RAS M-329

Subject: OE18478 - Update to OE 17412 Pipe Damage Found to Cause High Condenser Air In-leakage

Abstract: This is an update to OE17412 Clinton Power Station (CPS) submitted in November 2003. CPS took a down power to 49% reactor power on October 31, 2003 to perform field investigations to locate the source of high main condenser air in-leakage. CPS discovered that the continuous vent lines for both #2 feedwater heaters were leaking. During C1R09, CPS removed the leaking piping and installed CrMo

material replacement piping. CPS evaluated the damaged piping and determined that the cause of the through-wall holes was impingement.

Reason for Message: Communicate final evaluation results for the cause of a large condenser air in-leakage.

Event Date:.....10-31-03
Unit Name:.....Clinton
NSSS/A-E:.....General Electric / Sargent & Lundy
Turbine Manufacturer:...General Electric

Maintenance Rule Applicability: No

Description: The Drains and Vents (DV) system consists of piping that serves as the drainage path for excess heating steam (extraction steam (ES)) and water from the shell side of the FW heaters to either drain tanks or the condenser. Those portions of DV lines that connect to the condenser operate at a vacuum near the condenser. If a DV line experiences a through wall hole near the condenser, air in-leakage to the condenser will occur.

1DV07AA and AB are continuous flow DV lines that connect to the condenser. These lines connect the 2A and 2B FW heaters to the condenser. The piping geometry consists of a straight run of pipe connecting to a 45-degree elbow, then a short run (6-12 inches) of straight pipe connected to a second 45-degree elbow. Finally, a straight run of pipe (1-2 feet) connects the second 45-degree elbow to the condenser nozzle. Each of the welds had a backing ring attached.

Both of these lines had holes located on the extrados of the second 45-degree elbow. These holes allowed air in-leakage to the condenser.

Causes: The degradation mechanism that caused these holes is steam jet impingement. Impingement is a localized mechanical degradation mechanism and is similar to sandblasting the surface. The small water droplets in the steam/moisture mixture impact the surface removing very small amounts of material. Over time, the result is a hole through the component wall.

The impingement occurred because of the piping geometry; i.e. the back-to-back 45-degree elbows, and their close proximity to the condenser. The inclusion of the backing rings during construction magnified the impingement.

There is also some evidence of flow-accelerated corrosion (FAC), however FAC did not cause the holes. FAC is a chemical degradation

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DS-03

U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of Entergy Nuclear Vermont Yankee LLC

Docket No. 50-271 Official Exhibit No. E4-19-VY

OFFERED by: (Applicant/Licensee) Intervenor _____

NRC Staff Other _____

IDENTIFIED on 7/23/08 Witness/Panel NEC 4

Action Taken: (ADMITTED) REJECTED WITHDRAWN

Reporter/Clerk MAC

mechanism. Under the right conditions, i.e. temperature, pH, flow velocity, oxygen content, and moisture content for two-phase flow, the protective corrosion layer on the interior surface dissolves and washes away. The material then reforms the passive corrosion layer, causing wall thinning. This process continually repeats itself until there is significant wall loss. FAC covers larger sections of a component than impingement.

Corrective Actions: Action 1, identify the component scope for impingement inspection program. The systems of concern are DV, TD, ES, and HD. Closure of this assignment includes documentation of the results and providing the results to the FAC Program owner.

Action 2, develop and implement inspection program using scope from Action 1.

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