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1671 Worcester Road, Framingham, Massachusetts 01701

September 11, 1987
FYR 87-94

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

References: (a) License No. DPR-3 (Docket No. 50-29)
(b) NRC Bulletin No. 87-01: "Thinning of Pipe Walls in Nuclear Power Plants," dated July 9, 1987

Subject: Response to USNRC Bulletin No. 87-01, "Thinning of Pipe Walls in Nuclear Power Plants"

Dear Sir:

Prior to issuance of NRC Bulletin No. 87-01, Yankee had developed and performed a Pipe Thinning Inspection Program during the Cycle 18 refueling outage. The results of the inspection program indicate that there appears to be no significant pipe wall thinning other than that attributable to normal wear in piping with single phase fluid. The Extraction Steam System was found to have, as expected, erosion due to two-phase flow. Findings were consistent with previous examination of piping with two-phase flow. As requested in 87-01, information concerning the inspection program and its results is provided in Attachment A.

Yankee's program has proven to be an effective and thorough inspection program for examining the thickness of the walls of piping for effects of erosion/corrosion. This program ensures Yankee that the functional capability of high energy piping systems within the plant is maintained by verifying that pipe wall thicknesses are within the allowable thickness values.

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We trust that you will find this submittal satisfactory; however, if you have any questions or require additional information, please contact us.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

L. H. Heider
Vice President and Manager of Operations

GP/25.103

Attachment

cc: USNRC Region I
USNRC Resident Inspector, YNPS

COMMONWEALTH OF MASSACHUSETTS)
)ss
MIDDLESEX COUNTY)

Then personally appeared before me, L. H. Heider, who, being duly sworn, did state that he is Vice President and Manager of Operations of Yankee Atomic Electric Company, that he is duly authorized to execute and file the foregoing document in the name and on the behalf of Yankee Atomic Electric Company and that the statements therein are true to the best of his knowledge and belief.

Robert H. Groce Notary Public
My Commission Expires August 29, 1991

ATTACHMENT A

Information Requested for NRC Bulletin No. 87-01

Item No. 1.

Identify the codes or standards to which the piping was designed and fabricated.

Yankee Response

All piping, inspected under the Yankee Inspection Program, was designed, and fabricated per the 1955 issue of American Standard Code for Pressure Piping, ASA B31.1.

Item No. 2.

Describe the scope and extent of your programs for ensuring that pipe wall thicknesses are not reduced below the minimum allowable thickness. Include in the description the criteria that you have established for:

a. Selecting points at which to make thickness measurements.
b. Determining how frequently to make thickness measurements.
c. Selecting the methods used to make thickness measurements.
d. Making replacement/repair decisions.

Yankee Response

a. The criteria utilized for selecting individual inspection locations was based on fluid velocity, fluid temperature, and piping geometry. Each location within a piping system was given a rating in regards to its erosion/corrosion (E/C) susceptibility, based on experience of other utilities, inspection results of Surry 2, and various single and two-phase flow test results. Piping geometry was selected as an overriding parameter and given a (two-times) heavier weight for selecting inspection locations.

b. Although Yankee has performed random hand-held ultrasonic pipe wall thickness measurements since 1974, Yankee's most recent inspection during the Cycle 18 refueling constitutes an implementation of an inspection program which produces a detailed and accurate analysis of specific inspection locations which will serve as an overall base line condition of each system. Given the results of each of these inspections, a monitoring program will be established which requires future refueling Ultrasonic Testing (UT) inspections at locations that were found to experience the highest wall thinning. Data obtained from the next refueling inspection would then allow Yankee to establish a realistic wear rate which would then more accurately define frequency of monitoring for given locations.

c. Yankee has selected and utilized UT from the pipe outside diameter as an inspection method. The UT program utilized is P-scan, which is an Automated Scanning and Data Acquisition System which was uniquely developed for E/C application. The P-Scan UT System, when supplemented with minimal manual scanning, provides 100% coverage of areas of inspection with computer enhanced data processing. Since this system provides 100% coverage, selection of specific areas for future monitoring has been significantly narrowed.

d. The basis for development of an acceptance criteria is ANSI B31.1 - 1977 Edition, "Power Piping Code." The measured pipe ultrasonic wall readings resulted in the location being placed into one of the three basic categories: Accept, Evaluate, or Reject.

The initial screen criteria for a location being classified as Reject is the ANSI B31.G standard of the pipe wall being eroded to less than 20% of nominal wall.

Under the inspection program a Rejected component must be repaired or replaced. The evaluate category has several screening criteria. It is organized to account for wall loss in pipe through simple analytical methods. A component will be classified for erosion monitoring or repair after all analytical screening methods are exhausted.

In no case was an eroded inspection location allowed to violate the design code minimum wall thickness requirement.

Therefore, per the Yankee inspection program, any location which was found with a pipe wall area thinner than .2 ($T_{nominal}$) or code minimum wall required replacement or repair.

Item No. 3.

For liquid-phase systems, state specifically whether the following factors have been considered in establishing your criteria for selecting points at which to monitor piping thickness (Item 2a):

a. Piping material (e.g., chromium content).
b. Piping configuration (e.g., fittings less than ten pipe diameters apart).
c. The pH of water in the system (e.g., pH less than ten).
d. System temperature (e.g., between 190°F and 500°F).
e. Fluid bulk velocity (e.g., greater than ten ft/sec).
f. Oxygen content in the system (e.g., oxygen content less than 50 ppb).

Yankee Response

a. Piping material was considered as one of the criteria utilized for establishing inspection locations within the Yankee Inspection Program. Given that the Surry failure occurred in a carbon steel ASTM A-234

Grade B Piping System, and that even small percentages of chromium, copper, and Molybdenum will substantially improve the E/C resistance of carbon steels, Yankee's single-phase E/C Inspection Program included all secondary systems with carbon steel piping.

b. Piping geometry was selected as an overriding parameter and given a (two-times) heavier weight than other plant parameters. This heavier weight was due to the review of various tests performed within the industry, information received from other utilities, and the belief that the piping configuration played a major role in establishing conditions which promoted E/C in the Surry failure.

c. The pH level of water within the systems that were selected for E/C inspection was found to exist at levels approaching 9.2. While a pH level of 9.3 is desirable from a E/C standpoint, an upper limit of 9.2 has been implemented at Yankee due to the adverse effect the resultant ammonia has with copper within the secondary cycle. This operating pH level minimizes copper pickup and also guards against the E/C process. This pH level exists throughout the secondary plant and was not utilized as a criteria for selecting inspection locations but was evaluated extensively to ensure that the pH level did not adversely affect the piping systems at Yankee.

d. Fluid temperature was utilized as a criteria for selection of inspection locations in the Yankee program. Given that test reports indicate that the E/C rate is strongly temperature dependent, location rating was computed utilizing temperature as one of three variables. A higher (more E/C susceptible) rating was placed on systems which operate between 245°F and 350°F.

e. Fluid velocity calculations were performed for each piping size within the systems selected for E/C inspections at Yankee. A higher location rating was given for increased velocities over 5 ft/sec. Fluid velocities were found to exceed 20 ft/sec in selected areas of the plant and were subsequently given higher location ratings. Therefore, fluid velocity was utilized as a parameter in establishing criteria for selecting inspection locations.

f. Although a high oxygen content is desirable for E/C concerns, dissolved oxygen within the feedwater downstream of the first stage feedwater heater results in copper oxides being transmitted to the steam generators which results in tube degradation. At Yankee, oxygen levels are maintained at approximately seven ppb within the condensate and main feedwater systems. Although the oxygen level maintained at the Yankee plant may contribute to a higher E/C wear rate, it has been recognized as a sound corrosion control policy for the secondary plant. Until a significant E/C phenomenon is identified, oxygen content will not be altered in the secondary plant. Therefore, oxygen content is not utilized in establishing inspection locations in the Yankee program at this time, but has been thoroughly evaluated for its operating effect on plant maintenance.

Item No. 4.

Chronologically list and summarize the results of all inspections that have been performed which were specifically conducted for the purpose of identifying pipe wall thinning whether or not pipe wall thinning was discovered, and any other inspections where pipe wall thinning was discovered even though that was not the purpose of that inspection.

a. Briefly describe the inspection program and indicate whether it was specifically intended to measure wall thickness or whether wall thickness measurements were an incidental determination.

b. Describe what piping was examined and how (e.g., describe the inspection instrument(s), test method, reference thickness, locations examined, and means for locating measurement point(s) in subsequent inspections).

c. Report thickness measurement results and note those that were identified as unacceptable and why.

d. Describe actions already taken or planned for piping that has been found to have a nonconforming wall thickness. If you have performed a failure analysis, include the results of that analysis. Indicate whether the actions involve repair or replacement, including any change of materials.

Yankee Response

In 1974, Yankee began inspecting secondary plant piping systems to specifically observe pipe wall thicknesses. The inspections consisted of a random selection process with a hand-held ultrasonic device. Plant records indicate that the first, second, and third point heater extraction steam lines and the main steam lines were the focus of the program which centered around two-phase E/C. Records also indicate that: 1) extraction steam piping had been replaced relatively routinely in the past with new carbon steel extraction steam lines, and 2) signs of E/C were found by visual examination in the turbine cross-under piping from the HP turbine to the moisture separator resulting in numerous weld repairs which were performed on both 42-inch cross-under pipes during past refueling outages. Maximum pressures in the 42-inch piping is 45 psig during full load operation.

In 1980, all but one straight length portion of the second-stage extraction steam piping was replaced due to E/C not only in the pipe fittings, but in the form of "striping" in straight runs of pipe. In 1985, Westinghouse, the turbine manufacturer, after previously weld repairing the cross-under piping, replaced the two 42-inch HP exhaust to moisture separator inlet pipes and a partial replacement of the second-point extraction piping off the turbine due to excessive two-phase E/C. During the 1987 refueling outage, the turbine cross-under piping from the moisture separator to the LP turbine was visually inspected and the only remaining original section of the second-stage extraction steam piping was replaced. As a result of the newly implemented Yankee Inspection Program, 60 feet of first stage extraction steam piping was replaced due to indications of pipe wall thinning.

In response to the December 9, 1986 accident at Surry Unit 2, Yankee, in April of 1987, developed a more in-depth inspection program to evaluate selected critical areas of plant piping systems to determine the effects of E/C. Forty areas were selected for inspection. These areas and the extent of examinations are identified in the attached Inspection Program Status Report. Each location inspection consisted of a determination of piping wall thickness using an automated ultrasonic testing system with computer data acquisitions/display capabilities. Other testing methods, such as remote visual or manual UT were also used to supplement the automated UT data. Examination data, reports, etc., for each location are maintained on plant file for future reference. Because the UT method utilized (P-scan) does not require gridding to locate measurement points and provides 100% surface coverage, relocation of selected inspection areas for future monitoring is possible without difficulty.

The attached Inspection Program Status Report indicates that the results of each location inspection determines whether that location is placed in a Category 1, 2, or 3 group for classification. The categories have been devised utilizing wall thicknesses as boundaries for category classification. Depending upon the results of each inspection, the location is categorized as an accept, evaluate, or rejection. Of the 51 locations (40 subdivided for reference), 25 were categorized as accept, 22 are to be evaluated, and 3 were rejected. Documentation of inspection results are contained in packages numbered with their respective locations. Each data package contains essentially the following documents:

- Cover Sheet
- UT Data Sheets (indicating maximum, minimum, and average thickness for each location)
- Manual Data Sheet(s)
- UT Calibration Record(s)
- Detailed Sketch of Location (indicating location of scans, lengths of scans, orientation points, etc.)
- UT Equipment Parameter Sheets
- Hardcopy Printout of Scanned Areas set at Category 1/2 Level (i.e., prints out areas thinner than Category 1 limits)
- Mechanical Acceptance Criteria Evaluation Sheet

The attached Inspection Program Status Report further provides information relative to each location's operating parameters, material, inspection results, and final status.

In the comments column of the report, a percentage is given for each component. This percentage indicates the remaining wall thickness in the thinnest area within the inspection relative to the minimum wall allowed by manufacturing tolerance (i.e., the Category 1/Category 2 cut-off thickness).

The three inspection locations (4, 6, and 35) which were classified as "reject" were located on the first point steam extraction line. Each of these locations were found with wall thicknesses below the acceptable minimum wall thickness. The required amount of piping sections were cut out and replaced with new carbon steel piping.

Item No. 5.

Describe any plans either for revising the present or for developing new or additional programs for monitoring pipe wall thickness.

Yankee Response

Yankee does not intend to change the recently implemented E/C Inspection Program. Based on this refueling's initial inspection results, a number of Category 2 areas will be reinspected on a refueling basis to establish a realistic wear rate, which would then more accurately define frequency of monitoring for given locations. Meanwhile, if industry findings warrant an expansion or increased frequency of inspections, Yankee will subsequently expand the scope of the inspection program.

LOCATION #	SYSTEM / DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE DESIGN / OPER.	SYSTEM TEMP. DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
1	1st point extraction steam FP -4A	45 elbow 2 dia us to vlv ds	151	12" / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A234 WPA	*	.328" / .328" - .075" / .075"	.250"	2	1	REPLACED	PLANT DECISION TO REPLACE 76 %
2	1st point extraction steam FP -4A	45 elbow 1 dia us 1 dia ds	151	12" / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A234 WPA	*	.328" / .328" - .075" / .075"	.170"	2	2	REPLACED	PLANT DECISION TO REPLACE 52 %
3	1st point extraction steam FP -4A	straight pipe 2 dia	151	12" / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A53 ER A	*	.328" / .328" - .075" / .075"	.330"	1	3	ACCEPT	100 % *
4	1st point extraction steam FP -4A	90 elbow 1 dia us ds to valve	151	12" / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A234 WPA	11	.328" / .328" - .075" / .075"	.020"	3	4	REJECT / REPLACE	6 %
5	1st point extraction steam FP -4A	90 elbow 1 dia ds	151	12" / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A234 WPA	*	.328" / .328" - .075" / .075"	.090"	2	5	REJECT / REPLACE	PRE-EXAM SURVEY 27 %
6	1st point extraction steam FP -4A	90 elbow flange to flange	151	12" / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A216 WCB	*	.328" / .328" - .075" / .075"	.070"	3	6	REJECT / REPLACE	PRE-EXAM SURVEY 21 %
7	3rd point extraction steam FP -7A	90 elbow weld to weld	121	24" / 20	3 psig / 17 psia	223 F / 223 F	110,226 lbs/hr	242 ft/sec	(S)	A234 WPA	*	.328" / .328" - .075" / .075"	.240"	2	7	ACCEPT / MONITOR	73 %

LOCATION #	SYSTEM / DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE / DESIGN / OPER.	SYSTEM TEMP. / DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA / Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
8	htr. drain pump disch. FP -22C	(2) 90 elbows, from vlv thru elbows to 2 dia ds	301	8" / 40	307 psig / 290 psig	291 F / 291 F	1,200 gpm	7.8 ft/sec	(W)	A53 GR A A234 WPA	B	.282" .282" - .064" .064"	.224"	2	8	ACCEPT / MONITOR	79 %
9	htr. drain pump disch. FP -22C	90 elbow 1 dia us 2 dia ds	301	8" / 40	307 psig / 290 psig	291 F / 291 F	1,200 gpm	7.8 ft/sec	(W)	A53 GR A A234 WPA	*	.282" .282" - .064" .064"	.220"	2	9	ACCEPT / MONITOR	78 %
10 (a)	htr. drain pump disch. FP -22C FP -3A	TEE thru 2 90 elbows. 1 di us 2 dia ds	301	12" / std	250 psig / 140 psig	280 F / 215 F	3,690 gpm	11.4 ft/sec	(W)	A53 GR A A234 WPA	1	.328" .328" - .075" .075"	.273"	2	10A	ACCEPT / MONITOR	83 %
10 (b)	htr. drain pump disch. FP -22C FP -3A	TEE thru 2 90 elbows. 1 di us 2 dia ds	301	14" / std	250 psig / 140 psig	280 F / 215 F	3,690 gpm	11.4 ft/sec	(W)	A53 GR A A234 WPA	1	.328" .328" - .075" .075"	.348"	1	10B	ACCEPT	100 % +
10 (c)	htr. drain pump disch. FP -22C FP -3A	TEE thru 2 90 elbows. 1 di us 2 dia ds	301	8" / 40	250 psig / 140 psig	291 F / 291 F	1,200 gpm	7.7 ft/sec	(W)	A53 GR A A234 WPA	1	.282" .282" - .064" .064"	.208"	2	10C	ACCEPT / MONITOR	74 %
11	htr. drain pump suct. FP -22C	90 elbow us from valve to 1 dia ds	151	8" / 40	45 psig / 59 psia	291 F / 290 F	354,120 lbs/hr	5.0 ft/sec	(W)	A53 GR A A234 WPA	9	.282" .282" - .064" .064"	.200"	2	11	ACCEPT / MONITOR	71 %
12 (a)	cond. pump disch. FP -10B	90 elbow	151 A	10" / 40	250 psig / 200 psig	125 F / 90 F	1,230 gpm	5.0 ft/sec	(W)	A234 WPA	*	.319" .319" - .073" .073"	.420"	1	12A	ACCEPT	100 % +

LOCATION #	SYSTEM / DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE / DESIGN / OPER.	SYSTEM TEMP. / DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA / Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
12 (b)	cond. pump disch. FP -10B	reducer	151 A	12" std	250 psig 200 psig	125 F 90 F	1,230 gpm	5.0 ft/sec	(W)	A234 WPA	*	.328" .328" - .075" .075"	.410"	1	12B	ACCEPT	100 % +
13	cond disch. hdr. FP -10B	90 elbow 1 dia ds	151 A	12" std	250 psig 200 psig	125 F 90 F	3,690 gpm	10.5 ft/sec	(W)	A53 GR A A234 WPA	*	.328" .328" - .075" .075"	.291"	2	13	ACCEPT / MONITOR	89 %
14	cond.hdr. FP -10B FP -74A	TEE 1 dia us to valve ds	151 A	12" std	250 psig 200 psig	210 F 106 F	3,690 gpm	10.5 ft/sec	(W)	A53 GR A A234 WPA	*	.328" .328" - .075" .075"	.300"	2	14	ACCEPT / MONITOR	91 %
15	cond. hdr. FP-3A FP -74A	90 elbow htr. to vlv	301	12" std	250 psig 200 psig	280 F 215 F	3,690 gpm	10.5 ft7sec	(W)	A234 WPA	*	.328" .328" - .075" .075"	.360"	1	15	ACCEPT	100 % +
16	cond. hdr. FP -3A FP -74A	TEE & 90 elbow 1 dia us 2 dia ds	301	12" std	250 psig 200 psig	290 F 287 F	3,690 gpm	10.5 ft/sec	(W)	A234 WPA	10	.328" .328" - .075" .075"	.280"	2	16	ACCEPT / MONITOR	85 %
17 (a)	feed pump suction hdr. FP -3A	HDR / TEE & end cap 1 dia us	301	14" std	250 psig 200 psig	290 F 288 F	4,890 gpm	11.4 ft/sec	(W)	A234 WPA	2	.328" .328" - .075" .075"	.353"	1	17A	ACCEPT	100 % +
17 (b)	feed pump suction hdr. FP -3A	90 reducing elbow 1 dia ds	301	10" 40	250 psig 200 psig	290 F 288 F	1,630 gpm	6.8 ft/sec	(W)	A234 WPA	2	.319" .319" - .073" .073"	.280"	2	17B	ACCEPT / MONITOR	88 %

LOCATION #	SYSTEM / BWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE DESIGN / OPER.	SYSTEM TEMP. DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
18	feed pump disch. FP -9D FP -9E	90 elbow from valve to 2 dia ds	601	10" / 80	1,100 psig / 750 psig	280 F / 280 F	2,160 gpm	9.6ft/sec	(W)	A234 WPB / A106 GR B	6	.520" / .520" - .119" / .119"	.569"	1	18	ACCEPT	100 % +
19	feed pump disch. hdr. FP -9D FP -9E	90 & 45 elbows 1 dia us & 1 dia ds	601	14" / 80	1,100 psig / 750 psig	280 F / 280 F	5,165 gpm	13.5 ft/sec	(W)	A234 WPB / A106 GR B	*	.656" / .656" - .150" / .150"	.664"	1	19	ACCEPT	100 % +
20	feed pump disch. hdr. FP -9D FP -9E	90 elbow 1 dia us to vlv ds	601	14" / 80	1,100 psig / 750 psig	355 F / 351 F	5,165 gpm	13.5 ft/sec	(W)	A234 WPB / A106 GR B	*	.656" / .656" - .150" / .150"	.696"	1	20	ACCEPT	100 % +
21 (a)	feed pump disch. hdr. FP -9D FP -9E	90 el to 1cE 1 dia us to feedline cut outs .co) + 1 dia ds on (co)	601	14" / 80	1,100 psig / 750 psig	355 F / 351 F	5,165 gpm	13.5 ft/sec	(W)	A234 WPB / A106 GR B	4	.656" / .656" - .150" / .150"	.640"	2	21A	ACCEPT / MONITOR	98 %
21 (b)	feed pump disch. hdr. FP -9D FP -9E	straight pipe	601	8" / 80	1,100 psig / 750 psig	355 F / 351 F	1,290 gpm	9.1 ft/sec	(W)	A234 WPB / A106 GR B	4	.437" / .437" - .100" / .100"	.440"	1	21B	ACCEPT	100 % +
22 (a)	main feed FP -9D FP -9E 8" side	8" x 6" reducer flange to vlv	601	8" x 6" / 80	1,100 psig / 750 psig	355 F / 351 F	1,290 gpm	16 ft/sec	(W)	A234 WPB / A106 GR B	*	.437" / .437" - .100" / .100"	.463"	1	22A	ACCEPT	100 % +
22 (b)	main feed FP -9D FP -9E 6" side	8" x 6" reducer flange to vlv	601	6" x 6" / 80	1,100 psig / 750 psig	355 F / 351 F	1,290 gpm	16 ft/sec	(W)	A234 WPB / A106 GR B	*	.378" / .378" - .086" / .086"	.493"	1	22B	ACCEPT	100 % +

LOCATION #	SYSTEM / DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE / DESIGN / OPER.	SYSTEM TEMP. / DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA / Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
23 (a)	main feed FP -9D FP -9E 6" side	8" x 6" reducer v/v to 3 dia ds red.	601	8" x 6" 80	1,100 psig 750 psig	355 F 351 F	1,290 gpm	16 ft/sec	(W)	A234 WPB A106 GR B	5	.437" .437" - .100" .100"	.500"	1	23A	ACCEPT	100 % +
23 (b)	main feed FP -9D FP -9E 6" side	8" x 6" reducer v/v to 3 dia ds red.	601	8" x 6" 80	1,100 psig 750 psig	355 F 351 F	1,290 gpm	16 ft/sec	(W)	A234 WPB A106 GR B	5	.378" .378" - .086" .086"	.480"	1	23B	ACCEPT	100 % +
24	main feed FP -9D FP -9E	90 elbow 2 dia ds	601	8" 80	1,100 psig 750 psig	355 F 351 F	1,290 gpm	9.1 ft/sec	(W)	A234 WPB A106 GR B	*	.437" .437" - .100" .100"	.463"	1	24	ACCEPT	100 % +
25	main feed FP -9D	straight pipe 2 ft. section	601	8" 80	1,100 psig 750 psig	355 F 351 F	1,290 gpm	9.1 ft/sec	(W)	A234 WPB A106 GR B	*	.437" .437" - .100" .100"	.500"	1	25	ACCEPT	100 % +
26	main feed FP -9D	(2) 45 elbows only	601	8" 80	1,100 psig 750 psig	355 F 351 F	1,290 gpm	9.1 ft/sec	(W)	A234 WPB A106 GR B	*	.437" .437" - .100" .100"	.480"	1	26	ACCEPT	100 % +
27	aux steam FP -8A FP -8B	90 elbow 2 dia ds	601	6" 80	1,035 psia 536 psia	550 F 464 F	14,500 lbs/hr	21 ft/sec	(S)	A234 WPB A106 GR B	*	.378" .378" - .086" .086"	.420"	1	27	ACCEPT	100 % +
28	aux steam FP -8A FP -8B	90 elbow 3 dia ds	601	3" 80	1,035 psia 440 psig	550 F 464 F	14,500 lbs/hr	21 ft/sec	(S)	A234 WPB A106 GR B	*	.262" .262" - .060" .060"	.290"	1	28	ACCEPT	100 % +

LOCATION #	SYSTEM / DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE / DESIGN / OPER.	SYSTEM TEMP. / DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA / Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
29	main steam FP -2B	90 elbow only weld to weld	601	24" 80	1,035 psia 584 psia	550 F 464 F	2,384,350 lbs/hr	253 ft/sec	(S)	A234 WPB A106 GR B	*	1.066" 1.066" - .244" .244"	.924"	2	29	ACCEPT MONITOR	87 %
30 (a)	main steam FP -2B	45 lateral	601	24" 80	1,035 psia 584 psia	550 F 464 F	2,384,350 lbs/hr	253 ft/sec	(S)	A234 WPB A106 GR B	*	1.066" 1.066" - .244" .244"	.880"	2	30A	ACCEPT MONITOR	83 %
30 (b)	main steam FP -2B	45 elbow only	601	18" 80	1,035 psia 584 psia	550 F 464 F	1,190,000 lbs/hr	222 ft/sec	(S)	A234 WPB A106 GR B	*	.821" .821" - .188" .188"	.640"	2	30B	ACCEPT MONITOR	78 %
31	htr. drain pump disch. FP -22E	90 elbow check vlv to 1 dia ds	301	8" 40	307 psig 290 psig	291 F 291 F	600 gpm	4.0 ft/sec	(W)	A53 GR A A234 WPA	*	.282" .282" - .064" .064"	.230"	2	31	ACCEPT MONITOR	82 %
32	feed pump suction FP -3A	90 elbow flange to flange	301	10" 40	250 psig 200 psig	290 F 288 F	1,630 gpm	6.8 ft/sec	(W)	A216 WCB	*	.319" .319" - .073" .073"	.380"	1	32	ACCEPT	100 %
33 (a)	feed pump suction FP -3A	HDR./TEE 1 dia us 1 dia ds	301	14" std	250 psig 200 psig	290 F 288 F	4,890 gpm	11.4 ft/sec	(W)	A234 WPA	3	.328" .328" - .075" .075"	.300"	2	33A	ACCEPT MONITOR	91 %
33 (b)	feed pump suction FP -3A	90 reducing elbow 1 dia ds	301	10" 40	250 psig 200 psig	290 F 288 F	1,630 gpm	6.8 ft/sec	(W)	A234 WPA	3	.319" .319" - .073" .073"	.253"	2	33B	ACCEPT MONITOR	79 %

LOCATION #	SYSTEM DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE SCHEDULE	SYSTEM PRESSURE DESIGN OPER.	SYSTEM TEMP. DESIGN OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA Cat 1 Cat 2 Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
34	main feed disch. FP -9D	straight pipe 3 dia	601	8* / 80	1,100 psig / 750 psig	355 F / 351 F	1,290 gpm	9.1 ft/sec	(W)	A 106 GR B / A234 WPB	*	.437* / .437* - .100* / .100*	.469*	1	34	ACCEPT	100 % +
35	extraction steam 1st point FP -4A	90 elbow 0 dia ds	151	12* / std	150 psig / 150 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A53 GR A / A234 WPA	*	.328* / .328* - .075* / .075*	.088*	2	35	REPLACED STRAIGHT RUN ONLY ELBOW ACCEPTED	PLANT DECISION TO REPLACE 27%
36 (a)	main steam FP-2D	45 laterals 1 dia all directions	601	24* / 80	1,035 psig / 584 psia	550 F / 464 F	2,384,350 lbs/hr	253 ft/sec	(S)	A106 GR B / A234 WPB	*	.1066* / .1066* - .244* / .244*	.949*	2	36A	ACCEPT ---------- MONITOR	89 %
36 (b)	main steam FP-2D	45 laterals 1 dia all directions	601	14* / 80	1,035 psig / 584 psia	550 F / 464 F	596,000 lbs/hr	185 ft/sec	(S)	A106 GR B / A234 WPB	*	.656* / .656* - .150* / .150*	.692*	1	36B	ACCEPT	100 % +
37 (a)	steam dump FP -2D	90 elbow 2 dia ds & 6* around hdr. penet.	601	6* / 80	1,035 psig / 584 psia	550 F / 464 F	100,000 lbs/hr	3.0 ft/sec	(S)	A106 GR B / A234 WPB	*	.378* / .378* - .086* / .086*	.400*	1	37A	ACCEPT	100 % +
37 (b)	main steam header FP -2D	straight pipe	601	24* / 80	1,035 psig / 584 psia	550 F / 464 F	2,384,350 lbs/hr	253 ft/sec	(S)	A106 GR B / A234 WPB	*	1.066* / 1.066* - .244* / .244*	.950*	2	37B	ACCEPT ---------- MONITOR	89 %
38	main steam FP -2D	flow orifice 2 dia ds	601	14* / 80	1,035 psig / 584 psia	550 F / 464 F	596,000 lbs/hr	185 ft/sec	(S)	A106 GR B	*	.656* / .656* - .150* / .150*	.624*	2	38	ACCEPT ---------- MONITOR	95 %

LOCATION #	SYSTEM / DWG. #	GEOMETRY	PIPING CLASS	LINE SIZE / SCHEDULE	SYSTEM PRESSURE / DESIGN / OPER.	SYSTEM TEMP. / DESIGN / OPER.	SYSTEM FLOW	APPROX. VELOCITY	STEAM (S) / WATER (W)	MATERIAL	INSP. PRIORITY	SCREENING CRITERIA / Cat 1 / Cat 2 / Cat 3	MEASURED MIN. * t*	ASSIGNED CATEGORY	REPORT #	FINAL STATUS	COMMENTS
39	extraction steam 1st point rP-4A	90 elbow 1 dia ds	151	12" / std	150 psig / 130 psig	356 F / 356 F	213,980 lbs/hr	220 ft/sec	(S)	A53 GR A / A234 WPA		.328* / .328* - .075* / .075*	.300'	2	39	REPLACED	PLANT DECISION TO REPLACE 91Z
40	main feedwater FP -9D FP -9E	90 elbow 2 dia ds	601	14" / 80	1,100 psig / 750 psig	356 F / 351 F	5,165 gpm	13.5 ft/sec	(W)	A216 WFB	7	.656* / .656* - .150* / .150*	.660*	1	40	ACCEPT	100 % +