50.55(e) CONDITION #269
BECHTEL REPAIR OF WRONG WELD AREA

FINAL REPORT

Description of Deficiency

Weld RHR-851-18.19, 12AR1-FW12A was originally made, radiographed, repaired, reradiographed and accepted by WBG, the previous mechanical contractor. As a special task under the WWP-2 Quality Verification Program, Bechtel performed a 100% review of the WBG weld radiographs. Upon reinterpretation of the WBG radiographs for weld RHR-851-18.19, 12AR1-FW12A, Bechtel concluded that a rejectable indication had been overlooked, and further repairs were necessary to meet Code requirements.

A nonconformance report was prepared, the appropriate weld papers were issued, and the weld was excavated, repair welded, reradiographed and accepted by Bechtel. However, because of an error in determining the location of the defect from the weld station markers on the WBG radiograph, Bechtel excavated, repair welded and reradiographed the wrong area. This layout error, which resulted in repairing and radiographing the wrong area, was not detected by Bechtel when they reviewed and accepted the repair radiographs. This deficiency was due to a failure to compare the original WBG film, which Bechtel had found unacceptable, with the Bechtel repair film which was accepted. This error was discovered by the NRC CAT inspector by comparing the original film with the repair film when he performed a random check of Bechtel weld repair radiographs.

Analysis of Safety Implication

Two of the 14 deficient repair welds were in non-safety related Quality Class II, ANSI 831.1 piping systems. Of the remaining 12 Quality Class I welds, two of the deficiencies were due to lack of complete film coverage. One of these was completely cut out because of an isometric drawing modification, and the other one was free of weld flaws.

A linear elastic fracture mechanics analysis has been performed on the radiographic flaw indications in the remaining 10 Quality Class I pipe welds using the methodology of ASME XI, Appendix A. This analysis shows that the stress intensity factors (K_I) are lower than the conservatively estimated critical values of K_{Ic} ($120 \text{ ksi}\sqrt{\text{in}}$) and K_{Ia} ($100 \text{ ksi}\sqrt{\text{in}}$). ASME XI, IWB-3512 provides the following acceptance criteria based upon applied stress intensity factors:

1. For normal conditions: $K_I \times \sqrt{10} < K_{Ia}$
2. For emergency and faulted conditions: $K_I \times \sqrt{2} < K_{Ic}$

As shown by the data presented in Table 2, the stress intensity factors for all weld flaws multiplied by 10 are well below the conservatively estimated critical value of 100 ksi in for K_{Ia} . From this it can be conservatively concluded that had the weld repair deficiencies gone undetected, they would not have adversely affected the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant.

Based upon the above information, it is concluded that the deficiency is not reportable under the rules of 10CFR50.55(e).

Cause of Deficiency

The above described deficiency can be directly traced to a failure to compare the repair radiographs with the original radiographs to assure that the correct area was repaired, and the originally rejected discontinuity was satisfactorily removed.

The review, interpretation and acceptance of radiographs is a Bechtel QC responsibility. The governing procedures used by Bechtel QC for reviewing radiographs were RT-ASME, Rev. 0 and QCI W-1.00A. Neither of these procedures specifically state that the original film shall be compared with the repair film when reviewing and accepting radiographs for weld repairs. This procedure inadequacy is believed to be the underlying root cause responsible for the deficiency.

Corrective Action

Weld RHR-851-18.19, 12AR1-FW12A, was documented on NCR #21688, repair welded (QCIR W-100A-6974), reradiographed (NDE Report #4073) and finally accepted on 6/24/83.

In addition to correcting the one specific deficiency identified on NCR-21688, Bechtel performed a 100% review of all other welds which were repaired, radiographed and accepted without comparing the rejected film against the repair film to confirm that the originally rejected defects were removed. From a complete review of all Bechtel RT reports, it was determined that Bechtel made and accepted 297 weld repairs without comparing the original film with the repair film. For each of these 297 welds, the necessary comparisons were made and it was determined that 13 additional weld repairs were incorrectly accepted. A complete description of these 13 deficient repair welds plus the one original weld repair deficiency discovered by the NRC Construction Appraisal Team is presented in Table 1.

The data in Table 1 shows that the deficiencies for all 14 welds have been satisfactorily resolved. The one ASME III/1 and three of the four ASME III/2 welds were successfully repaired and reradiographed. The one remaining ASME III/2 weld which did not have full film coverage of the repair, has been reradiographed and accepted.

Six of the seven ASME III/3 welds, which do not require radiographic examination, successfully passed the Code required surface NDE (liquid penetrant) examination. The one remaining ASME III/3 weld was completely cut out due to an isometric drawing modification. These seven ASME III/3 welds were originally radiographed as a part of the project welder performance evaluation program which was outside of the design specification and Code requirements. Fracture Mechanics analysis using the methodology of ASME XI, Appendix A, shows that the radiographic indications are within the acceptable limits for the design service conditions.

The remaining two welds were Quality Class II, ANSI B31.1. These two welds were successfully repaired and reradiographed.

With one exception, the failure to identify deficient weld repairs for all 14 items was due to not comparing the original film with the repair film. The one exception was item 14 in Table 1, classified as category D (Weld FPC-669-1.7-2AFW2A). The error in this case was unrelated to comparing the original film with the repair film, but was simply due to a misinterpretation of or failure to identify rejectable indications on the repair radiographs. Further corrective action was taken to resolve this single case of a radiographic film interpretation error.

The radiographs for a sample of 61 original production welds was selected from a total population of 604 welds reviewed and accepted by the same Level II RT technician who made the interpretation error on repair weld FPC-669-1.7-2AFW2A. All of the film for the 61 sample welds was re-reviewed by Bechtel Level II or Level III RT technicians. The radiographs for 60 of the 61 welds were found to have been correctly interpreted. One radiograph for one of the welds was noted by the original Level II interpreter as containing borderline but acceptable porosity. Upon re-review by a Level III interpreter, it was determined that although the original Level II interpreter had correctly identified the indication as porosity, he apparently made a computation error in measuring its size, calculating the area and comparing it to the code allowable limits. What the original Level II interpreter had noted as borderline porosity-acceptable, was in fact borderline porosity-unacceptable to ASME Section III requirements. This particular weld, EDR-066-11.17-FW2, has subsequently been reclassified as Quality Class II, ANSI B31.1 which is not safety significant and does not require radiographic examination.

All remaining RT reports for the 543 other welds accepted by the same Level II interpreter were then reviewed to see if he had made any other borderline acceptable notations. Four additional RT reports were found with this notation and the corresponding film was re-reviewed by a Level III technician. The radiographs for all four of these RT reports were found to have been correctly interpreted and dispositioned by the original Level II interpreter.

Action to Prevent Recurrence

The procedure inadequacy identified as the underlying root cause of the deficiency has been corrected by issuing Administrative Instruction #27, dated August 16, 1983, to supplement Bechtel procedure RT-ASME, Rev. 0. This Administrative Instruction contains the following specific provisions to prevent recurrence of the described deficiency.

1. Repair weld film must be compared to the original rejected film for area of coverage, number of defects and original defect removal.
2. For radiographic rejects, the Bechtel Level II interpreter must make a transparency of the rejected film showing the weld identification, the area of the weld requiring repair, and the location and type of defects to be removed. This transparency is given to the welding engineer responsible for making the repair to minimize layout errors which could result in repairing the wrong weld area.
3. Radiographic film for rejected welds is maintained in a suspense file by the Bechtel NDE group until repairs are completed so that the original film is readily available for comparison with the repair film.

A training session covering Administrative Instruction #27 was conducted by a Bechtel Level III technician and attended by all WNP-2 Bechtel Level II film interpreters on August 17, 1983.

It is believed the above described actions will prevent recurrence of the deficiency on the WNP-2 Project.

TABLE 1
INCORRECTLY ACCEPTED WELD REPAIRS

ITEM NUMBER	CATEGORY	ISO NUMBER	WELD NUMBER	ASME CLASS	AREA REJECTED	DESCRIPTION	NCR NUMBER	DISPOSITION	REPAIR/REWORK COMPLETE	REMARKS
1	A	RHR-851 18.19	12AR1FW12A	2	1-1/2" to 3-1/2" 18" 21"	Concavity Concavity Incomplete Fusion	21688	Repair	06/24/83	NRC CAT team audit finding
2	A	RFW-419-3	12-1FW12	1	65" - 66"	Slag Inclusion	21827	Repair	08/05/83	
3	B	RHR-899 39.44	FW20R1	2	1-2	Coverage	N/A	Reshoot	07/16/83	Insufficient film coverage of repair area. Reshot OK.
4	B	FPC-605 1.4	2FW2	3	0-9	Coverage	N/A	Cut out	N/A	Insufficient film coverage of repair area. Pipe was cut out due to iso modifications. Reshot not required.
5	C	RHR-1968-5	FW17R1	2	2-3	Incomplete Penetration	21767	Repair	06/09/83	
6	C	FPC-4444-1	W120R1	3	0-1	Incomplete Fusion	21768	Accept as-is	N/A	Surface NDE and fracture mechanics acceptable.
7	C	FPC-605 10.12	3FW3R1	3	1-4 25-27, 28-31	Incomplete Penetration Incomplete Fusion	21766	Accept as-is	N/A	Surface NDE and fracture mechanics acceptable.
8	C	FPC-670 1.2	4AFW4A	3	22	Incomplete Fusion	21824	Accept as-is	N/A	Surface NDE and fracture mechanics acceptable.
9	C	FPC-687 7.13	6FW6	3	1-3	Incomplete Fusion	21824	Accept as-is	N/A	Surface NDE and fracture mechanics acceptable.

CATEGORY DEFINITIONS:

- A. Wrong area repaired and radiographed - rejectable indications not noted due to failure to compare film
- B. Insufficient film coverage of repaired area not noted due to failure to compare film.
- C. Correct area repaired and radiographed - rejectable indications not noted due to failure to compare film.
- D. Correct area repaired and radiographed - interpretation error made in reviewing repair film.

TABLE 1 (CONTINUED)
INCORRECTLY ACCEPTED WELD REPAIRS

ITEM NUMBER	CATEGORY	ISO NUMBER	WELD NUMBER	ASME CLASS	AREA REJECTED	DESCRIPTION	NCR NUMBER	NCR DISPOSITION	REPAIR/REWORK COMPLETE	REMARKS
10	C	FPC-640 1.6	4-1R1FW4-1	3	8	Incomplete Fusion	21824	Accept as-is	N/A	Surface NDE and fracture mechanics acceptable.
11	C	OG-783 15.21	1FW1	N/A	11-12 14, 17-19	Slag Inclusion Incomplete Fusion	N/A	Repair	08/03/83	ANSI B31.1 - Quality Class II Repair acceptable.
12	C	OG-783 12.14	2FW2	N/A	16	Incomplete Fusion	N/A	Repair	07/27/83	ANSI B31.1 - Quality Class II Repair acceptable.
13	C	HPCS-629 1.4	16AFW16A	2	2-5	Incomplete Fusion	21826	Repair	08/09/83	
14	D	FPC-699 1.7	2AFW2A	3	12	Incomplete Fusion	21824	Accept as-is	N/A	Surface NDE and fracture mechanics acceptable.

CATEGORY DEFINITIONS:

- A. Wrong area repaired and radiographed - rejectable indications not noted due to failure to compare film
- B. Insufficient film coverage of repaired area not noted due to failure to compare film.
- C. Correct area repaired and radiographed - rejectable indications not noted due to failure to compare film.
- D. Correct area repaired and radiographed - interpretation error made in reviewing repair film.

TABLE 2

FRACTURE MECHANICS ANALYSIS DATA

ITEM NUMBER	ISO NUMBER	WELD NUMBER	PIPE DIAMETER (inch)	WALL THICKNESS (inch)	DESIGN PRESSURE (psig)	DESIGN TEMP (F)	σ_m (ksi)	σ_b (ksi)	INDICATION LENGTH (inch)	INDICATION DEPTH (inch)	K_I (ksi \sqrt{in})	$\sqrt{I_0} \times K_I$ (ksi \sqrt{in})	MATERIAL
1	RHR-851 18.19	12AR1FW12A	14	0.375	500	480°	1.9	32	0.5	0.06	14.3	45	A106-B Pipe to A106-B Pipe
2	RFW-419-3	12-1FW12	24	1.812	1300	575°	4.3	32	0.625	0.06	16.9	53	A106-B Pipe to A352 WCB Valve
3	RHR-899 39.44	FW20R1	WELD ONLY REQUIRED AN ADDITIONAL RADIOGRAPH TO PROVIDE COMPLETE COVERAGE. NOT SUBMITTED FOR FRACTURE MECHANICS ANALYSIS AS RADIOGRAPH SHOWED NO DEFECTS.										
4	FPC-605 1.4	2FW2	WELD CUT OUT DUE TO PIPING MODIFICATIONS NOT SUBMITTED FOR FRACTURE MECHANICS ANALYSIS AS DISCREPANCY WAS LACK OF COMPLETE FILM COVERAGE NOT WELD FLAWS.										
5	RHR-1968-5	FW17R1	2	0.218	125	480°	0.3	36	0.125	0.06	7.4	23	A106-B Pipe to A234 WBP Elbow
6	FPC-4444-1	W120R1	2	0.218	150	175°	0.3	36	0.125	0.06	13.3	42	A106-B Pipe to A234 WBP Elbow
7	FPC-605 10.12	3FW3R1	10	0.365	220	175°	1.5	36	0.125 1.5 1.75	0.06 0.06 0.06	7.8 18.5 20.4	25 59 64	A106-B Pipe to A234 WBP Elbow
8	FPC-670 1.2	4AFW4A	10	0.165	150	175°	2.3	30	0.563	0.06	12.5	40	A312-T304 Pipe to A312-T304 Pipe
9	FPC-687 7.13	6FW6	10	0.365	150	175°	1.0	36	0.375 0.125	0.06 0.06	14.5 7.6	46 24	A106-B Pipe to A234 WBP Elbow
10	FPC-640 1.6	4-1R1FW4-1	8	0.322	150	175°	0.9	32	0.125	0.06	7.7	24	A106-B Pipe to A105 Valve

TABLE 2 (CONTINUED)

FRACTURE MECHANICS ANALYSIS DATA

ITEM NUMBER	ISO NUMBER	WELD NUMBER	PIPE DIAMETER (inch)	WALL THICKNESS (inch)	DESIGN PRESSURE (psig)	DESIGN TEMP (F)	σ_m (ksi)	σ_b (ksi)	INDICATION LENGTH (inch)	INDICATION DEPTH (inch)	K_I (ksi \sqrt{in})	$\sqrt{10} \times K_I$ (ksi \sqrt{in})	MATERIAL
11	OG-783 15.21	1FW1	QUALITY CLASS II NOT SUBMITTED FOR FRACTURE MECHANICS ANALYSIS										
12	OG-783 12.14	2FW2	QUALITY CLASS II NOT SUBMITTED FOR FRACTURE MECHANICS ANALYSIS										
13	HPCS-629 1.4	16AFW16A	24	0.375	100	212°	1.6	32	0.5	0.06	14.1	45	A106-B Pipe to A352 WCB Valve
14	FPC-669 1.7	2AFW2A	6	0.134	150	175°	1.7	30	0.219 0.25 0.188	0.06 0.06 0.06	11.6 11.6 11.1	37 37 35	A312-T304 Pipe to A403-T304 Elbow