ENERGY NORTHWEST

P.O. Box 968 ■ Richland, Washington 99352-0968

October 4, 2002
GO2-02-159

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397**
REPORT OF PIPE WALL THINNING EXAMINATION RESULTS

References: (1) NRC Generic Letter 90-05 "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping"

(2) American Society of Mechanical Engineers (ASME) Code Case N-480

Dear Sir or Madam:

Pursuant to paragraph IWB-3134 of Section XI of the ASME code, Energy Northwest hereby submits an evaluation of an Ultrasonic Testing (UT) examination of localized wall thinning in ASME Code Class III Service Water (SW) piping. The evaluation applies the ASME Code Case N-480 approach for evaluating wall thinning as referenced in Enclosure 1 Section C.3.b of NRC Generic Letter 90-05. The evaluation concludes that the measured pipe wall thickness is greater than the allowable local wall thickness as determined by ASME Code Case N-480 rules. Because the flaw in the piping satisfies the acceptance criteria of the evaluation approach endorsed by Generic Letter 90-05, immediate repair of the Code Class III piping is not required.

The thinned wall areas were discovered in the piping downstream of the SW loop A discharge to ultimate heat sink valve SW-V-12A. The UT thickness measurements were performed on SW loop A at this location following discovery of a through-wall leak at a similar location on SW loop B piping that required replacement. Based on a projected thinning rate, the SW loop A thinned location will be inspected at a three-month interval until it is replaced during the

A047

next refueling outage in May 2003. Based on examinations of the replaced SW loop B piping, the cause of the flaw has been attributed to cavitation. This conclusion is supported by the observed condition of the pipe surface, which was clean and free of corrosion deposits with random pitting displaying clean metal. The wall thinning flaw, characterized by UT in the SW A loop, displayed morphology similar to the wall thinning found in loop B. Other similarities between loop A and loop B are flaw location, valve operation, and piping geometry. The evaluation in Enclosure 1 shows that the predicted wall thickness at the time the pipe will be replaced is greater than the thickness allowed by the code case.

Should you have any questions or desire additional information regarding this matter, please call Ms. CL Perino at (509) 377-2075.

Respectfully,

D.K. Atkinson

DK Atkinson
Vice President, Technical Services
Mail Drop PE08

Enclosure:

1. Evaluation of localized wall thinning in Service Water loop A piping

cc: EW Merschoff – NRC RIV
BJ Benney – NRC NRR
NRC Senior Resident Inspector/988C
TC Poindexter – Winston & Strawn
DL Williams – BPA/1399
JO Luce – EFSEC

Evaluation of Service Water (SW) loop A flaw examination results

This evaluation applies the American Society of Mechanical Engineers (ASME) Code Case N-480 approach for evaluating wall thinning as referenced in Enclosure 1 section C.3.b of NRC Generic Letter (GL) 90-05. The following sections of Code Case N-480 are applicable to this evaluation:

- Section 3400 Acceptance Standards
- Section 3410 Evaluation for Repair or Replacement
- Section 3420 Evaluation for Continued Service
- Section 3600 Analytical Evaluation

Based on Ultrasonic Testing (UT) results, the piping downstream of SW loop A discharge to ultimate heat sink valve SW-V-12A has the following measured thicknesses (t_{meas}):

1. A spot indication 0.25 in. from the weld toe where t_{meas} = 0.210 in.

2. A localized area 1.5 in. by 0.75 in. where t_{meas} = 0.180 in.

Application of ASME Code Case N-480 is acceptable in accordance with GL 90-05 because the predicted wall thickness (t_p = 0.172 in.) at the time of scheduled replacement is greater than the allowable thickness (t_{aloc} = 0.076 in.) as determined by the code case methodology. In accordance with the criteria of GL 90-05 these localized thinning areas can be treated as independent single flaws. This evaluation addresses the largest and deepest flaw where t_{meas} = 0.180 in.

The nominal thickness (t_{nom}) for the 18 in. diameter SW piping at the evaluated flaw location is 0.375 in. The minimum thickness (t_{min}) for the piping based on the design pressure of 309 psi and in consideration of the Construction Code is 0.184 in., thus:

t_{nom} = 0.375 in.

t_{min} = 0.184 in.

Evaluation of piping flaw per Code Case N-480 Section as endorsed in GL 90-05 section C.3.b

Section 3400 Acceptance Standards

To accept this flaw for continued service without further evaluation, the minimum predicted wall thickness (t_p) cannot be less than $0.875t_{nom}$. For the evaluated SW piping, $0.875t_{nom}$ = 0.328 in. Because t_p < 0.328 in., further evaluation is required.

Section 3410 Evaluation for Replacement or Repair

When t_p is not greater than $0.3t_{nom}$, further evaluation is not permitted, and the piping must be repaired or replaced. For the evaluated piping, $0.3t_{nom} = 0.113$ in. Since $t_p >$ 0.113 in., further evaluation for continued service is acceptable.

Section 3420 Evaluation for Continued Service

When t_p is less than $0.875t_{nom}$ but greater than $0.3t_{nom}$, the piping may be evaluated for acceptability for continued service. An acceptable evaluation method and criteria are given in Section 3600.

Section 3600 Analytical Evaluation

Piping with wall thinning exceeding the standards of Section 3600 may be evaluated to determine acceptability for continued service in accordance with the evaluation procedures and acceptance criteria of Sections 3610 and 3620. The evaluation is a two-part procedure. Compliance with the criteria of the first part demonstrates adequacy for continued service without further evaluation. The second part evaluates piping with deeper wall degradation.

Section 3610 Evaluation Procedure and Acceptance Criteria – Step 1

For acceptance of affected piping for continued service without further evaluation, t_p must not be less than t_{min}. For the evaluated piping, $t_{min} = 0.184$ in. and $t_p = 0.172$ in. Since $t_p < t_{min}$, evaluation for continued service must be performed in accordance with Step 2 below.

Section 3620 Evaluation Procedure and Acceptance Criteria – Step 2

Section 3621 Acceptance Criteria

For acceptance of the affected piping with degradation deeper than that permitted by Section 3610 for continued service, t_p, predicted to the end of the evaluation period must not be less than the allowable local wall thickness (t_{aloc}). The extent of degradation as measured by L_m, $L_{m(t)}$, and $L_{m(a)}$, as defined in Figure –3621-1 of the referenced Code Case N-480, must not exceed the requirements of Section 3622. It should be noted that for the evaluated piping, t_p is predicted to the time of piping replacement.

Section 3622 Evaluation Procedure

The evaluation procedure is a function of the depth and extent of the affected area. An erosion-corrosion area and the parameters that define the depth and extent of thinning are illustrated in Figure -3621-1 of the referenced Code Case N-480. The allowable local wall thickness (t_{aloc}), is determined from Sections 3622.1, 3622.2, and 3622.3 based on the extent and shape of the thinned area.

Section 3622.1 Local Thinning (Case 1)

When the transverse extent of wall thinning that exceeds t_{min}, $L_{m(t)}$, is not greater than $\sqrt{Rt_{min}}$ (where R is the outside radius of the pipe), t_{aloc} is determined from curve 1 of Figure -3622-1 of the referenced Code Case N-480. When this criteria is not met, the criteria of Section 3622.2 must be met.

For the evaluated (18 in. diameter) SW piping:

$\sqrt{Rt_{min}} = 1.286$ in.

and

$L_{m(t)} = 1.5$ in. *

Since, $L_{m(t)} > \sqrt{Rt_{min}}$, t_{aloc} cannot be determined from curve 1 of Figure -3622-1 of the referenced Code Case N-480 and the criteria of 3622.1 is not met.

* (1.5 in. is the maximum length of the flaw in any direction as determined from the UT examination, it is used in this evaluation as a value for L_m, $L_{m(t)}$, and $L_{m(a)}$ to ensure a conservative t_{aloc})

Section 3622.2 Local Thinning (Case 2)

When the maximum extent of wall thinning that exceeds t_{min}, L_m, is not greater than $2.65\sqrt{Rt_{min}}$ and t_{nom} is greater than $1.13t_{min}$, t_{aloc} is determined by satisfying both of the following equations:

$$\frac{t_{aloc}}{t_{min}} \geq \frac{1.5\sqrt{Rt_{min}}}{L}\left[1-\frac{t_{nom}}{t_{min}}\right] + 1.0 \qquad (1)$$

$$\frac{t_{aloc}}{t_{min}} \geq \frac{0.353L_m}{\sqrt{Rt_{min}}} \qquad (2)$$

The evaluated piping meets the conditions for application of this section:

$t_{min} - t_p < 2.65\sqrt{Rt_{min}}$ and $t_{nom} > 1.13t_{min}$

Solving for t_{aloc} in Equation (1) above yields:

$t_{aloc} = -0.062$ in.

t_{aloc} is a negative number due to the ~ 2:1 ratio of t_{nom}/ t_{min}

Solving for t_{aloc} in Equation (2) above yields:

$t_{aloc} = 0.076$ in.

Conclusion

Because the two equations in Section 3622.2 are satisfied, t_{aloc} must equal or exceed 0.076 in. Comparing this value to the Section 3410 value for $0.3t_{nom}$, shows that t_{aloc} is less than the $0.3t_{nom}$ value of 0.113 in. As a conservative measure, 0.113 in. will be the acceptance criteria for future examinations until the thinned section of SW loop A piping is replaced.