Florida Power & Light Company, 6351 S. Ocean Drive, Jensen Beach, FL 34957

March 22, 2000

L-2000-41
10 CFR 50.4
10 CFR 50.55a

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Re: St. Lucie Unit 1
Docket No. 50-335
In-Service-Inspection Plan
Second Ten-Year Interval
Relief Request 17 Closeout Action

Pursuant to 10 CFR 50.55a (a)(3) on March 2, 1998, Florida Power and Light Company (FPL) requested approval of interim Relief Request (R/R) 17, *Main Feed Isolation Valve Bypass Line Repair*. The second ten-year interval interim request was submitted by FPL letter L-98-68 and supplemented by FPL letter L-98-75 on March 20, 1998. The interim R/R was for a temporary non-code repair to install an engineered mechanical clamp to enclose a steam leak at a socket welded elbow fitting on the one inch bypass line for MV-09-7, main feed isolation valve. The temporary non code repair was approved until the next refueling outage (SL1-16) by NRC Safety Evaluation (SE) dated May 20, 1998. The SE requested FPL to submit the root cause analysis of the leaking joint. During the fall 1999 refueling outage (SL1-16), FPL completed the code repair of the main feed isolation valve bypass line. The attached laboratory examination report and root cause analysis of the removed elbow validates the original FPL root cause documented in condition report (CR) 98-0372 and closes this issue. A copy of the root cause analysis, as requested by the SE, is attached for your information.

Please contact us if there are any questions about this submittal.

Very truly yours,

Rajiv S. Kundalkar

Rajiv S. Kundalkar
Vice President
St. Lucie Plant

RSK/GRM

Attaachment

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

A047

ROOT CAUSE ANALYSIS
SOCKET WELD FAILURE, MFW ISOLATION VALVE (V09188) BYPASS LINE

BACKGROUND

On 2/27/98, a leak was discovered in a socket weld joining the 1", Schedule 80 carbon steel pipe and elbow, located downstream of the St. Lucie Unit 1, 1A main feedwater isolation valve bypass. A temporary repair was implemented utilizing a pressure retaining clamp and injection compound. The elbow and adjoining sections of pipe were subsequently replaced during the 1999 refueling outage (SL1-16) and forwarded to the Metallurgical Laboratory for analysis. The piping components were original plant equipment.

OBSERATIONS

The failed socket weld and associated components are shown in the as-received condition in Figure 1. The outside surfaces were covered with a dark brown corrosion product. There were also remnants of the rubbery injection compound present on the surface. The joint did not display any evidence of plastic deformation.

The outside surfaces of the components were lightly sandblasted to facilitate identification of the leak location. Several patches of porosity were noted as shown typically in Figure 2. Additionally, the weld contour was rather irregular in the vicinity of one such patch as shown in Figure 3. There was also a linear type defect, possibly the result of peening, in this region.

The joint was split axially to facilitate examination of the components' internal surfaces. They were covered with a dark brown corrosion product and did not exhibit any evidence of excessive wastage. The leaking socket weld joint displayed adequate pull-back, however, the non-leaking joint displayed none as shown in Figure 4.

Several axially oriented cuts were made through the aforementioned patches of porosity, and the cut surfaces were prepared metallographically. In the vicinity of the patch previously displayed in Figure 3, there was a significant amount of subsurface porosity and lack of penetration at the weld root as shown in Figure 5. Further grinding in this region revealed the leak path as shown in Figures 6 and 7. The microstructures displayed by the base and weld metals were normal for the plain carbon steel components.

DISCUSSION

Failure of the subject socket weld joint was initiated by preservice welding defects. Specifically, the presence of excessive porosity and lack of penetration resulted in a very thin ligament of weld metal available for pressure retention. Final ductile fracture of this ligament occurred after minor internal and/or external corrosion reduced its wall thickness below the required load carrying capacity. There was not any evidence of external mechanical loads having contributed to the failure. The likely root cause of the welding defects was poor welder technique.

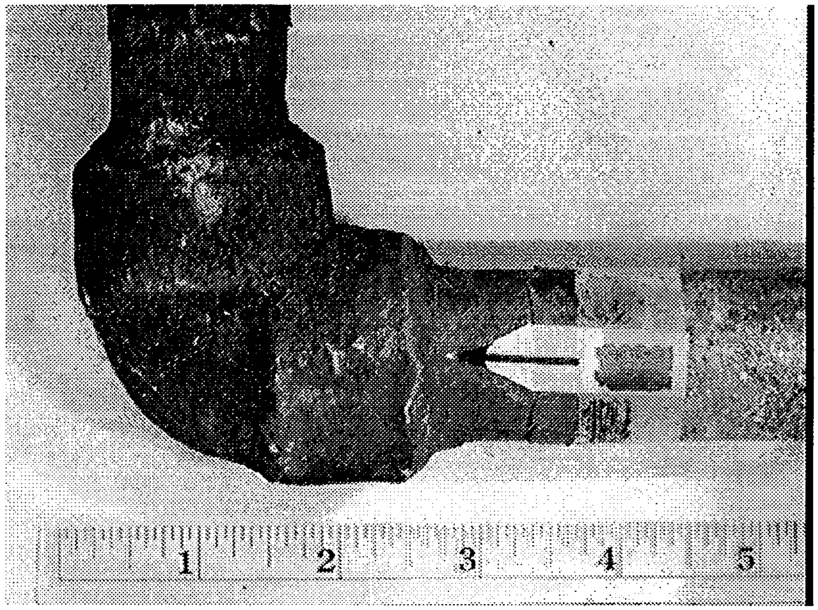

Figure 1. Photograph showing piping components in the as-received condition. Arrow points to leaking socket weld.

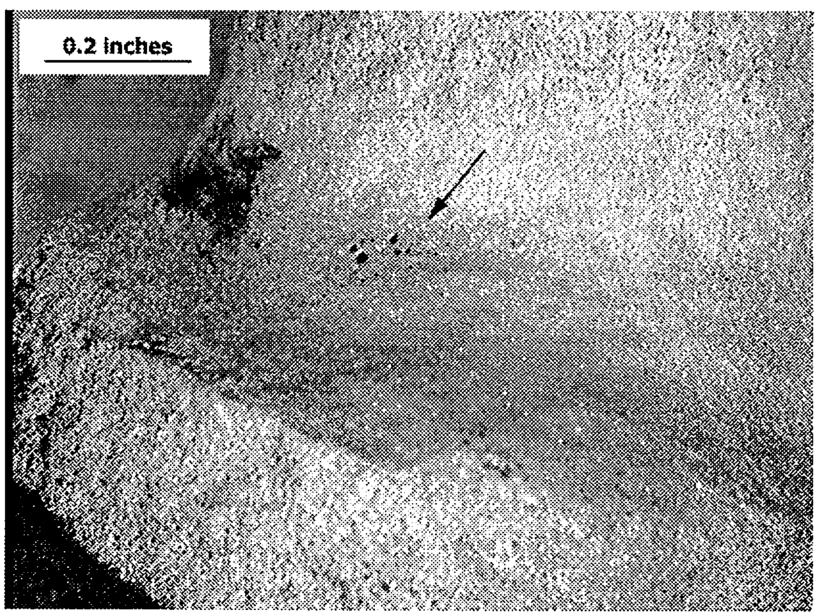

Figure 2. Photograph showing patch of porosity on outside surface, at pipe-side toe of socket weld.

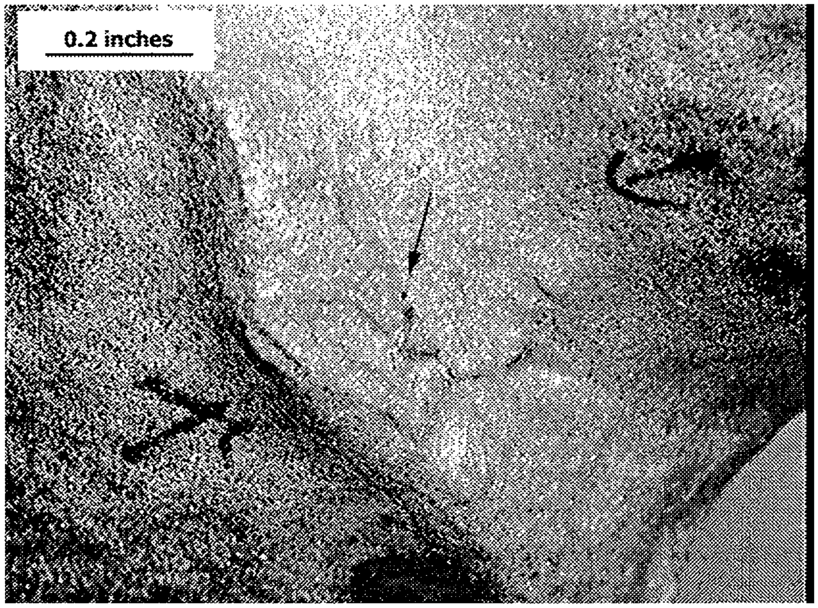

Figure 3. Photograph showing porosity and linear defect on outside surface, at pipe-side toe in another region of socket weld.

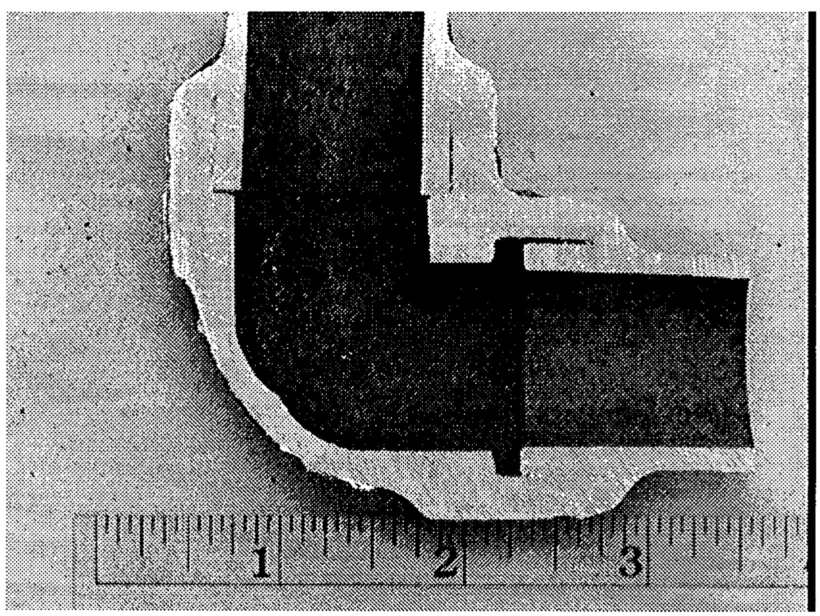

Figure 4. Photograph showing ID surface of components. Note lack of pull-back in vertically oriented weld. Leaking weld is oriented horizontally and exhibits adequate pull-back. Internal surfaces do not exhibit any evidence of excessive wastage.

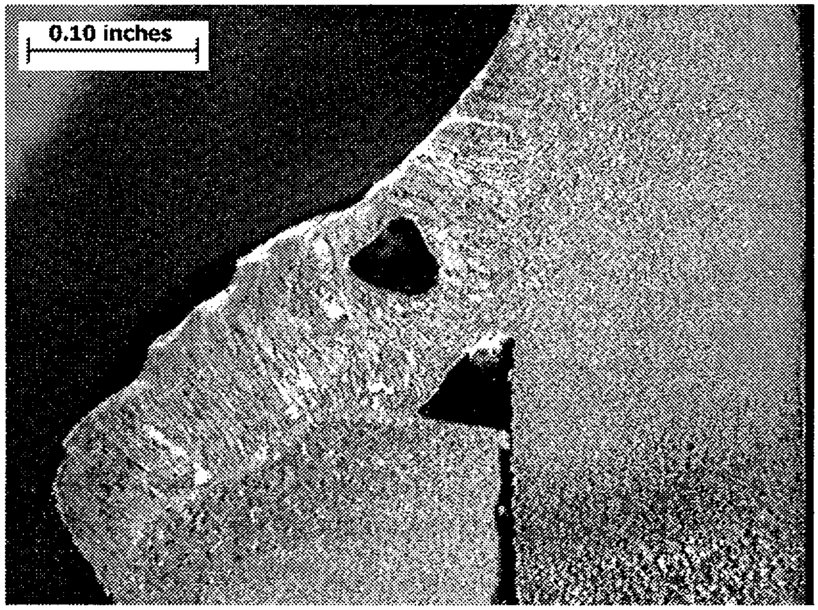

Figure 5. Photomacrograph of axially oriented metallographic specimen showing lack of penetration at root and subsurface porosity in region displayed in Figure 3. Solidification and etching patterns indicate that defects were preservice in nature.

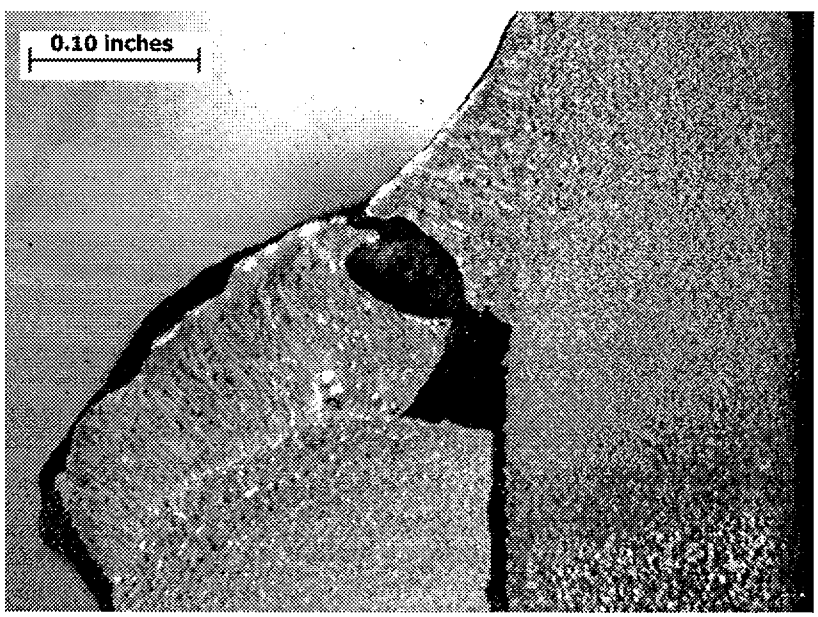

Figure 6. Photomacrograph of axially oriented metallographic specimen showing leak path in plane immediately adjacent to that displayed above.

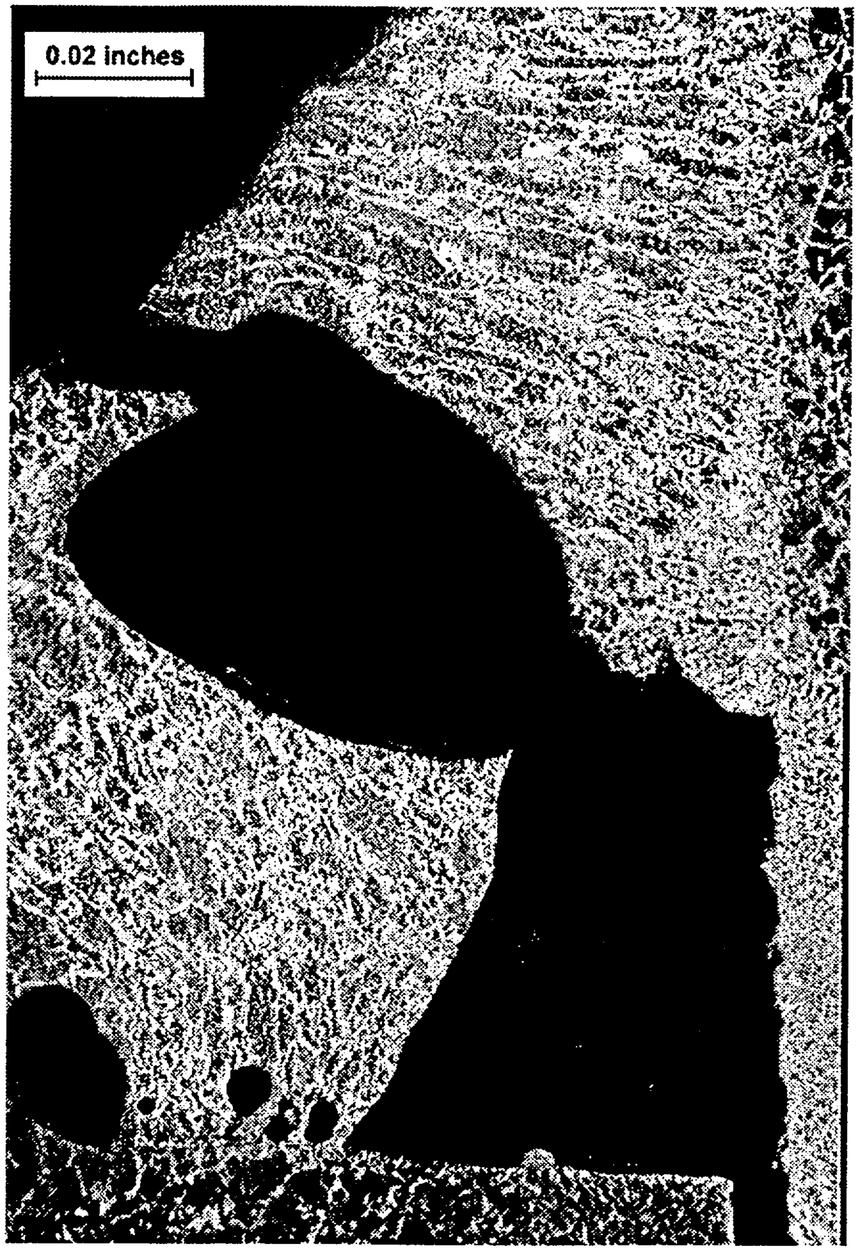

Figure 7. Photomicrograph showing higher magnification view of leak path region. Excessive porosity and lack of penetration at root are evident. Final ductile fracture of outer ligament likely occurred after its thickness was reduced by minor internal and/or external corrosion.