Out-of-Service Corrosion Failure of Horizontal Downcomer, Supply, and Riser Pressure Part Connections

Introduction

PSB2-83 was issued on November 15, 1983 to provide awareness of the corrosion failure of horizontal downcomer, supply, and riser pressure part connections. In the seven years since PSB2-83 was issued, new data has been obtained requiring revision of the previously released information.

Problem

In 1983, a failure occurred on a twenty-nine year old B&W unit due to corrosion of a horizontal section on a downcomer tube. See Figure 1 for the location of the failure. The failed downcomer tube was a 4 in. O.D. x 0.340 in. minimum thickness tube, on a 1,300,000 lb/hr, 2,200 psig natural circulation boiler. Injury to personnel and the immediate loss of unit generation resulted from this failure as these tubes are external to the boiler setting.

In January, 1987, a failure occurred on a 30-year old B&W "Tower" boiler. The failure was in a 6-5/8 in. O.D. x 0.562 in. minimum thickness

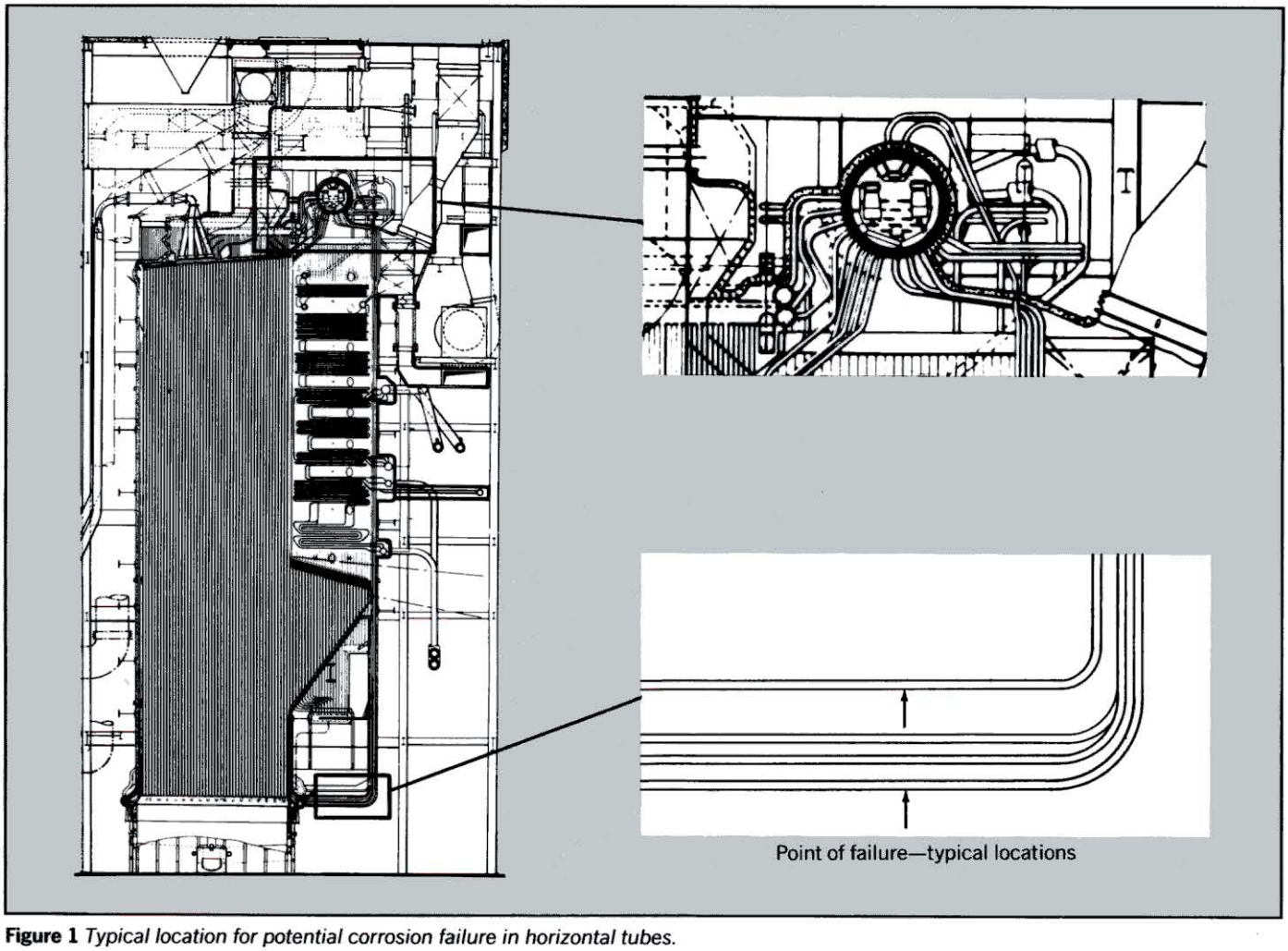

Figure 1 *Typical location for potential corrosion failure in horizontal tubes.*

furnace sidewall riser tube on a 2,200,000 lb/hr natural circulation boiler operating at 2100 psig. See Figure 2 for the location of the failure.

Corrosion to the point of failure in both cases was probably due to one or more of the following factors:

1. Inadequate flushing of the horizontal tubes after a chemical cleaning.
2. Out-of-service corrosion due to exposure to air and water.
3. Improper chemical cleaning, resulting in localized pitting (nine chemical cleanings were performed on the first unit in question, between 1958-1981).

Almost all boilers have pressure part connections with near horizontal runs, such as downcomers, supplies, and risers, making it difficult to assure complete drainage. A residual "ribbon" of fluid can remain along the bottom of such tubes. When the unit is open to the atmosphere, air can interact with the residue and may result in corrosion. Corrosion may be aggravated during chemical cleaning, because the solvent can remain in a crevice and accelerate the pitting. Figures 3, 4 and 5 show the type of pitting and crevices that can be produced and can lead to failures.

The failures cited above had pitting between the 5 and 7 o'clock positions of the failed tube. Similar corrosion pitting has been present on other units that have been inspected.

Recommendations

B&W recommends inspecting areas that may not completely drain, such as those described above. Unfortunately, these areas are usually not easily

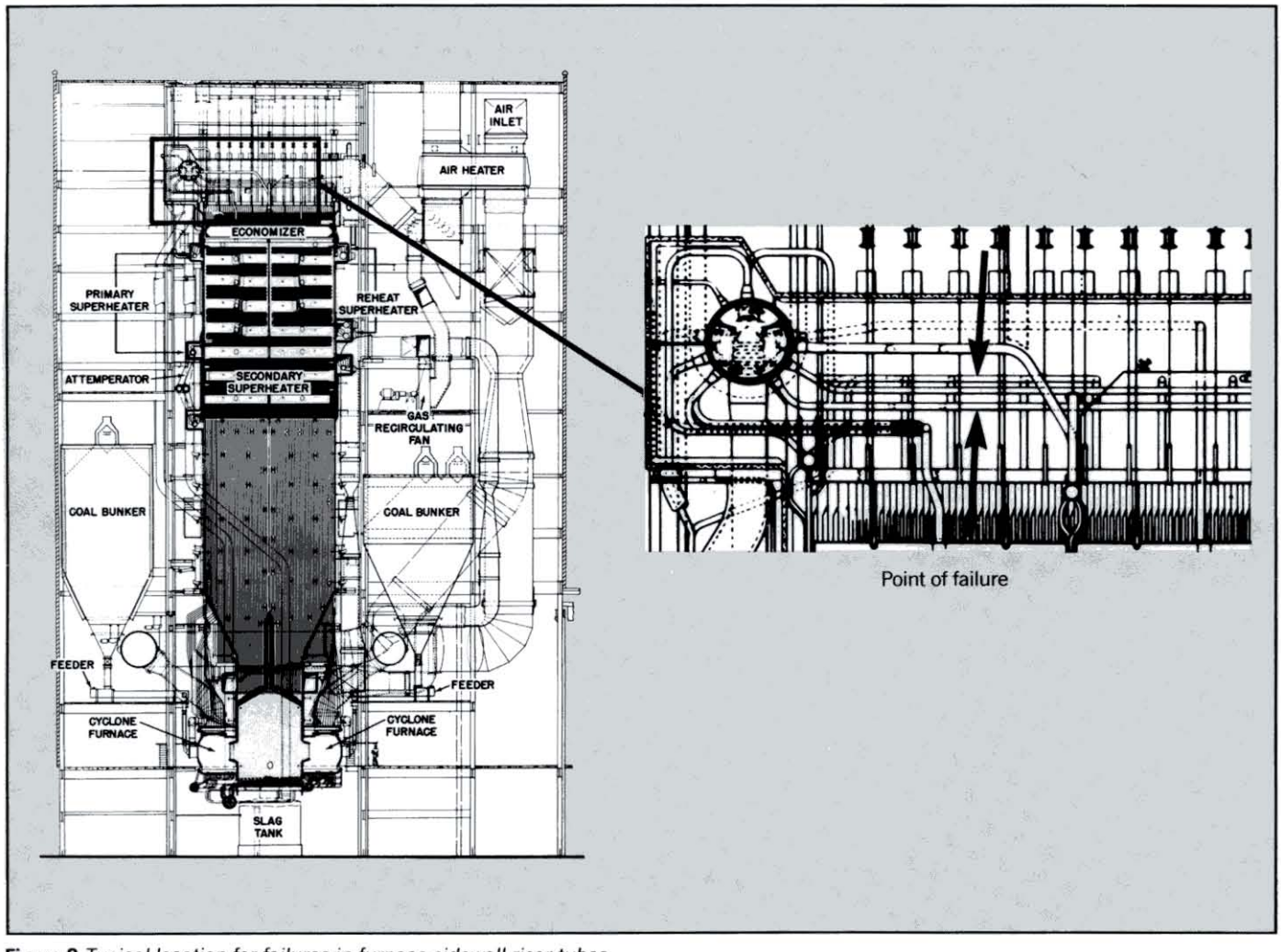

Figure 2 *Typical location for failures in furnace sidewall riser tubes.*

accessible for inspection, and require alternate examination methods such as ultrasonic flaw detection, radiography, fiber-optic inspection or tube sampling. There is usually no visible external sign that a tube is approaching failure.

Tubes with horizontal runs and especially those with sagging, non-drainable, low spots in the horizontal run should be inspected. Any reduction in the pressure part wall thickness must be evaluated with regard to safety and continued operation. Review maintenance and operating procedures to emphasize the importance of the following:

1. When performing boiler chemical cleanings, thorough passivation of the cleaning solvents must be accomplished quickly, using procedures that will generate adequate mixing and reaction of the chemicals.
2. Flushing followed by internal inspection after chemical cleaning must be considered an important step in the procedure to assure solvents and sludge accumulations have been removed. Individual tube flushing with a water hose may be required to remove accumulations.
3. Wet storage with O_2 scavenging and inert blanketing with nitrogen should be used and carefully maintained during out of-service periods. Freeze protection must be considered during winter months.

B&W Support

If you require more information or technical assistance, contact your local Babcock & Wilcox Field Service Engineering office.

Figure 3 *Typical valley crevice.*

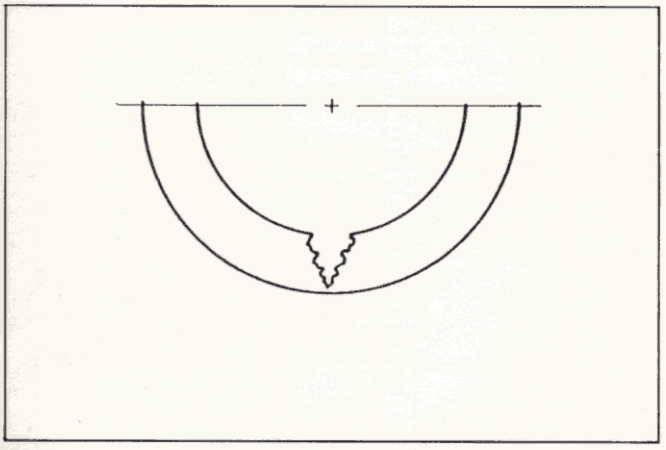

Figure 4 *Crevice leading to failure.*

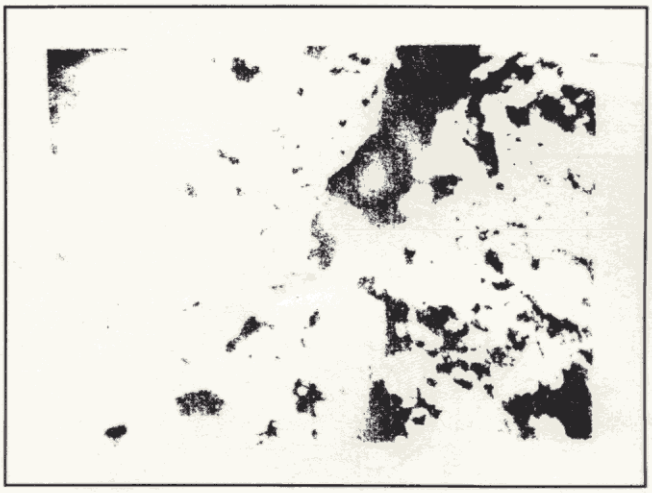

Figure 5 *Pitting and cracking.*

For more information, contact your nearest B&W sales and service office. In the U.S.A., write: Dept. CIC, Power Generation Group, Babcock & Wilcox, P. O. Box 351, Barberton, Ohio 44203-0351. In Canada, write: Manager, Marketing and Sales, B&W Canada, Cambridge, Ontario, N1R 5V3.

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