

Bechtel Associates Professional Corporation

Attachment to
Howe-310-79

SUBJECT: MCAR 29 (issued 5/22/79, revised 5/25/79)
Impact Testing of Main Feedwater Pipe

FINAL REPORT

DATE: November 19, 1979

PROJECT: Consumers Power Company
Midland Plant Units 1 & 2
Bechtel Job 7220

Introduction

This final report is prepared in response to Midland project management Corrective Action Report 29. This concludes and summarizes our actions as previously reported in Interim Reports 1 through 4.

Description of Discrepancy

During a review of Grinnell documents, the NRC identified nine pipe spools fabricated from ASME SA 106 Grade B pipe, Heat N-32762, which failed to meet the physical impact requirement for the material in accordance with ASME Section III Class 2 Code criteria. Grinnell subsequently notified Bechtel of the potentially reportable discrepancy.

Potential Safety Implication

A potential safety problem would exist if inadequate material impact toughness properties at low feedwater temperatures resulted in, or contributed to, a main feedwater line break.

Summary of Investigation and Historical Background

Bechtel, after being informed by Grinnell that a discrepancy with potential safety implications existed, reviewed at Grinnell 70 spool data packages for impact test properties. This review covered all material requiring Charpy impact testing. This review was done to determine whether additional material, other than that identified during the NRC audit, met specifications and ASME Section III, Class 2 Code requirements.

The specific Code requirements are as follows:

In accordance with NB 2332(1) of ASME Section III, test three Cv (Charpy V-notch test) specimens at a temperature lower than or equal to the lowest service temperature. All three specimens shall meet the requirements of Table NB 2332-1.

According to Table NB 2332-1, the required Cv values for piping are as follows:

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<u>Nominal Wall thickness</u>	<u>Lateral expansion (mils)</u>
5/8" or less	No test required
Over 5/8" to 3/4" (inclusive)	20
Over 3/4" to 1-1/2" (inclusive)	25
Over 1-1/2" to 2-1/2" (inclusive)	40

Subarticle NB2350 of ASME Section III permits one Charpy V-notch impact retest (consisting of two additional specimens taken as near as practicable to the failed specimens) to be conducted at the same temperature provided the following:

- a) The average value of the test meets the minimum requirements.
- b) Not more than one specimen per test is below minimum.
- c) The specimen not meeting the requirement is not lower than 10 ft-lb or 5 mils below specification requirements.

The above spools were fabricated from a total of 16 heats. Of these heats, two material test reports (for Heats N-32762 and L-20479) contained questionable data.

For Heat 32762, Grinnell had performed four separate tests as identified below:

- a) 19151: Test voided because specimen oriented incorrectly
- b) 19676-1 Results: 21, 40, and 45 mils (The minimum requirement is 25 mils for a material with a nominal wall thickness of 0.937 inches.)
- c) 19676-3 Results: 21, 40, 45, 25, and 18. The last two were not noted as retests, which was permissible, though Test 19676-1 indicated that only three samples were tested.

The failing 18 mils value precludes a further test at the same temperature.

- d) A subsequent test was performed by the ITT Grinnell test laboratory with passing values at 29, 30, and 32 mils. This was a third test of the heat which is not allowed by the Code. This test was accepted by ITT Grinnell Industrial Pipe Inc.

Heat N-32762 was considered questionable because Grinnell performed more than one retest, which is not allowed by ASME Section III, Class 2 Code, as discussed previously.

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In May 1979, Grinnell tested three samples of Heat N-32762. These samples were from a fabricated spool which was still at its facility, spool 1ELB-2-S-638-13-2. This spool which consisted of a straight piece of pipe which was hot-bent, air-cooled, and then full-furnace stress-relieved. These samples yielded results of 9, 6, and 17 mils lateral expansion. Because the samples were taken near the area of the bend, it was thought that they may have been from a heat-affected zone (an area which had received an intermediate heating and cooling cycle because of its proximity to the hot-bend area).

Grinnell has indicated that measurement of the actual sample location relative to the area which was heated and bent, shows that it was not significantly heated during the bending cycle.

Grinnell submitted a graph verifying that the above samples were not in the heat-affected zone of the bend.

The Heat L-20479 retest at 30F was considered questionable because the acceptable test results were based on material in a stress-relieved condition. Grinnell's rationale was based on its experience that a subcritical (1100-1200F) heat treatment has the effect of reducing the spread of toughness values (smaller variances) and slightly improving lateral expansion values through a softening mechanism (a slightly reduced yield point). The retest of Heat L-20479 after stress-relieving, met the code impact test requirements. However, Grinnell concedes that its rationale, as demonstrated by the previously identified poor impact test results of Heat N-32762 after stress relieving was not 100% consistent, and as a result, it believes that other stress-relieved heats would also be suspect in relation to the repeatability of the impact properties at 30F on each spool.

Grinnell rationalized that because it did not obtain improved Charpy test results for Heat N-32762 after stress-relieving, Heat L-20479 cannot be considered to have the desired impact properties (+30F) either.

Bechtel investigated the minimum service temperatures for all questionable spools in the feedwater system. In accordance with Code definitions of minimum service temperature and the operating criteria for the applicable portion of the system, a minimum service temperature of 70F is required. However a minimum service temperature of 30F was originally specified, based on the minimum expected service temperature for any fluid piping system within the plant. The 30F temperature was chosen to achieve a uniformity in testing requirements for the project.

Grinnell submitted 2 supplier deviation disposition requests (SDDRs) with test data requesting Bechtel to revise the temperature requirement for impact testing from 30F to 70F for all spools of Heat L-20479 and all but spool 1-ELB-2-S-638-13-2 of Heat N32762. Bechtel approved the SDDRs based on the above-identified rationale. All spools tested passed at 70F or lower.

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The test results for Heat L-20479 at 70F are as follows:

Material Identification	Testing Temperature	Impact Toughness ft-lb	Lateral Expansion Mils	Percent Shear
76-1	+70F	63	51	60
76-2	+70F	40	44	50
76-3	+70F	57	60	50

The test results for Heat N-32762 at 60F are as follows:

N-32762-7	+60F	136	87	100
N-32762-8	+60F	53	48	60
N-32762-9	+60F	53	49	60

Spool 1ELB-2-S-638-13-2 of Heat N-32762 was not placed on an SDDR. This is the previously identified hot bend spool which had received full-furnace stress-relieving and yielded uniformly excessively lower test results. Therefore, it was decided to replace that spool. Grinnell is replacing spool 1ELB-2-S-638-13-2 with one fabricated from ASME SA 333 Grade 6 material. The other hot-bend spools in the feedwater system were not fabricated from the questionable heats and were acceptable in the as-received condition.

Corrective Action

As a result of the determination that satisfactory operation at the minimum service temperature of 70F is provided by the applicable portion of the installed feedwater piping spools, no corrective action is required. Grinnell is replacing the one hot-bend spool, 1ELB-2-S-638-13-2, which had not been shipped.

Reportability

Project engineering's final evaluation is that the originally reported discrepancy of the subject MCAR has been resolved and thus there is not a reportable condition within the requirements of 10 FCR 50.55 e.

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