containing the defect was examined in the lab. MPI analysis as well as visual examination of the fracture surface indicated the presence of a LOF weld defect. The non-fused region was wider on the inside surface (12 mm [0.5 in]) than the outside surface (7.6 mm [0.3 in]). This LOF region also underwent general corrosion, which was confirmed by SEM/EDS analysis.

Metallography performed across the LOF defect, and an intact seam weld brought out differences in microstructure between the two regions. While both mounts displayed flow lines typically observed along the fusion line of the weld, the microstructure at the LOF area was like that of the base material (i.e., banded microstructure of ferrite and pearlite). This indicates incomplete fusion during the welding process, thereby causing an LOF defect to form. The intact weld had an equiaxed microstructure that was appropriate for an API 5L X65 ERW weld.

The pipeline material met the mechanical and chemical property requirements per API 5L (2018).

Conclusions

The 508-mm (20-in) natural gas pipeline failed the pre-commission hydrostatic testing due to a lack of fusion weld defect at the ERW seam. This was confirmed through visual observations, MPI analysis, SEM/EDS analysis, and metallographic evaluation.

During hydrotesting, most pipelines fail along the ERW region. Lack of fusion occurs due to failure of the two strip edges to fuse completely, thereby weakening the seam weld.

This study reinforces the need for hydrotesting since some lack of fusion weld defects can be undetectable by current NDT techniques.

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