

VY Piping FAC Inspection Program PP 7028 - 2004 Refueling Outage

Inspection Location Worksheets / Methods and Reasons for Component Selection

By: JCA 3/17/03 Reviewed: TJC 3/21/03

Piping components are selected for inspection during the 2004 refueling outage based on the following groupings and/or criteria.

Large Bore Piping

- LA: Components selected from measured or apparent wear found in previous inspection results.
- LB: Components ranked high for susceptibility from current CHECWORKS evaluation.
- LC: Components identified by industry events/experience via the Nuclear Network or through the EPRI CHUG.
- LD: Components selected to calibrate the CHECWORKS models.
- LE: Components subjected to off normal flow conditions. Primarily isolated lines to the condenser in which leakage is indicated from the turbine performance monitoring system. (through the Systems Engineering Group).
- LF: Engineering judgment / Other
- LG: Piping identified from EMPAC Work Orders (malfunctioning equip., leaking valves, etc.)

Small Bore Piping

- SA: Susceptible piping locations (groups of components) contained in the Small Bore Piping data base which have not received an initial inspection.
- SB: Components selected from measured or apparent wear found in previous inspection results.
- SC: Components identified by industry events/experience via the Nuclear Network or through the EPRI CHUG.
- SD: Components subjected to off normal flow conditions. Primarily isolated lines to the condenser in which leakage is indicated from the turbine performance monitoring system. (through the Systems Engineering Group).
- SE: Engineering Judgment / Other.
- SG: Piping identified from EMPAC Work Orders (malfunctioning equip., leaking valves, etc.)

Feedwater Heater Shells

No feedwater heater shell inspections will be performed during the 2004 RFO. Previous plans were to complete the UT grids on the No.1 & 2 heaters have been made moot by the decision to replace all 4 HP feedwater heaters for EPU. The shells on all four new heaters will be a chrome-moly material (P-11). Informational visual inspections of the open ends of Feedwater, Extraction Steam, Heater Drain, Vents and Moisture Separator piping will be performed as access is available.

DOCKETED
USNRC

August 12, 2008 (11:00am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of Energy Nuclear Vermont Yankee LLC

Docket No. 05-271 Official Exhibit No. E4-40-14

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

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LA: Large Bore Components selected(identified) from previous Inspection Results

From the 1995/1996/1998/1999/2001/2002 Refueling Outage Inspections (Large Bore Piping) these components were identified as requiring future monitoring. The following components have either yet to be inspected as recommended, or the recommended inspection is in a future outage

Inspect. No.	Loc. SK.	Component ID	Notes /Comments / Conclusions
96-13 96-14	001	FD01EL04 FD01SP04	1996 report recommended inclusion of FD01SP04 into 2001 RFO Scope (lower readings at U.S. counterbore). UT inspect elbow and downstream pipe in 2004
99-03 99-04	002	FD02EL01 FD02TE01	1999 Recommendation to inspect tee in 2002. Component is downstream of pump 1B. "B" Pump is used a standby pump, based on usage, inspection was deferred until 2004. UT inspect elbow and downstream tee in 2004
99-25 99-26	008	FD14EL03 FD14SP03	1999 recommendation to inspect pipe at upstream counterbore in 2004. Given that the only low readings were at the pipe counterbore and that 2004 RFO work includes replacement of both No.1 feedwater heaters located under the elbow. Defer re-inspection of the elbow FD14EL03 & pipe FD14SP03 until the 2005 RFO.
01-03 01-04	001	FD01EL01 FD01TE05	2001 recommendation to inspect the tee in 2004. UT inspect elbow and downstream tee in 2004 (1998 RFO results recommended inspection in 2001) Also add inspection of the reducer upstream of the elbow.
02-08 02-09	016	FD18EL01 FD18SP02US	2002 recommendation to inspect the elbow in 2007 based on a single measurement. Re-inspect elbow and downstream pipe in 2007 (3 cycles from 2002).

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LA: Large Bore Components selected (Identified) from previous inspection Results - continued

Turbine Cross-around Piping:

Previous Internal Visual UT & Repair History:

Line	Mat.	Year Replaced	Internal Visual =V, Internal Thickness =UT, Repairs Performed =R							
			RFO16 S1992	RFO17 F1993	RFO18 S1995	RFO19 F1996	RFO20 S1998	RFO21 F1999	RFO22 S2001	RFO23 F2002
36"-A	GE**	1983		V	V	V	V			
36"-B	GE**	1981	V	V	V	V	V	V		
36"-C	GE**	1981	V	V	V		V			
36"-D	GE**	1983		V	V		V			
30"-A	P-22*	1985	V		V		V			
30"-B	C.S.	Original	V/UT/R	V/UT/R	V/UT/R	V/UT	V	V		V
30"-C	P-22*	1993	V/UT/R							
30"-D	P-22*	1985			V					

** 36" straight pipe sections replaced with GE B50A242E, elbows on the B & C lines are original GE specification D50A67D, elbows on A & D lines are D50A67E (Tnom = 0.625 inch).

* 30" A,B,C replaced with A691 CL22 (2-1/4Cr), Fittings A234 WP22. (Tnom. = 0.625 inch)
30" B remains GE B50A242D, fittings and GE D50A67D carbon steel (Tnom = 0.50 inch).

NOTE: Reference Dwg. No. 5920-6841 Sh. 1 of 2 needs to be updated with correct information. This will be performed during the EPU design change effort.

2004 RFO HP turbine work and MS Internals/drain line work will have all (4) 36 inch line manways open for access to perform internal visual inspections.

Perform internal visual inspection of all four lines. Priority is A 36" line for access to internals of the 12 inch diameter CS stub piece in extraction steam line. Also if manways and CIV SRVs are removed, perform visual inspection of the 30" C & D lines to confirm condition of P22 replacement materials.

2005 RFO based on increased flows and the possibility of different flow regimes in both the 36 & 30 inch piping, perform a visual inspection. LP turbine work in 2005 RFO may provide opportunity for access to the 30" lines. As a minimum inspect (2) 36 inch lines and the 30" B line.

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LB: Large Bore Components Ranked High for Susceptibility from CHECWORKS Evaluation

The current CHECWORKS wear rate calculations contain inspection data up to the 1999 RFO and wear rate predictions are current to the 2001 RFO. The 2001 and 2002 RFO inspection data has been entered into the CHECWORKS database. However, updated wear rate calculations are not complete, and won't be in time to support the schedule date for issuing the inspection scope for the Spring 2004 outage. Based on a review of the 2001 and 2002 RFO inspection data for components on the Feedwater, Condensate, and Heater Drain Systems, the CHECWORKS models still appear to over-predict actual wear. Nothing new or unanticipated was observed in 2002.

Feedwater System

Listed below are components which meet the following criteria:

- a) negative time to T_{min} from the predictive CHECWORKS runs which include inspection data up to the 1999 RFO,
- b) no inspections have been performed on these components or the corresponding components in a parallel train since the 1999 RFO.

Component ID	Location Sketch	Location	Notes
FD07EL03	005	T.B Feed Pump Room	No inspection data for corresponding component FD08EL02 in other train. Inspect this or the other train component in 2004. This component will be inspected in 2004.
FD07TE01 FD07EL11	006	T.B Heater Bay Elevs 228 & 248	Components on other train were inspected in 1998. Results indicate minimal wear. After updating the CHECWORKS model with newer data, assess need for additional inspections in 2005 RFO.
FD07EL12	006	T.B Heater Bay Elev. 248	Feedwater heater replacement to occur in 2004 RFO. Perform internal visual inspection at open end on this component.
FD14EL07	009	RX Steam Tunnel El. 266	Internal visual of elbow performed in 1996 during check valve replacement. no indication of wall loss at that time. Inspect this or the other train component in 2004. (Inspect this component in 2004).
FD08EL02	011	T.B Feed Pump Room	No inspection data for corresponding component FD07EL03 in other train. Inspect this or the other train component in 2004. FD07EL03 will be inspected in 2004.
FD08TE01 FD08EL07	012	T.B Heater Bay Elevs 228 & 248	Intermediate components FD08EL06 & FD08SP06 were inspected in 1998. Results indicate minimal wear. After updating CHECWORKS model with newer data, assess need for inspecting components on the train vs. these.
FD08EL08	012	T.B Heater Bay Elev. 248	Feedwater heater replacement to occur in 2004 RFO. Perform internal visual inspection at open end on this component.
FD15EL08	013	RX Steam Tunnel El. 266	Internal visual of elbow performed in 1996 during check valve replacement. no indication of wall loss at that time. After updating CHECWORKS model with newer data, assess need for inspecting this component in 2005 RFO.

**VY Piping FAC Inspection Program PP 7028 - 2004 Refueling Outage
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LB: Large Bore Components Ranked High for Susceptibility from CHECWORKS Evaluation - continued

Condensate System

Only one component was identified as having a negative time to Tmin. This was CD30TE02DS, the downstream side of a 24x24x20 tee on the condensate header in the feed pump room. The CHECWORKS prediction for the downstream side of the tee has a small negative hrs relative to the remainder of the components in the system and relative to the upstream side of the same tee. Other tees on the same header have been previously inspected and show no significant wear. The CHECWORKS model includes UT data up to the 1999 RFO. The inspections on this system performed in 2001 indicate minimal wear. The 2001 inspection data will be input to CHECWORKS to better calibrate the model.

To inspect the components with the highest susceptibility as ranked by CHECWORKS and to obtain a more complete set of inspection data for the Condensate System inspect additional components between the No.3 feedwater heaters and the feedwater pumps. **Inspect CD30TE02 and CD30SP04 in 2004.**

Moisture Separator Drains & Heater Drain System.

No components identified as having negative times to Tmin. No components were selected for inspection in 2001 or 2002 based on high susceptibility. However future operation under HWC will change dissolved oxygen in system. A separate evaluation has been performed and components were selected for inspection in 2002. See Section LD below.

Extraction Steam System

Three components on this system with negative time to code min. wall. The piping is Chrome-Moly. ES4ATE01 & ES4ATE02, 30inch diameter tees inside the condenser have negative prediction (-3426Hrs.) for time to min wall. The negative times to tmin may be conservative based on the modeling techniques used. Refinement of the model of this system is in progress. The negative time to tmin is most likely a function of lack of inspection data vs. actual wear. Due to external lagging on this piping and the location inside the condenser, no components are selected for external UT inspection in 2004 based on high susceptibility. However, an opportunity to perform an internal visual inspection of all the Extraction Steam lines inside the condenser during planned LP turbine work in the 2005 RFO may present itself. See Section LF below.

Note the short section of A106 Gr. B straight pipe on line 12^o-ES-1A at the connection to the 36 inch A cross around line is not modeled in CHECWORKS. The component material should be included in the next model update.

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LC: Large Bore Components Identified by Industry Events/Experience.

Review of FAC related Large Bore Operating Experience (OE) and/or piping failures reported since January 2001

Date	Plant - Type	Description & Recommended Actions at VY
4/7/01	Callaway - PWR	Unexpected extent of thinning in feedwater piping (NRC IN 2001-009 & INPO OE12342) Additional components were inspected in the feedwater system in the Drywell during the 2002 RFO in response to this event.
5/9/01	Grand Gulf - BWR	Pin Hole Leak in 4 inch carbon steel elbow in RHR min flow line. System has low use at VY (<2% of time). A review of VY drawings VYI-RHR-Part 14 Sht.1/1 and VYI-RHR Part 15 Sht.1/1 show elbows downstream of restriction orifices. Additional research into this event is warranted. Inspections can be performed with the plant operating. Don't include in the scope of 2004 RFO.
11/20/01	Hamoka 1 - BWR	Rupture of HPCI/RCI 6 inch steam supply line at a section of pipe to RHR Hx sprays. VY is an older design which does not have this configuration.
9/24/02	IP2 - PWR	Pin hole leak on 26 1/2" cross-under piping (HP to MSR) in vicinity of dog bones at expansion joint under location of weld overlay localized wear under/around a previous weld overlay repair. VY has solid piping (no expansion joints. Visual Inspections of CAR piping will be performed in 2004.
1/2/02	Point Lepreau-PHWR	Failure of Extraction Steam Bellows from LP turbine. VY bellows are made from stainless steel. Primary causes of past failures have been cracking of convolutions and vibration failures of tie rods. The bellows were replaced in 1995 and should not be susceptible to FAC damage.
1/15/02 CHUG Meeting	Surry 1-PWR	Leak in 8 inch Condenser drain header for 3 rd /4 th pt. FDW Heater vents. Also thinning in Gland Steam Piping inside the condenser and the 12" Condenser Drain header from MS Drain trap lines. The only large bore drain collector at VY is the 8 inch diameter low point drain header. Inspect sections of this line during the 2004 RFO.
1/15/02 CHUG Meeting	Cooper - BWR	Thinning found in two 20 inch diameter exit nozzles off LP turbine for extraction steam piping. (VY has replaced all LP turbine stub pieces upstream of the expansion bellows with P-11 material. No actions are required at this time.
6/02 CHUG Meeting.	Oconee 1	Wear found in Heater Drain piping downstream of block valve. Ops was using the gate valve to control flow. All valves on VY HD system are control valves. Normal flow downstream of valves is directly into the feedwater heaters. Bypass valve discharge directly into condenser. TPM monitors possible leakage past the Bypass valves.
6/24/02	Prairie Island 1 - PWR	Preliminary notice of possible extraction steam line piping/bellows failure inside condenser. (See 1/2/02 Point Lepreau notice above).
8/29/02	Turkey Point 3 - PWR	Failure of a 6x10 Schedule 40 carbon steel expander in Heater Drain System downstream of a level control valve. Same valve on other train was replaced. However, no inspections were performed on this valve (from INPO Event 250-020829-1, OE 14865, & Info at 1/03 CHUG Meeting). Location is similar to millstone 2 & 3 events in 1991/92. Piping on HD system at VY DS of normal level control valves is constructed from FAC resistant materials or planned for replacement with new Feedwater Heaters. No actions are required for this OE.
10/9/02	Clinton -BWR	Interconnecting piping (4 and 6 inch diameter) between RWCU Heat Exchanger not included in FAC program. Plant assumed they were equipment when in fact they are piping. VY has replaced the original 3 Perflex Hx design with a U-tube Hx. RWCU piping in this area is stainless steel. Therefore not an immediate concern.

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LD: Large Bore Components Selected to Calibrate CHECWORKS

The CHECWORKS models have been upgraded to include the 96, 98, & 99 RFO inspection data. The 2001 and 2002 inspection data has been loaded however wear rate analyses are not complete at this time. In 2001 components on the higher temperature end of the Condensate System were inspected to calibrate the CHECWORKS models. The inspection data indicate minimal wear and should reinforce the assessment of low wear in the Condensate System. Additional components selected for inspection in 2004 in Section LB above will be used to calibrate the CHECWORKS model.

Prior to the 2002 there was limited inspection data for the Heater Drain system. The current CHECWORKS models (Pass 1 and some Pass 2) indicate low wear rates. During 2002 a number of new inspections were performed to obtain base line data prior to operation under GE Noble Metals HWC. No additional components on the Heater Drain system will be inspected in 2004.

LE: Large Bore Components subjected to off normal flow conditions identified by turbine performance monitoring system (Systems Engineering Group).

The Systems Engineering Production Variance Reports for 2002 & since startup from 2002 (RFO23) do not identify any leaking valves. No other leaking valves or steam traps have been identified (to date) using the Turbine Performance Monitoring (TPM) system. No components will be scheduled for the 2004 RFO based on the TPM reports to date. However, if new data indicates leaking valves then, additions to the outage scope may be required.

LF: Engineering Judgment / Other

Nine ASME Section XI Class 1 Category B-J welds are to be inspected by the FAC program per Code Case N-560 in lieu of a Section XI volumetric weld inspection. The VY ISI Program Interval 4 schedule for inspection of these welds is as follows:

Refueling Outage	Section XI ISI Program Weld ID	Description	FAC Program Components
Spring 2004 (RFO24) Interval 4 Period 1, Outage 1.	FW19-F3B FW19-F3C FW19-F4 FW21-F1	upstream pipe to tee tee to reducer reducer to pipe tee to pipe	"A" Feedwater on Sketch 010 FD19TE01 FD19RD01 FD19SP04 FD21SP01
Fall 2011 (RFO29) Interval 4 Period 3, Outage 6.	FW18-3A FW20-3A FW20-F1 FW20-F1B FW18-F4	upstream pipe to tee tee to reducer reducer to pipe horizontal pipe to pipe tee to pipe	"B" Feedwater on Sketch 016 FD18TE01 FD20RD01 FD20SP01 FD18SP04

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LF: Engineering Judgment / Other – continued

All Extraction Steam piping is A335-P11, a 1-1/4 chrome material, except for a short carbon steel stub piece in line 12"-ES-1A at the connection to the 36" A cross around line. Internal visual inspection of this stub piece will be performed along with the 36" A cross around line. This extraction steam line (6th point extraction) has the highest quality steam of all extraction lines which indicates a relatively lower wear rate. Based on the 1996 inspection data for the carbon steel section, ES1ASP01 (Inspection 96-07A) showing a small area of wall thickness less than 0.875 x nominal thickness, the expected changes in flow regime due to power uprate, and that this is the only carbon steel section in the ES system, a repeat inspection to confirm actual wall thickness and also to obtain a baseline thickness prior to power uprate should be performed. **Perform external UT inspection of ES1ASP01 in RFO24.**

Extraction Steam piping in the condenser has external lagging which requires significant effort for removal when performing external UT inspections (plus there are significant staging costs). The piping is A335-P11. However an opportunity to perform an internal visual inspection of all the Extraction Steam lines inside the condenser during planned LP turbine work in the 2005 RFO may present itself.

LG: Piping identified from EMPAC Work Orders (malfunctioning equip., leaking valves, etc.)

Word searches of open work orders on EMPAC were performed for the following keywords: trap, leak, valve, replace, repair, erosion, corrosion, steam, FAC, wear, hole, drain, and inspect. No previously unidentified components or piping were identified as requiring monitoring during the Spring 2004 RFO.

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Small Bore Piping

SA: Susceptible piping locations (groups of components) contained in the Small Bore Piping data base which have not received an initial inspection.

Locations on the continuous FDW heater vents to the condenser on the No. 3 heaters were inspected in 2002. The continuous vents on the No. 4 heater were installed new in 1995. The start up vents operate less than 2% of operating time. No wear was found in previous inspections on Heater Vent piping from the No.1 & 2 heaters. Given that and the lower pressure in the No. 4, shells a complete inspection of the remainder of the No. 4 heater vent piping can be deferred. The existing small bore data base and the piping susceptibility analysis is under revision. No additional components from Revision 1 of the data base will be inspected.

SB: Components selected from measured or apparent wear found in previous inspection results.

Small Bore Point No. 20. 2-1/2" MSD-6 @ connection to condenser A at Nozzle 33 (Inspection No. 96-SB01 identified a low reading at weld on stub to condenser). Upstream valves are normally closed. TPM system does not indicate any abnormal flow. No inspections will be performed on this line in 2004.

A through wall leak in the turbine bypass valve chest 1st seal leak-off line from the No. 1 bypass valves occurred in 2003. (ER 2003-044) A temporary leak enclosure has been installed (T.M.2003-002 to contain the leak). W.O. 03-0364 was written to inspect/repair/replace/line. The line should be completely replaced with chrome-moly piping. (Dresden has already done this) Given the amount of work already scheduled for the heater bay during the 2004 RFO a complete replacement will be deferred. A local code repair of the piping will be performed to remove the temp Mod during the 2004 RFO. Additional inspections should be performed to insure the integrity of the line. The long term solution (if license renewal is pursued) should include replacement the entire line with chrome-moly material.

System	Description	Inspection No.
2"-1SLBPV	2 inch header off the turbine bypass valve chest first seal leak-off connections. Inspect five locations on this line. Include the 1/2 line at the No. 2 valve. It has the next highest usage from the no.1 valve.	2004 SB01 to SB05
2-1/2" 1SPL2	HP Turbine pocket drains, inspect first two elbows and connecting piping under turbine based on reading from 1993 (inspections 93-SB49 to 93-SB52)	2004 SB06 & SB07

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Small Bore Piping

SC: Components identified by Industry events/experience via the Nuclear Network or through the EPRI CHUG.

Date	Plant - Type	Description & Recommended Actions at VY
7/23/98	Calvert Cliffs 2 -PWR	Rupture of a moisture separator re-heater (MSR) 2 inch vent line (INPO Event 318-980723-1) No MSRs at VY, therefore no equivalent line at VY.
11/03/98	Hamoka 2 - BWR	Leak due to FAC in turbine driven feed pump casing drain line No turbine driven feed pump at VY, therefore no equivalent line at VY.
4/29/99	Darlington 1 - PHWR	Severed line at steam trap discharge pipe at threaded connection. Equivalent to HHS system at VY. (INPO Event 931-990429-1) Threaded connections typically on condensate side of HHS piping. Lower energy/consequence of leak. Consider during next update of the Small bore data base.
5/07/99	Darlington 4 - PHWR	Leak on HP Feedwater Heater Vent Line downstream of orifice (INPO Event 934-990507-1). At VY inspections have performed DS of orifices on HV lines.
6/14/99	Darlington 2 - PHWR	Leak on steam trap discharge pipe at threaded connection. Equivalent to HHS system at VY. (INPO Event 932-990614-1) Same as above.
10/07/99	Darlington 2 - PHWR	Leak on Feedwater Heater Vent Line downstream of orifice (INPO Event 932-991007-1). At VY inspections have performed DS of orifices on HV lines.
10/1/00	Ocone3 -PWR	From 1/2001 CHUG Meeting. MSR Scavenging steam line Pinhole leak in 1" pipe downstream of flow control valve. No equivalent system at VY.
1/8/01	Oyster Creek - BWR	Rupture of 2 inch line connecting controller/transmitter level column to re-heater drain tank. No MSRs at VY, therefore no equivalent line at VY.
9/1/01	Peach Bottom 3 -BWR	(From 1/14/02 CHUG Meeting), leak on 1 Inch Sch. 80 line from In Off Gas Re-combiner pre-heater drain line to condenser. Additional review of AOG steam supply system is required. Consider during next update of the Small bore data base.
6/22/01	Pilgrim - BWR	Leak on 2 inch feedwater heater vent line (OE discussed at 1/02 CHUG Meeting), Equivalent lines at VY have been inspected.
10/22/01	St. Lucie 1 - PWR	(From 1/14/02 CHUG Meeting), Leak on 1 inch Sch. 80 normally isolated drain line remote from process system. TPM used to determine leaks from N.C. valves.
11/28/01	Browns Ferry 3 - BWR	Through - wall leaks in drain lines from extraction stream non-return check valves back to condenser. (Similar lines at VY are chrome-moly and there have been previous inspections performed on these lines. No additional inspections are required.
1/15/02 CHUG Mtg.	Hatch1/2 -BWR	Condenser in leakage due to through wall erosion (external ?) of 1-1/2 inch "slop" drains lines inside the condenser. Lines in each unit were cut and capped similar events at Byron Unit 1 (OE 12609) and Columbia (OE12145). Limerick & Dresden. VY slop drain lines do not show up on VY P&IDs.
1/15/02 CHUG Mtg.	Catawba 2 - PWR	Leak in HP turbine pocket shell drain 1 inch dia. OEM showed pipe as P-11. However, A-106 Gr. B was installed. Inspections will be performed on this line in 2004 to base line condition prior to HP turbine rotor replacement.
1/15/02 CHUG Mtg.	Columbia - BWR	Leak in 2 inch drain line from bleed steam trap to condenser. At VY SB piping DS of steam traps is included in the small bore data base.
1/15/02 CHUG Mtg.	Peach Bottom2 - BWR	Pin Hole leaks in 1" schedule 160 HPCI Steam Supply drains (Plant thought piping was replaced with P-11, However field conditions showed that it was not. Piping at VY inspected in 1999 (99-SB01 to 99-SB03)

continued

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Small Bore Piping

SC: Components identified by Industry events/experience via the Nuclear Network or through the EPRI CHUG – continued.

Date	Plant – Type	Description & Recommended Actions at VY
1/15/02 CHUG Mtg.	Dresden 2 BWR	Thinning found in Bypass valve leak-off line to the 7 th stage extraction steam line. Line is 2" Sch. 80, GE B4A39B. Lowest reading was 0.070" found using Phosphor Plate radiography. Line was replaced with A335 P-11. Same line as recent VY through wall leak, RFO 2004 inspect locally, then long term replacement with A335-P11.
6/02 CHUG Mtg.	ANO1 & ANO 2 PWR	Leaks in Gland seal steam to No.3 bearing 1-1/4 vendor supplied line. Leak in 1" Sch.80 drain from Reheat 2 nd stage drain tank to condenser. Additional review of GE supplied steam seal & drains is required. Consider during next update of the Small bore data base.
6/02 CHUG Mtg.	Brunswick 1 - BWR	Replaced continuous vent lines on #4 feedwater heaters with chrome-moly pipe. (Smart move for long term.) New vent lines on No.1 & 2 FDW heaters at VY will be chrome-moly.
6/02 CHUG Mtg.	Calvert Cliffs 1 PWR	Pin hole leak in 3/4 inch Sch. 80 drain line off MS supply to steam generator feed pump just downstream of orifice. No steam driven feed pumps at VY.
6/02 CHUG Mtg.	Fermi 2 - BWR	Leak in first elbow downstream of AOV in 1/1/2" continuous vent from Turbine Bypass Valve seat drain to condenser. Valve has travel stop which prevents complete closure. Fermi has no steam traps, AOVs are used instead. Piping DS of steam traps on MSD lines are included in the SB program. The only continuous opening to the condenser at VY is the steam leads drains through RO 60-1. This piping has been replaced with chrome-moly piping.
1/03 CHUG Meeting.	JAF -BWR	Through wall leaks in 2" Sch. 80 C.S. lines from 5 th /6 th extraction drain lines immediately downstream of restricting orifices. At VY the only drain lines on the extraction steam piping are upstream of the reverse current valves. There are no restriction orifices at VY. The piping is chrome-moly.
1/03 CHUG Meeting.	Turkey Pt.4 -- PWR	Leak in HP turbine bowl drain. 1" sch 80 C.S. pipe. OEM recommended replacement with SS pipe in 1982, did not occur. Equivalent line at VY will be inspected in 2004 to baseline thickness prior to HP turbine rotor replacement.

SD: Components subjected to off normal flow conditions, as indicated from the turbine performance monitoring system (Systems Engineering Group).

No small bore lines have been identified by Systems Engineering on or before 2/27/2003

SE: Engineering Judgment

(None at this time.)

SG: Piping identified from EMPAC Work Orders (malfunctioning equip., leaking valves, etc.)

See LG above. The EMPAC search performed in LG above is applicable to both Large and Small components.

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- The meeting then split into breakout sessions. Aaron Kelley led a session on BWR issues. The following discussions were noted:

FAC Problem Areas.

- N/A - Hatch has had lots of wear and repairs to their 8th stage extraction (3rd highest), even though the heat balance diagram shows it to be 99% steam. CHROMIUM MOLY @ VJ
- N/A - LaSalle is wondering if there may be problems in their carbon steel turbine nozzles to extraction steam. Riverbend has had to inspect these locations from the turbine side because of the shields. " "
- N/A - Quad Cities has had lots of problems in their expansion bellows.
- - Riverbend replaced the extraction steam check valves using chrome moly. Unfortunately, the internals were carbon steel and they had problems after only two cycles. SOUND PUMILAC
- ? → - LaSalle had a failure caused by droplet impingement in a heater vent line 17' downstream of the valve.
- 400 8" MSD? - LaSalle is experiencing impingement damage in an 8" common drain header to condenser that collects six to eight 2" and smaller diameter lines. Stainless will help, but they still will need to inspect. INSPECT 8" MSD 9 IN 2004
- N/A - Hope Creek has seen a lot of damage in the drain to condenser of the steam to reactor feed pump turbines.

Water Chemistry.

- → - Riverbend experienced significant increases to iron transport after applying hydrogen injection (medium level of injection). GE did a mini-test. * MONITOR FE
- - Nine Mile Point had unexpected failures on the lower end of the heater drains after applying HWC.
- ? - LaSalle measured oxygen on the heater drains, and then used the data to revise the CHECWORKS model. The data caused to LCFs on the MSR drains, 1st stage reheaters, and 2nd stage reheaters to skyrocket.
- ! - Columbia River has tentatively concluded that noble metals does not effect the fuel. It is too soon to see if hydrogen water chemistry affects the FAC rates.

RPV Bottom Head Drain.

- LaSalle has not inspected the first elbow below the vessel because of its inaccessibility and high radiation dose involved. For this reason, they selected the second 90° elbow which is outside the vessel pedestal. Results were provided on FACNet. Additionally, the sump will maintain water level if there is a break at the first elbow.
- It was noted that it may be possible to inspect the nominally inaccessible areas when there is a 10% disassembly to replace some blades.
- LaSalle and Clinton plan to inspect the accessible portions of the line.
- Columbia River has inspected several locations on the line. No wear was found. Three inspections were also performed on the RWCU near the drywell. No damage was found.
- Exelon (Harold Crockett) volunteered to collate and publish a summary of industry inspections on the line.

Inspection Methods.

- LaSalle is performing some pre-outage RTs in selective areas due to final feedwater temperature reduction. This is the second time that some pre-outage work was done in normally high radiation areas. Aaron Kelly can be contacted for more information.
- Riverbend is training their QC inspectors to perform UT.

Power Upgrades.

- Nine Mile Point saw little change to wear rates after a 7% uprate.
- Dresden and Quad Cities did a 15% uprate. Some lines saw increases to wear rates of up to 30%. Temperature changes are believed to be responsible.
- Perry did a pre-power uprate analysis on the effects to FAC. They used the results to justify line replacements as part of the planning process.
- LaSalle found no changes to their susceptible-not-modeled rankings as a result of their uprate.

Life Extension.

- General comment was that the NRC has emphasized compliance with NSAC-202L-R2 and brought up main steam susceptibility as part of their approval process.
- At Nine Mile Point, the NRC brought up service water issues.
- Southern Nuclear is taking credit for other programs in response to the NRC questions on valves.

~~In parallel with the BWR session, Jeff Horowitz led the PWR Breakout Session. The session was broken down into three parts:~~

- ~~- A description of the very high levels of iron transport experienced at San Onofre. This presentation included details of the investigation into the phenomenon, a description of the deposits found, several possible explanations for the deposits, and what the effects of the deposit were on plant performance.~~
- ~~- A status report on the EdF hydrazine testing program. Unfortunately, no progress has been made since the last report in June due to a number of problems. The latest problem, inadequate water quality, has been resolved and testing resumed earlier this month. The testing program is expected to take all year to complete. Details of the test program have been presented at previous CHUG meetings.~~
- ~~- There was also a brief discussion of feedwater oxygen and FAC. Several PWRs are now allowing the entry of small amounts of oxygen into the condensate system in hopes of reducing the iron transport. The potential for change to the PWR Water Chemistry Guidelines in this area was discussed.~~

- Tina Gaudreau discussed several EPRI chemistry projects that have FAC implications. The first was the EdF testing for the effects of hydrazine and oxygen on FAC as summarized by Jeff Horowitz in the PWR breakout session. The second project was the next revision to the PWR Secondary Chemistry Guidelines, that will begin this spring. The third project is an investigation into the influence of dissolved iron, electrochemistry, and chemical parameters on



Vermont Yankee Nuclear Power Station
Design Engineering Department - Mechanical/Structural

To S.D.Goodwin Date March 27,2003

From J.C. Fitzpatrick File # VYM 2003/009

Subject Piping FAC Inspection Scope for the 2004 Refueling Outage

REFERENCES

- (a) PP 7028 Piping Flow Accelerated Corrosion Inspection Program, LPC 1 12/06/01.
- (b) V.Y. Piping F.A.C. Inspection Program - 1996 Refueling Outage Inspection Report, March 23,1999.
- (c) V.Y. Piping F.A.C. Inspection Program - 1998 Refueling Outage Inspection Report, April 2,1999.
- (d) V.Y. Piping F.A.C. Inspection Program - 1999 Refueling Outage Inspection Report, February 11, 2000.
- (e) V.Y. Piping F.A.C. Inspection Program - 2001 Refueling Outage Inspection Report, August 11,2001.
- (f) V.Y. Piping F.A.C. Inspection Program - 2002 Refueling Outage Inspection Report, January 20,2003.

DISCUSSION

Attached please find the Piping FAC Inspection Scope for the 2004 Refueling Outage. The scope includes locations identified using: previous inspection results, the CHECWORKS models, industry and plant operating experience, input from the Turbine Performance Monitoring System, the CHECWORKS study performed to postulate affects of Hydrogen Water Chemistry operation on FAC wear rates in plant piping, postulated power uprate effects, and engineering judgment.

The planned 2004 RFO inspection scope consists of 26 large bore components at 11 locations, internal inspection of 6 of the 8 lines of the turbine cross around piping, and 11 sections of small bore piping. Given that it's a full year from the start of the outage, any industry or plant events that occur in the interim or new information may necessitate an increase in the planned scope.

I am available to support planning and inspections as necessary. If you have any questions or need additional information please contact me.


James C. Fitzpatrick
VY FAC Program Coordinator

ATTACHMENT: 2004 RFO FAC Inspection Scope (4 Pgs.)

- CC D.Girroit (Code Programs Supervisor)
- D.King (ISI Program Engineer)
- T.M.O'Connor (Design Engineering)
- M.LeFrancois (Systems Engineering)

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LARGE BORE PIPING: External UT Inspections

Point No.	Component ID	Location Sketch	Location	Previous Inspections	Reason / Comments / Notes
2004-01	FD01RD01	001	T.B. FPR. Elev. 232.	2001	2001 recommendation for repeat inspection of FD01TE05.
2004-02	FD01EL01	001	" " "	2001	
2004-03	FD01TE05	001	" " "	2001	
2004-04	FD01EL04	001	T.B. FPR Elev. 241.	1996	1996 recommendation for repeat inspection of FD01SP04.
2004-05	FD01SP04	001	" " "	1996	
2004-06	FD02RD01	002	T.B. FPR. Elev. 232.	1999	1999 recommendation for repeat inspection of FD02TE01.
2004-07	FD02EL01	002	" " "	1999	
2004-08	FD02TE01	002	" " "	1999	
2004-09	FD03SP01	003	T.B. FPR. Elev. 232.	NO	Ranked high by CHECWORKS.
2004-10	FD07SP02DS	005	T.B. FPR. Elev. 232.	NO	Ranked high by CHECWORKS include minimum of 36 inch of vertical run upstream of elbow.
2004-11	FD07EL03	005	" " "	NO	
2004-12	FD14SP08DS	009	Strm Tunnel Elev. 266	NO	Ranked high by CHECWORKS include minimum of 32 inch of vertical run upstream of elbow.
2004-13	FD14EL07	009	" " "	NO	
2004-14	FD19TE01	010	Rx Drywell Elev. 270	1999	Required Inspections per ASME Section XI ISI Program FAC inspections per ASME Code Case N-560.
2004-15	FD19RD01	010	" " "	1999	
2004-16	FD19SP04	010	" " "	1999	
2004-17	FD21SP01	010	" " "	1999	

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LARGE BORE PIPING: External UT Inspections - continued.

Point No.	Component ID	Location Sketch	Location	Previous Inspections	Reason / Comments / Notes
2004-18	CD30TE02	036	T.B. FPR Elev. 243.	NO	Ranked high by CHECWORKS include 12 inch long stub between CD32LE01 & CD32EL02.
2004-19	CD30SP04	036	" " "	NO	
2004-20	CD32EL01	039	" " "	NO	
2004-21	CD32EL02	039	" " "	NO	
2004-22	ES1ASP01	063	T.B. HB Elev. 255.	1998	Highly susceptible to FAC damage. This is the only remaining carbon steel section in Extraction Steam system. Baseline data for power uprate.
2004-23	MSD9TE01 thru MSD9TE08	097	T.B. HB Elev. 249.	NO	Industry Experience with numerous through wall leaks in drain collector headers. Scan as much of header below drains from LCV 38A to 38D and ST-60-2A to 2D as accessible. See Note 3.
2004-24	MSD9EL05	097	T.B. HB Elev. 237.	NO	Industry Experience with numerous through wall leaks in drain collector headers. Inspect a minimum of 16 inch length on MSD9SP06US. See Note 3.
2004-25	MSD9EL06	097	" " "	NO	
2004-26	MSD9SP06US	097	" " "	NO	

LARGE BORE UT NOTES:

1. Coordinate minimum extent of insulation to be removed with J.Fitzpatrick or T.M. O'Connor from DE-M/S.
2. A "No" in the previous inspection column indicates asbestos abatement may be required.
3. Piping is part of the proposed ALT Boundary for Power Uprate AST.

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VERMONT YANKEE PIPING FAC INSPECTION PROGRAM 2004 INSPECTION SCOPE (3/27/03) Page 3 of 4

LARGE BORE PIPING: Internal Visual Inspections (with supplemental UT as required)

Inspection Point No.	Description
2004-27	"A" 36 inch diameter Turbine Cross Around line (CAR).
2004-28	"B" 36 inch diameter Turbine Cross Around line (CAR).
2004-29	"C" 36 inch diameter Turbine Cross Around line (CAR).
2004-30	"D" 36 inch diameter Turbine Cross Around line (CAR).
2004-31	"C" 30 inch diameter Turbine Cross Around line (CAR).
2004-32	"D" 30 inch diameter Turbine Cross Around line (CAR).

Note: Internal visual inspections of open ends at all large bore connections to the new High Pressure feedwater heaters will be performed during installation of the new heaters during the 2004 RFO. (This includes Feedwater, Extraction Steam, Moisture Separator Drains, and Heater Drain piping.)

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