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Pacific Gas and Electric Company
Metallurgical Lab Test Report
3400 Crow Canyon Road
San Ramon, CA 94583

SUBJECT: METALLURGICAL ANALYSIS OF LEAKING GAS TRANSMISSION PIPE, LINE 402, ADOBE ROAD

Background Information

At the request of [redacted] of CGT, we examined segments of a 16 inch diameter pipe. This pipe had been in service as part of transmission line 402. It was removed after a gas leak was found.

Testing and Results

We did metallurgical cross sections of the leak and an adjacent area. Based on these results, we then cut similar samples from each end of the original (leaking) section, and from the other two segments that were supplied.

#1	Failure location (known leak)	#4	48" from failure in opposite direction, end of cut pipe
#2	Nearby to failure (3" distant)	#5	Sample from an adjacent section
#3	24" from failure, end of cut pipe	#6	Sample from an adjacent section

The segment containing the leak, and another cross section from about 3 inches away, had defective welds (see Figure 1). There was a wide heat affected zone that showed that some heat had been applied in the area of the intended weld. There was some slight deformation on the inner surface of the pipe at the intended weld location. But there was little or no fusion at the points where the plate edges were in contact, and the deformation and grain flow normal to ERW welds were not present. It was probably caused by insufficient welding current. This defect was extremely tight and depending on the exact extent of it along the pipe might have held pressure or at least had a very slow leak rate. It appeared similar to normal pipe surface marks.

The samples from the furthest ends of the pipe appeared to be fairly normal welds at those locations. The seam had no lack of fusion defects, though there was less deformation than usual.

The samples from the other pipe segments contained normal, fully fused ERW welds (see Figure 2).

SUMMARY

Based on these results, it appears that only the pipe segment that leaked had an original manufacturing flaw that was not detected, but eventually leaked in service. The other pieces that were tested had no similar defect at the locations sampled.

pc: [redacted]

Date: September 13, 1999

Tested by: [redacted]

Prepared by:

Approved by

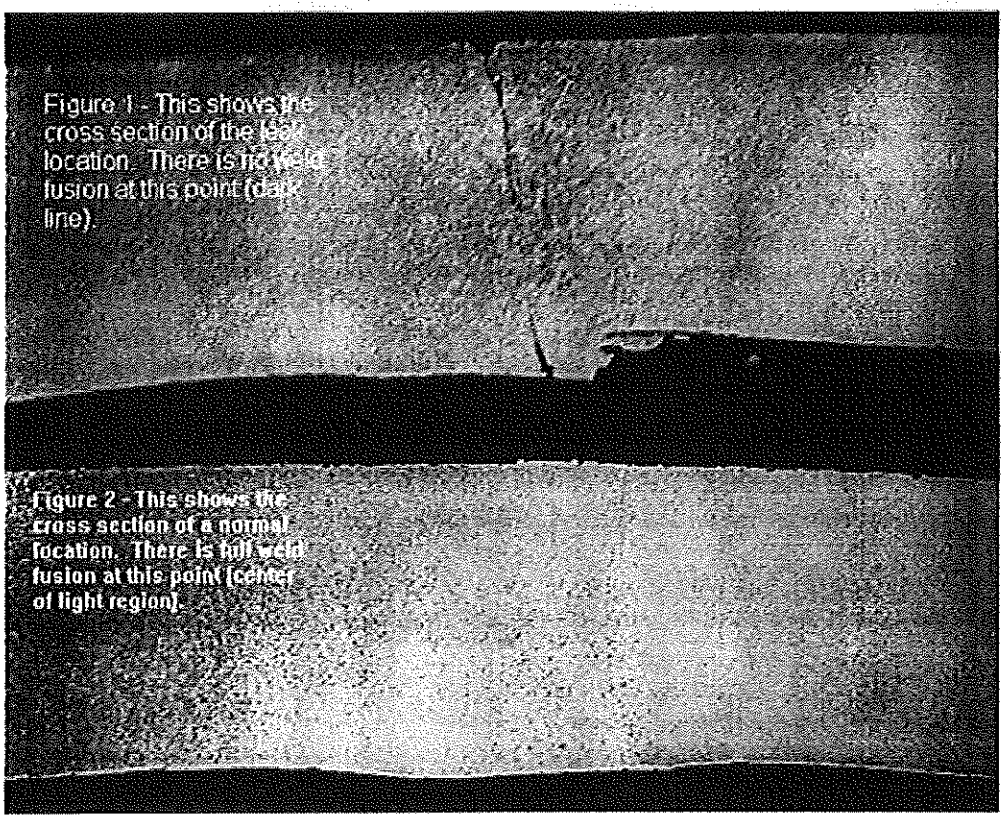
Figure 1 - This shows the cross section of the leak location. There is no weld fusion at this point (dark line).
Figure 2 - This shows the cross section of a normal location. There is full weld fusion at this point (center of light region).