PHILADELPHIA ELECTRIC COMPANY
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September 24, 1987
Docket Nos.: 50-277
50-278
50-352

Mr. William T. Russell
Administrator, Region I
U. S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

Subject: Response to IE Bulletin 87-01
"Thinning of Pipe Walls in Nuclear Power Plants"

Dear Mr. Russell:

The attached responses for both Peach Bottom and Limerick are being resubmitted with a date of signature. This information was omitted from the original transmittal because of a clerical oversight.

Please take appropriate action to correct the files for this Bulletin. We regret any inconveniences this may have caused.

Very truly yours,

Wm M. Alden

William M. Alden
Engineer-In-Charge
Licensing Section

cc: Addressee
J. W. Gallagher w/attachment
T. P. Johnson w/attachment
E. M. Kelly w/attachment

Attachment

IE11
1/1

COPY

PHILADELPHIA ELECTRIC COMPANY

2301 MARKET STREET

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JOSEPH W. GALLAGHER
VICE PRESIDENT
NUCLEAR OPERATIONS

September 9, 1987

Docket Nos. 50-277
50-278

Mr. W. T. Russell, Administrator
U.S. Nuclear Regulatory Commission
Region I
Attn: Document Control Desk
Washington, DC 20555

Subject: Peach Bottom Atomic Power Station, Units 2 & 3
Response to I.E. Bulletin 87-01 "Thinning of Pipe Walls at Nuclear Power Plants"
Mod Request #2259

Reference: NRC Bulletin No. 87-01 dated 7/9/87

Attachment: Peach Bottom Atomic Power Station Units 2 & 3
Response to NRC I. E. Bulletin No. 87-01
Thinning of Pipe Walls in Nuclear Power Plants

File: GOVT 1-1 (Bulletins)

Dear Mr. Russell:

The referenced bulletin requests information regarding utility programs addressing pipe wall thinning due to erosion/corrosion under single and two phase flow conditions. Philadelphia Electric's response to the five requested actions is provided in the following attachment. If further information is required, please do not hesitate to contact us.

Sincerely,

JW Gallagher

PRB/pd08068706

Attachment

Copy to: Addressee

T. P. Johnson, Resident Inspector
U.S. Nuclear Regulatory Commission
Peach Bottom Atomic Power Station

8709160111
24pp.

Distribution: S. J. Kowalski
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ATTACHMENT

Peach Bottom Atomic Power Station Units 2 & 3
Response to NRC I.E. Bulletin No. 87-01
Thinning of Pipe Walls in Nuclear Power Plants

The subject NRC Bulletin was generated as a result of the 1986 Surry feedwater pipe break accident. Licensees were requested to provide the following information concerning their programs for monitoring the wall thickness of pipes in condensate, feedwater, steam, and connected high energy piping systems, including all safety-related and non-safety-related piping systems fabricated of carbon steel. Information for Peach Bottom Units 2 & 3 in response to I.E. Bulletin 87-01 is provided below.

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

   Response:

   The piping systems included in the Peach Bottom Units 2 and 3 inspection programs are listed in Table I. The applicable design code for each system is as shown.

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 repair/replacement decisions.

   Response:

   The inspection programs for Peach Bottom Units 2 & 3 address carbon steel piping systems subject to single phase or two phase flow erosion/corrosion (E/C). Each is addressed separately below:

Two Phase E/C

Based on our experience dealing with E/C of carbon steel piping in fossil stations, chrome-moly piping was installed in systems such as extraction steam and piping downstream of control valves in feedwater heater drains. This application includes most of the large diameter lines subject to two phase flow. Inspection of particular systems such as the turbine crossaround piping (tiger striping) has been performed for a number of years. A comprehensive review of piping systems to address E/C of carbon steel piping subject to wet steam environments was performed in 1983. This review concentrated on identifying the remaining carbon steel piping subject to two phase flow. The analysis included the review of the system operating parameters and whether there were significant pressure drops (orifices, control valves) which could lead to flashing or cavitation. The operating history of the various systems was also reviewed to identify previous repairs due to leaks or system operational problems. Based on this review, 16 carbon steel piping systems or portions thereof where included in the inspection program as shown in Table I.

a. The piping inspection points were selected based upon locations in the system where there are abrupt changes in the direction of flow (elbows, tees) immediately downstream of significant pressure drops (orifices, control valves) and at other fittings which cause flow perturbations (reducers, branch connections).

b. The frequency of the inspections for each of the 16 piping systems is determined by review of the prior inspection data. Those systems which historically have shown significant E/C damage are scheduled for inspection every refueling outage. The remaining lines which have not shown E/C damage based on data review or have low estimated erosion rates are scheduled for inspection every 2 or 3 refueling outages.

c. All inspections to date have been by manual ultrasonic (UT) thickness measurements supplemented by visual examination where practical. PECo chose UT because it provides accurate verifiable data.

d. Repair/replacement decisions are based upon review of the inspection data, estimating the erosion rate and comparing it to the design min. wall requirements. All piping below code min. wall or anticipated to encroach on min. wall within the next operating cycle is scheduled for replacement. Replacements are made with chrome-moly materials whenever practical.

Single Phase E/C

Following the Surry failure PECo developed a program to detect single phase E/C damage. Piping systems were selected for inspection based upon review of parameters known to contribute to single phase E/C. Systems were initially screened using operating temperature. Those systems operating in the temperature range of high E/C susceptibility were further evaluated based upon bulk velocities and configuration including the spacing between fittings in the overall system. A list of the single phase systems included in the Peach Bottom program is contained in Table 1.

a. Inspection point selection was primarily based upon temperature, bulk velocity and system geometry. The initial step in inspection point selection was to rank the systems or subsystems for potential E/C damage using operating conditions. These system data points were plotted on a graph which relates velocity and temperature to a predicted E/C rate for a given geometry. This graph is shown in Figure 1. Pipe geometry factors were then applied to the various components in each system to prioritize inspection locations. The final locations selected represent the highest rated components for potential E/C damage. A total of 25 locations were chosen for inspection.

b. Since no baseline thickness data is available for comparison, we intend to perform inspections during the next two refueling outages in order to establish E/C wear rates. The inspection frequency for subsequent outages will be determined based upon evaluation of the inspection data and the estimated wear rates.

c. This section is identical to the description provided for two phase flow.

d. This section is identical to the description provided for two phase flow.

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 10 pipe diameters apart).

c. pH of water in the system (e.g. pH less than 10).

d. System temperature (e.g. between 190 and 500F).

e. Fluid bulk velocity (e.g. greater than 10ft/sec.).

f. Oxygen content in the system (e.g. oxygen content less than 50 ppb).

Response:

The evaluation of each parameter listed above in the selection of inspection locations is discussed below:

a. Piping material composition can have a significant affect on the E/C rate of a component. Most severe E/C damage has occurred in plain carbon steel piping systems. Small additions of Cr, Cu and Mo can significantly reduce E/C damage of carbon steels. However, specific chemical analysis information for the systems included in the program for Peach Bottom was not available. Therefore, the carbon steel pipe material was considered identical for all system components and was not used for selecting inspection points within a system.

b. Piping configuration is a important factor contributing to the E/C rate. The relationship of piping geometries that produce the greatest turbulence also produce the highest E/C rates. Pipe component geometry and the spacing between components was considered within each system to identify and prioritize inspection locations.

c. Peach Bottom is a BWR with neutral pH. As pH levels increase above 9.2, E/C is reduced. Since pH was constant throughout the systems evaluated it was not considered for inspection point selection.

d. Fluid temperature was considered for rating the pipe systems or subsystems in terms of the predicted E/C rate. Temperature versus E/C rate has a peak between 240 to 300F. The number of inspection locations is greater for systems operating in this temperature range.

e. Fluid bulk velocity coupled with pipe configuration produce turbulent flow. Flow in conjunction with temperature determine the E/C rate. Velocity and temperature were used for ranking the pipe systems. Velocity and pipe geometry were used for selecting the inspection locations within a system.

f. The oxygen content of the water strongly affects the E/C rate of carbon steel. The data curves for oxygen content versus E/C rate vary considerably; however, the Peach Bottom feedwater oxygen levels have been historically between 20-30ppb which are significantly higher than those reported for Surry (4ppb). Since the oxygen levels are relatively constant for the piping systems evaluated, oxygen was not specifically considered for selecting inspection locations.

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 instruments, test method, reference thickness, locations examined, means for locating measurement points 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.

Response:

A chronological listing of inspections performed at Peach Bottom is provided in Table II.

a. The inspections listed in Table II were specifically intended to measure wall thickness in response to E/C concerns.

b. A description of the piping inspected is provided in Table II. All of the inspections were performed utilizing manual UT techniques. The inspectors were qualified in accordance with SNT-TC-1A and the procedures prepared by a qualified Level III.

1) Two Phase

In order to maintain repeatability of thickness measurement data, the inspection approach has remained unchanged since 1983. Most of the two phase inspections are performed on small diameter piping. Each location is given a unique identification. Typically there are 4 measurements per location 90 degrees apart. Prior to recording the measurements, the entire area is scanned in order to insure that local areas of wall thinning are being detected. If an area is found to be below the specified thicknesses shown in Table II, the affected area is mapped and the minimum value located and recorded. For the 42 in. dia. turbine crossaround piping, internal visual examinations are performed in addition to UT thickness measurements.

2) Single Phase

Single phase inspections also use manual UT. A specific procedure for scanning and data recording was generated based upon experience gained from the Surry failure. Since these inspections are generally performed on large diameter lines, the scans are concentrated on inspection bands in regions where E/C damage would most likely occur. The minimum value detected and the thickness range are recorded. If an area is found to be below the specified value, the area is mapped, a grid established and the min. value located and recorded.

c. Thickness measurement results are recorded in Table II. The minimum wall values are calculated from ANSI B31.1 Par. 104.1.2 plus a corrosion allowance ranging from 0.030" to 0.080" depending on the pipe diameter.

Measurements thicker than these specified values are considered acceptable unless reviews of prior data indicate an extremely high E/C rate. Those measurements thinner than the specified value require engineering evaluation.

d. If the engineering evaluation determines that a code min.-wall violation is likely during the next operating cycle, replacement of the piping is scheduled. Removed pipe sections are visually examined to determine if cavitation damage is present; no formal failure analysis is performed. Wherever practical, replacements are made using 1 1/4 Cr-1/2 Mo material.

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

Response:

The Peach Bottom E/C program provides for the addition or deletion of inspection areas based upon new information. We intend to perform the EPRI Chexal-Horowitz-Erosion-Corrosion (CHEC) analysis for single phase E/C and will amend our program upon evaluation of the results. In addition, we intend to evaluate findings from other utility inspections for their applicability to Peach Bottom.

PRB/pd08048703

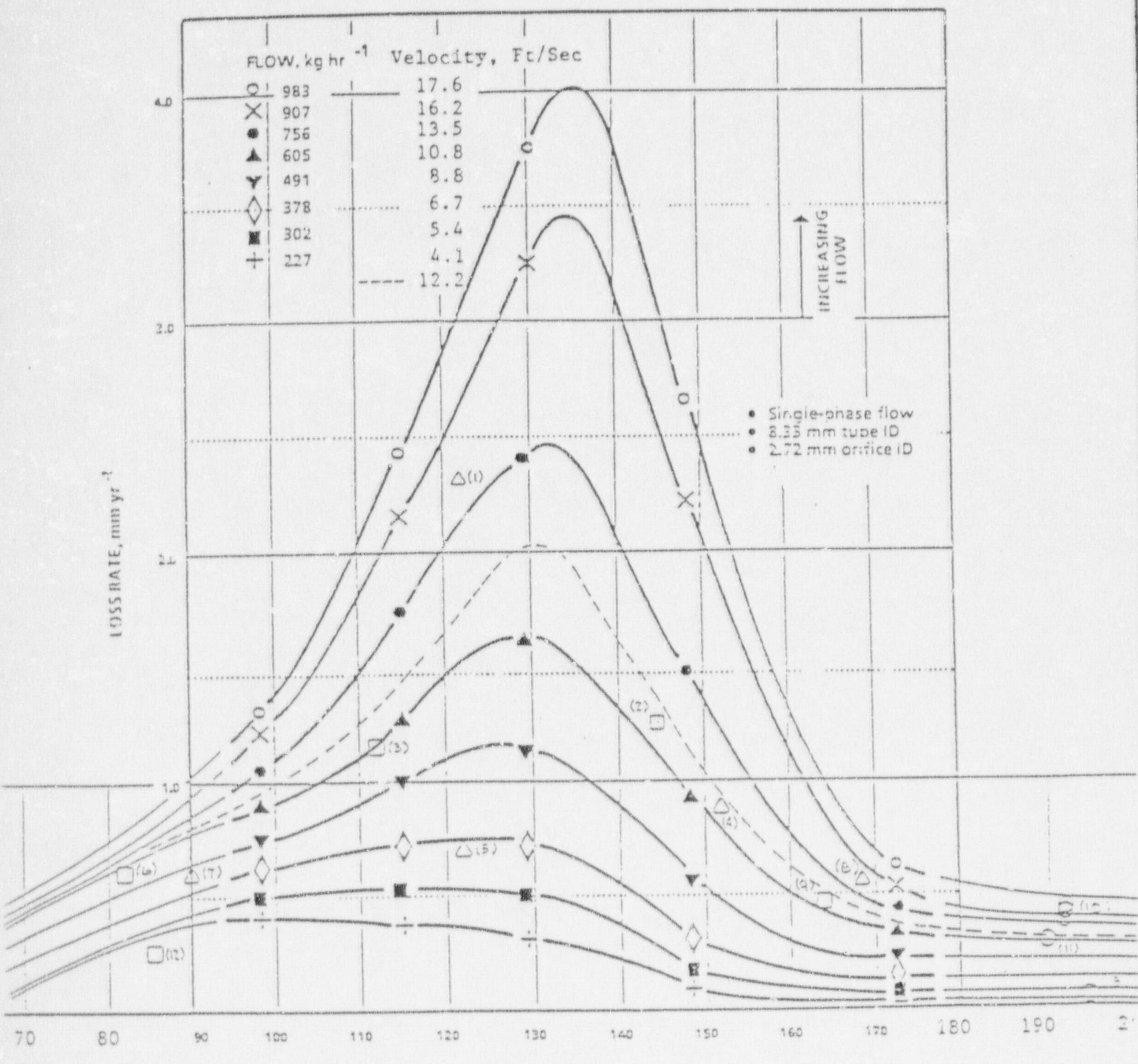

Figure 1 Flow/Temperature Dependence of Post-Orifice Erosion/Corrosion Rates

△ Heater Drain Piping
□ Condensate Piping
○ Feedwater Piping
○ Moisture Separator Drain Piping

For A Description Of Each Line See The Corresponding No. On The Next Page

Ref. EPRI Report NP-3944 dated 4/85.

System Selection Priority
Based on Temperature and Velocity
(See Figure 1)

1. Drain line from 3rd heater to 2nd heater at control valve inlet reducer.

2. Condensate piping from 3rd heater to 4th heater.

3. Condensate piping from 2nd heater to 3rd heater.

4. Drain line from 4th heater to 3rd heater at control valve inlet reducer.

5. Drain line from 3rd heater to 2nd heater.

6. Condensate piping from 1st heater to 2nd heater.

7. Drain line from 2nd to 1st heater at control valve inlet reducer.

8. Drain line from 5th to 4th heater at control valve inlet reducer.

9. Condensate piping from 4th to 5th heater.

10. Feedwater piping from reactor feed pumps to reactor.

11. Condensate piping from 5th heater to reactor feed pump suction.

12. Condensate piping from drain cooler to 1st heater.

13. Moisture separator drain lines to control valve.

PRB/pd08198704

Table 1
Pipe Systems Inspected for
Erosion/Corrosion Damage

All piping for two phase and single phase flow systems was designed in accordance with ANSI B31.1 1967 except where noted.

Pipe materials are A106 Grade B or A53 Grade B except where noted.

Fitting materials are A234 WPB or A105 Grade II except where noted.

A. Two Phase Flow

1. Main steam crossaround piping between the high pressure turbine exhaust and the moisture separator inlet. (see note 1).

2. Reactor feed pump recirculation (min.-flow) piping from valves AO-2139/3139A, B and C to the condenser inlet.

3. Feedwater long path recirculation piping between orifice RO-2663/3663 and the condenser inlet.

4. Reactor water clean-up piping between RO-106 and the condenser inlet.

5. Main steam drains - main steam lead drains, main stop valve above seat drains, high pressure turbine inlet lead drains. (see note 1)

6. HPCI steam drains- HPCI turbine steam supply line drain from steam trap (ST-3) to condenser, HPCI turbine stop valve above seat drain from orifice RO-70A to the drain pot.

7. RCIC steam drains - RCIC turbine steam supply line drain from steam trap (ST-122) to condenser, RCIC turbine stop valve above seat drain from orifice RO-76 to the barometric condenser.

8. Reactor feed pump turbine steam supply piping drains - steam lead, high pressure main stop valve above seat and below seat, low pressure main stop valve above seat and below seat drains. (see note 1)

9. Reactor feed pump turbine first stage and shell drains downstream of valves AO-2557/3557 and AO-2685/3685.

10. Reactor feed pump leakoff loop seal.

11. Offgas recombiner preheater steam supply drain.

12. Extraction steam lines to condenser.

13. Feedwater heater vent lines to condenser downstream of orifices RO-2059/3059, 2062/3062, 2068/3068 and 2071/3071.

14. Main turbine 13th stage shell drain. (see note 1)

15. Any carbon steel relief valve discharge piping where leakage through the valve is suspected.

16. Reactor feed pump suction side relief valve discharge piping downstream of valves RV-2141/3141A, B, C.

B. Single Phase Flow (Bulk velocities indicated)

1. Feedwater piping (14-17 feet/sec.).

2. Condensate piping (10-12 feet/sec.).

3. Feedwater heater drain piping (4-7 feet/sec.).

4. Moisture separator drain piping (4-7 feet/sec.).

Note 1 - These piping systems or portions thereof are design in accordance with the turbine manufacturer's proprietary requirements.

PRB/pd08148702

TABLE II
PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
	END OF FUEL CYCLE SIX INSPECTIONS (UNIT 2)					
7/84	AREA 1 A,B,C,D,E,F TURBINE CROSSAROUND	2	42/0.625	0.332	.700-.800 (ELBOW) .600-.620 (REDUCER) .470-.670 (OTHERS)*	
7/84	AREA 2 A,B,C RFP RECIRCULATION	2	6/0.562	0.414	.300-.900 (ELBOW) .400-.670 (OTHERS)	SEE NOTE 1
10/84	AREA 2 A,B,C RFP RECIRCULATION MIN FLOW LINE	2	10/0.500	0.282	.450-2.100 (FLANGE) .340-.400 (OTHERS)	
11/84	AREA 3 FW LONG PATH RECIRCULATION	2	12/0.375	0.143	.370-.450 (ELBOW) .580-.660 (TEE) .360-.500 (OTHERS)	
11/84	AREA 3 FW LONG PATH RECIRCULATION	2	10/0.365	0.134	.300-.380 (ELBOW) .320-.420 (OTHERS)	
11/84	AREA 3 FW LONG PATH RECIRCULATION	2	8/0.322	0.123	.320-.410 (ELBOW) .320-.420 (OTHERS)	
11/84	AREA 4 RWCU-BLOWDOWN TO CONDENSER	2	4/0.438	0.262	.380-.480	
11/84	AREA 4 RWCU BLOWDOWN TO CONDENSER	2	4/0.237	0.102	.200-.340 (ELBOWS) .410-.460 (FLANGE) .200-.360 (OTHERS)	
11/84	AREA 5 MAIN STEAM DRAINS HP TURBINE INLET	2	1/0.250	0.192	.150-.380 (ELBOWS) .490-.640 (TEES) .150-.360 (OTHERS)	SEE NOTE 4
11/84	AREA 5 MAIN STEAM DRAINS MAIN STEAM LEAD DRAIN	2	2/0.343	0.231	.300-.670 (ELBOWS) .620-.660 (TEES) .310-.410 (OTHERS)	

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
11/84	AREA 5 MAIN STEAM DRAINS MAIN STEAM LEAD DRAINS	2	1/0.250	0.192	.230-.260	
11/84	AREA 5 MAIN STEAM DRAINS MSV ABOVE SEAT DRAIN	2	2/0.343	0.231	.320-.640 (ELBOWS) .310-.580 (OTHERS)	
11/84	AREA 5 MAIN STEAM DRAINS MSV ABOVE SEAT DRAIN	2	1/0.250	0.192	.220-.280	
11/84	AREA 5 MAIN STEAM DRAINS MSV ABOVE SEAT DRAIN	2	1/NA GE SUPPLIED	0.098	.180-.260 (ELBOWS) .180-.220 (OTHERS)	
11/84	AREA 6 HPCI STEAM DRAIN TO DRAIN POT	2	0.75/0.154	0.100	.360-.450 (ELBOWS) .140-.280 (ELBOWS) .240-.250 (TEE) .420-.450 (TEE) .390-.450 (JOINTS) .140-.240 (OTHERS)	
11/84	AREA 6 HPCI STEAM DRAINS	2	1/0.250	0.192	.200-.490 (ELBOWS) .440-.480 (JOINTS) .200-.330 (OTHERS)	
11/84	AREA 7 RCIC STEAM DRAIN TO DRAIN POT	2	1/0.179	0.102	.170-.290 (ELBOWS) .450-.560 (ORIFICE) .160-.280 (OTHERS) .550-.590 (OTHERS)	
11/84	AREA 7 RCIC STEAM DRAIN TO CONDENSER	2	1/0.250	0.192	.140-.300 (ELBOWS) .440-.480 (JOINTS) .200-.340 (JOINTS) .120-.280 (OTHERS)	SEE NOTE 1
11/84	AREA 8 RFPT DRAINS A,B,C HP/LP MSV ABOVE AND BELOW SEAT DRAINS	2	0.75/0.154	0.154	.230-.720 (ELBOWS) .100-.650 (OTHERS)	SEE NOTE 1

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
11/84	AREA 8 RFPT DRAINS RFPT STEAM SUPPLY DRAIN	2	0.75/0.154 1/0.179	0.154 0.156	.045-.335 (ELBOWS) .160-.240 (TEE) .080-.200 (OTHERS)	SEE NOTE 1
11/84	AREA 8 A,B,C RFPT DRAINS	2	2/0.343	0.231	.300-.710 (ELBOWS) .180-.640 (OTHERS)	SEE NOTE 1
11/84	AREA 9 RFPT FIRST STAGE AND SHELL DRAINS	2	2/0.218	0.165	.210-.220	
11/84	AREA 9 RFPT FIRST STAGE AND SHELL DRAINS	2	6/0.280	0.131	.260-.280	
2/85	AREA 10 RFP SEAL LEAK-OFF LOOP SEAL	2	4/0.237	0.088	.235-.335 (ELBOWS) .235-.330 (OTHERS)	
2/85	AREA 10 RFP SEAL LEAK-OFF LOOP SEAL	2	6/0.280	0.091	.300-.325 (ELBOWS) .280-.400 (OTHERS)	
5/85	AREA 11 OFFGAS RECOMBINER PREHEATER STEAM SUPPLY DRAIN	2	1/0.179	0.160	.100-.200	SEE NOTES 1,4
5/85	AREA 11 OFFGAS RECOMBINER PREHEATER STEAM SUPPLY DRAIN	2	2/0.218	0.156	.250-.260 (ELBOWS) .170-.230 (OTHERS)	
5/85	AREA 12 2ND HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	2	3/0.216	0.151	.220-.260 (ELBOWS) .190-.220 (OTHERS)	
5/85	AREA 12 2ND HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	2	4/0.237	0.127	.220-.270 (ELBOWS) .200-.320 (OTHERS)	
5/85	AREA 12 3RD HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	2	1/0.179	0.148	.090-.150 (ELBOWS) .120-.180 (OTHERS)	SEE NOTE 2

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID / SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
5/85	AREA 12 4TH HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	2	1/0.179	0.151	.090-.110 (ELBOWS) .090-.180 (OTHERS)	SEE NOTE 2
5/85	AREA 12 5TH HEATER EXTRACTION STEAM DRAINS TO MOIST. SEP. TANK	2	2/0.218	0.165	.270-.480 (ELBOWS) .190-.230 (OTHERS)	
5/85	AREA 12 5TH HEATER EXTRACTION STEAM DRAINS TO MOIST. SEP. TANK	2	1/0.179	0.156	.190-.260 (ELBOW) .300 (TEE) .150-.255 (OTHERS)	
2/85	AREA 13 FEEDWATER HEATER VENT LINES	2	3/0.216	0.160	.220	
2/85	AREA 13 FEEDWATER HEATER VENT LINES	2	2/0.218	0.155	.180-.190	
2/85	AREA 16 A,B,C RFP (SUCTION) RELIEF VALVE DISCHARGE PIPE	2	2/0.218	0.099	.070-.410 (ELBOWS) .300-.460 (COUPL'G) .430 (REDUCER) .120-.430 (OTHERS)	SEE NOTE 1
11/84	AREA 16 A RFP SUCTION SIDE RELIEF VALVE PIPING	2	1/0.179	0.097	.140-.330	

END OF FUEL CYCLE SIX INSPECTIONS (UNIT 3)

DATE	AREA ID / SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
11/85	AREA 2 A,B,C RFP RECIRCULATION	3	6/0.562	0.414	.380-.700 (ELBOWS) .400-.700 (OTHERS)	SEE NOTE 2
8/85	AREA 6 HPCI STEAM DRAINS	3	1/0.250	0.192	.060-.710 (ELBOWS) .095-.290 (OTHERS)	SEE NOTES 1,3
8/85	AREA 6 HPCI TURBINE STOP VALVE DRAIN	3	0.75/0.154	0.100	.230-.410 (ELBOWS) .210-.600 (TEES) .150-.470 (OTHERS)	

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
8/85	AREA 7 RCIC STEAM DRAINS	3	1/0.250	0.192	.140-.690 (ELBOWS) .500-.560 (TEE) .115-.300 (OTHERS)	SEE NOTES 1,3
8/85	AREA 7 RCIC STEAM DRAINS	3	1/0.179	0.102	.190-.620 (ELBOWS) .175-.545 (OTHERS)	
11/85	AREA 8 A,B,C RFP HP/LP MSV DRAINS	3	2/0.343	0.231	.290-.660 (ELBOWS) .300-.390 (OTHERS)	
11/85	AREA 8 A,B,C RFP HP/LP MSV DRAINS	3	2/0.343	0.231	.470-.850 (ELBOWS) .180-.370 (OTHERS)	SEE NOTE 4
11/85	AREA 8 RFPT STEAM SUPPLY CONTINUOUS DRAINS TO CONDENSER	3	0.75/0.154	0.154	.210-.399 (ELBOWS) .140-.180 (OTHERS)	SEE NOTE 4
11/85	AREA 8 RFPT STEAM SUPPLY CONTINUOUS DRAINS TO CONDENSER	3	1/0.179	0.156	.180-.310 (ELBOWS) .200-.220 (TEES) .030-.200 (OTHERS)	SEE NOTE 2
11/85	AREA 12 2ND HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	3	3/0.216	0.151	.200-.300	
11/85	AREA 12 2ND HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	3	4/0.237	0.127	.150-.285 (ELBOWS) .180-.340 (OTHERS)	
11/85	AREA 12 3RD HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	3	1/0.179	0.148	.125-.320 (ELBOWS) .090-.230 (OTHERS)	SEE NOTE 2
11/85	AREA 12 4TH HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	3	1/0.179	0.151	.140-.305 (ELBOWS) .120-.275 (OTHERS)	SEE NOTE 2
11/85	AREA 12 5TH HEATER EXTRACTION STEAM DRAINS TO MOIST. SEP. TANK	3	2/0.218	0.165	.240-.310 (ELBOWS) .200-.260 (TEE) .200-.310 (OTHERS)	

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
11/85	AREA 12 5TH HEATER EXTRACTION STEAM DRAINS TO MOIST. SEP. TANK	3	1/0.179	0.156	.160-.220	
11/85	AREA 16 A,B,C RFP (SUCTION) RELIEF VALVE DISCHARGE PIPE	3	2/0.218	0.165	.220-.470 (ELBOWS) .160-.480 (OTHERS)	SEE NOTES 2,4
END OF FUEL CYCLE SEVEN INSPECTIONS (UNIT 2)						
3/87	AREA 1 C,D,F CROSSAROUND PIPING	2	42/0.625	0.332	.470-.680	
3/87	AREA 2 A,B,C RFP RECIRC LINES		SYSTEM REDESIGNED-SUSPECT PIPING REPLACED WITH 316SS			
4/87	AREA 6 HPCI STEAM DRAIN	2	1/0.250	0.192	.240-.610 (ELBOWS) .260-.480 (JOINTS) .240-.310 (OTHERS)	
7/87	AREA 7 RCIC STEAM DRAINS	2	1/0.250	0.192	.160-.580 (ELBOW) .140-.380 (OTHERS)	SEE NOTES 1,3
5/87	AREA 8 A RFPT DRAIN	2	2/0.343	0.231	.320-.720 (ELBOWS) .280-.410 (OTHERS)	
5/87	AREA 8 C RFPT HP/LP MSV ABOVE AND BELOW SEAT DRAIN	2	2/0.343	0.231	.340-.700 (ELBOWS) .120-.380 (OTHERS)	SEE NOTES 1,3
5/87	AREA 8 C RFPT HP/LP MSV ABOVE AND BELOW SEAT DRAIN	2	0.75/0.154	0.154	.200-.240 (ELBOW) .330-.340 (TEE) .200-.230 (OTHERS)	
5/87	AREA 8 RFPT STEAM SUPPLY DRAIN	2	0.75/0.154	0.154	.280-.350 (ELBOWS) .145-.180 (OTHERS)	SEE NOTE 4
5/87	AREA 8 RFPT STEAM SUPPLY DRAIN	2	1/0.179	0.155	.105-.290	SEE NOTES 1,3

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART II **TWO PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
5/87	AREA 11 OFFGAS RECOMBINER STEAM SUPPLY DRAIN	2	0.75/0.154	0.107	.210-.370 (ELBOWS) .100-.310 (TEE) .450 (ORIFICE) .090-.380 (OTHERS)	SEE NOTE 2
5/87	AREA 11 OFFGAS RECOMBINER STEAM SUPPLY DRAIN	2	1.5/0.200	0.167	.160-.370 (ELBOWS) .150-.260 (TEE) .110-.400 (OTHERS)	SEE NOTE 4 SEE NOTE 4 SEE NOTES 1,3
5/87	AREA 11 OFFGAS RECOMBINER STEAM SUPPLY DRAIN	2	0.5/0.147	0.100	.260-.370 (ELBOWS) .150-.250 (OTHERS)	
5/87	AREA 11 OFFGAS RECOMBINER STEAM SUPPLY DRAIN	2	1/0.179	0.160	.110-.210	SEE NOTES 1,3
5/87	AREA 12 3RD HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	2	1/0.179	0.148	.100-.340 (ELBOWS) .330-.360 (JOINTS) .090-.220 (OTHERS)	SEE NOTES 1,3
5/87	AREA 12 4TH HEATER EXTRACTION STEAM DRAINS TO A,B,C CONDENSER	2	1/0.179	0.151	.240-.320 (ELBOWS) .220-.240 (JOINT) .120-.240 (OTHERS)	SEE NOTES 1,3
5/87	AREA 12 5TH HEATER EXTRACTION STEAM DRAINS TO MOIST. SEP. DRAIN	2	2/0.218	0.165	.300-.460 (ELBOWS) .180-.230 (OTHERS)	
4/87	AREA 14 MAIN TURBINE 13TH STAGE SHELL DRAIN	2	12/NA GE SUPPLIED	0.063	.350-.400	
5/87	AREA 16 A,B,C RFP (SUCTION) RELIEF VALVE DISCHARGE PIPE	2	1/0.179	0.097	.460-.470 (REDUCER) .170-.180 (OTHERS)	
5/87	AREA 16 A,B,C RFP (SUCTION) RELIEF VALVE DISCHARGE PIPE	2	2/0.218	0.099	.100-.450 (ELBOWS) .220-.230 (REDUCER) .130-.220 (OTHERS)	

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART A **TWO PHASE INSPECTION POINTS**

DATE	AREA ID / SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS

NOTES

1. REPLACEMENT RECOMMENDED FOR LOCATIONS BELOW SPECIFIED MIN WALL VALUE.
2. EVALUATION BASED UPON ESTIMATED WEAR RATE INDICATED THE PIPING WAS ACCEPTABLE FOR AN ADDITIONAL FUEL CYCLE. REPLACEMENT PENDING NEXT OUTAGE INSPECTION RESULTS.
3. REPLACEMENTS WERE MADE WITH CHROME MOLY MATERIALS (P11).
4. INSPECT NEXT OUTAGE.

DEFINITIONS

* OTHERS INCLUDE INLET AND OUTLET PIPING FROM ELBOWS AND TEES PLUS PIPING DOWNSTREAM OF CONTROL VALVES AND ORIFICES.

** MIN. WALL BASED UPON ANSI B31.1. PAR. 104.1.2. FOR PIPE GREATER THAN OR EQUAL TO 1" DIAMETER, THE MIN. WALL VALUE INCLUDES A CORROSION ALLOWANCE OF 0.080". FOR PIPE LESS THAN THAN 1" DIAMETER, THE CORROSION ALLOWANCE IS 0.030".

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART B **SINGLE PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
END OF FUEL CYCLE SEVEN INSPECTIONS (UNIT 2)						
3/87	CONDENSATE PIPING FROM DRAIN COOLER TO 1ST HEATER	2	20/0.593	0.516	.580-.720 (1 ELBOW)	SEE NOTE 4 FOR ALL LOCATIONS
4/87	CONDENSATE PIPING FROM 1ST TO 2ND HEATER	2	20/0.593	0.516	.530-.660 (1 ELBOW)	
3/87	CONDENSATE PIPING FROM 2ND TO 3RD HEATER	2	20/0.593	0.516	.540-.760 (3 ELBOWS)	
3/87	CONDENSATE PIPING FROM 3RD TO 4TH HEATER	2	20/0.593	0.516	.540-.780 (3 ELBOWS)	
3/87	CONDENSATE PIPING FROM 4TH TO 5TH HEATER	2	20/0.593	0.516	.540-.830 (3 ELBOWS)	
4/87	CONDENSATE PIPING FROM 5TH HEATER TO RFP SUCTION	2	20/0.593	0.516	.560-.760 (3 ELBOWS)	
4/87	FEEDWATER PIPING FROM RFP TO REACTOR	2	18/1.156	0.987	1.120-1.680 (1 TEE, 1 ELBOW)	
4/87	FEEDWATER PIPING FROM RFP TO REACTOR	2	24/1.531	1.289	1.400-2.300 (1 TEE, 1 ELBOW)	
3/87	FEEDWATER PIPING FROM RFP TO REACTOR	2	12/0.843	0.722	.840-1.200 (1 REDUCER)	
3/87	DRAIN LINE FROM 5TH TO 4TH HEATER	2	8/0.322	0.151	.300-.500 (1 REDUCER)	
3/87	DRAIN LINE FROM 4TH TO 3RD HEATER	2	12/0.375	0.133	.320-.440 (1 REDUCER)	
3/87	DRAIN LINE FROM 3RD TO 2ND HEATER	2	12/0.375	0.112	.340-.860 (1 REDUCER, 1 ELBOW)	

TABLE II

PEACH BOTTOM ATOMIC POWER STATION EROSION/CORROSION INSPECTIONS

PART B **SINGLE PHASE INSPECTION POINTS**

DATE	AREA ID SYSTEM LOCATION	UNIT	NOM DIA/NOM THICK (IN/IN)	MIN WALL** (IN)	THICKNESS RANGE (IN)	COMMENTS
4/87	DRAIN LINE FROM 2ND TO 1ST HEATER	2	14/0.375	0.250	.340-.420 (1 REDUCER)	
4/87	MOISTURE SEPARATOR DRAIN LINE	2	6/0.280	0.135	.230-.320 (2 ELBOWS)	

NOTES

1. REPLACEMENT RECOMMENDED FOR LOCATIONS BELOW SPECIFIED MIN WALL VALUE.
2. EVALUATION BASED UPON ESTIMATED WEAR RATE INDICATED THE PIPING WAS ACCEPTABLE FOR AN ADDITIONAL FUEL CYCLE. REPLACEMENT PENDING NEXT OUTAGE INSPECTION RESULTS.
3. REPLACEMENTS WERE MADE WITH CHROME MOLY MATERIALS (P11).
4. INSPECT NEXT OUTAGE.

DEFINITIONS

** MIN. WALL BASED UPON ANSI B31.1. PAR. 104.1.2. FOR PIPE GREATER THAN OR EQUAL TO 1" DIAMETER, THE MIN. WALL VALUE INCLUDES A CORROSION ALLOWANCE OF 0.080". FOR PIPE LESS THAN THAN 1" DIAMETER, THE CORROSION ALLOWANCE IS 0.030".

COPY

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JOSEPH W. GALLAGHER
VICE PRESIDENT
NUCLEAR OPERATIONS

September 9, 1987

Docket No. 50-352

Mr. W. T. Russell, Administrator
U.S. Nuclear Regulatory Commission
Region I
Attn: Document Control Desk
Washington, DC 20555

Subject: Limerick Generating Station, Unit 1
Response to I.E. Bulletin 87-01 "Thinning of Pipe Walls at Nuclear Power Plants"
Mod Request #5613

Reference: NRC Bulletin No. 87-01 dated 7/9/87

Attachment: Limerick Generating Station, Unit 1
Response to NRC I. E. Bulletin No. 87-01
Thinning of Pipe Walls in Nuclear Power Plants

File: GOVT 1-1 (Bulletins)

Dear Mr. Russell:

The referenced bulletin requests information regarding utility programs addressing pipe wall thinning due to erosion/corrosion under single and two phase flow conditions. Philadelphia Electric's response to the five requested actions is provided in the following attachment. If further information is required, please do not hesitate to contact us.

Sincerely,

JW Gallagher

PRB/pd08218706

Attachment

Copy to: Addressee

E. M. Kelly, Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P. O. Box 47
Sanatoga, PA 19464

8709150245
11 pp.

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ATTACHMENT

Limerick Generating Station Unit 1
Response to NRC I.E. Bulletin No. 87-01
Thinning of Pipe Walls in Nuclear Power Plants

The subject NRC Bulletin was generated as a result of the 1986 Surry feedwater pipe break accident. Licensees were requested to provide the following information concerning their programs for monitoring the wall thickness of pipes in condensate, feedwater, steam, and connected high energy piping systems, including all safety-related and non-safety-related piping systems fabricated of carbon steel.

Information for Limerick Unit 1 in response to I. E. Bulletin 87-01 is provide below

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

   Response:

   The Limerick, Unit 1 program is under development.

   The piping systems presently included in the program scope are listed in Table I. The applicable design code for each system is as shown.

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 repair/replacement decisions.

   Response:

   The inspection program for Limerick, Unit 1 will address carbon steel piping systems subject to single phase or two phase flow erosion/corrosion (E/C). Each is addressed separately below:

Two Phase E/C

Development of a program to address E/C of carbon steel piping subject to wet steam environments is in progress. Since Limerick, Unit 1 has completed only one fuel cycle of operation significant E/C damage is not expected. In addition most of the large diameter piping systems subject to two phase flow such as extraction steam are fabricated from chrome-moly materials. We plan to review piping systems utilizing experience gained form inspections performed at Peach Bottom and fossil stations in order to identify remaining carbon steel piping potentially affected by E/C damage. The analysis will include review of the system operating parameters and whether there are significant pressure drops which could lead to flashing or cavitation. Based on this review a program will be developed to monitor pipe wall thickness for the identified suspect systems.

a. The piping inspection points will include locations in the system where there are abrupt changes in the direction of flow (elbows, tees) immediately downstream of significant pressure drops (orifices, control valves) and at other fittings which cause flow perturbations (reducers, branch connections).

b. The inspection frequency for each of the piping systems will be determined by review of the prior inspection data. Those systems exhibiting high E/C wear rates will be scheduled for more frequent inspection.

c. Inspections will utilize ultrasonic (UT) thickness measurements supplemented by visual examination where practical. PECo chose UT because it provides accurate verifiable data.

d. Repair/replacement decisions will be based upon review of the inspection data, estimating the erosion rate and comparing it to the design min. wall requirements. All piping below code min. wall or anticipated to encroach on min. wall within the next operating cycle will be scheduled for replacement. Replacements will be made with chrome-moly materials whenever practical.

Single Phase E/C

Following the Surry failure PECo developed a program to detect single phase E/C damage. Piping systems were selected for inspection based upon review of parameters known to contribute to single phase E/C. Systems were initially screened using operating temperature. Those systems operating in the temperature range of high E/C susceptibility were further evaluated based upon bulk velocities and configuration including the spacing between fittings in the overall system. A list of the single phase systems included in the Limerick, Unit 1 program is contained in Table 1.

a. Inspection point selection was primarily based upon temperature, bulk velocity and system geometry. The initial step in inspection point selection was to rank the systems or subsystems for potential E/C damage using operating conditions. These system data points were plotted on a graph which relates velocity and temperature to a predicted E/C rate for a given geometry. This graph is shown in Figure 1. Pipe geometry factors were then applied to the various components in each system to prioritize inspection locations. The final locations selected represent the highest rated components for potential E/C damage. A total of 26 locations were chosen.

b. Since no baseline thickness data is available for comparison, we intend to perform inspections during the next two refueling outages in order to establish E/C wear rates. The inspection frequency for subsequent outages will be determined based upon evaluation of the inspection data and the estimated wear rates.

c. This section is identical to the description provided for two phase flow.

d. This section is identical to the description provided for two phase flow.

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 10 pipe diameters apart).

   c. pH of water in the system (e.g. pH less than 10).

   d. System temperature (e.g. between 190 and 500F).

e. Fluid bulk velocity (e.g. greater than 10ft/sec.).

f. Oxygen content in the system (e.g. oxygen content less than 50 ppb).

Response:

The evaluation of each parameter listed above in the selection of inspection locations is discussed below:

a. Piping material composition can have a significant affect on the E/C rate of a component. Most severe E/C damage has occurred in plain carbon steel piping systems. Small additions of Cr, Cu and Mo can significantly reduce E/C damage of carbon steels. However, specific chemical analysis information for the systems included in the program for Limerick, Unit 1 was not available. Therefore, the carbon steel pipe material was considered identical for all system components and was not used for selecting inspection points within a system.

b. Piping configuration is an important factor contributing to the E/C rate. The relationship of piping geometries that produce the greatest turbulence also produce the highest E/C rates. Pipe component geometry and the spacing between components was considered within each system to identify and prioritize inspection locations.

c. Limerick, Unit 1 is a BWR with neutral pH. As pH levels increase above 9.2, E/C is reduced. Since pH was constant throughout the systems evaluated it was not considered for inspection point selection.

d. Fluid temperature was considered for rating the pipe systems or subsystems in terms of the predicted E/C rate. Temperature versus E/C rate has a peak between 240 to 300F. The number of inspection locations is greater for systems operating in this temperature range.

e. Fluid bulk velocity coupled with pipe configuration produce turbulent flow. Flow in conjunction with temperature determine the E/C rate. Velocity and temperature were used for ranking the pipe systems. Velocity and pipe geometry were used for selecting the inspection locations within a system.

f. The oxygen content of the water strongly affects the E/C rate of carbon steel. The data curves for oxygen content versus E/C rate vary considerably; however, the oxygen levels are relatively constant for the piping systems evaluated; therefore, oxygen was not specifically considered for selecting inspection locations.

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 instruments, test method, reference thickness, locations examined, means for locating measurement points 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.

<u>Response:</u>

A chronological listing of inspections performed at Limerick, Unit 1 during the first refueling outage is provided in Table II.

a. The inspections listed in Table II were specifically intended to measure wall thickness in response to E/C concerns.

b. A description of the piping inspected is provided in Table II. All of the inspections were performed utilizing manual UT techniques. The inspectors were qualified in accordance with SNT-TC-1A and the procedures prepared by a qualified Level III.

   The inspection results listed in Table II are from single phase flow piping systems. As mentioned previously, the two phase flow inspection program is under development. Since Limerick, Unit 1 had only been operating for one fuel cycle, the primary purpose for performing the inspections was to gather baseline thickness data. The single phase examinations are generally performed on large diameter lines. Scans are concentrated on inspection bands in regions where E/C damage would most likely occur. The minimum value detected and the thickness range are recorded. If an area is found to be below the specified value, the area is mapped, a grid established and the min. value located and recorded.

c. Thickness measurement results are recorded in Table II. The specified minimum wall values are also listed.

Measurements thicker than these specified values are considered acceptable. Those measurements thinner than the specified value will require engineering evaluation.

d. If the engineering evaluation determines that a code min.-wall violation is likely during the next operating cycle, replacement of the piping will be scheduled. Wherever practical, replacements will be made using 1 1/4 Cr-1/2 Mo material.

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

Response:

The Limerick, Unit 1 E/C program is still under development. We intend to perform the EPRI Chexal-Horowitz-Erosion-Corrosion (CHEC) analysis for single phase E/C and will amend our program upon evaluation of the results. In addition, we intend to evaluate findings from other utility inspections for their applicability to Limerick.

PRB/pd08198706

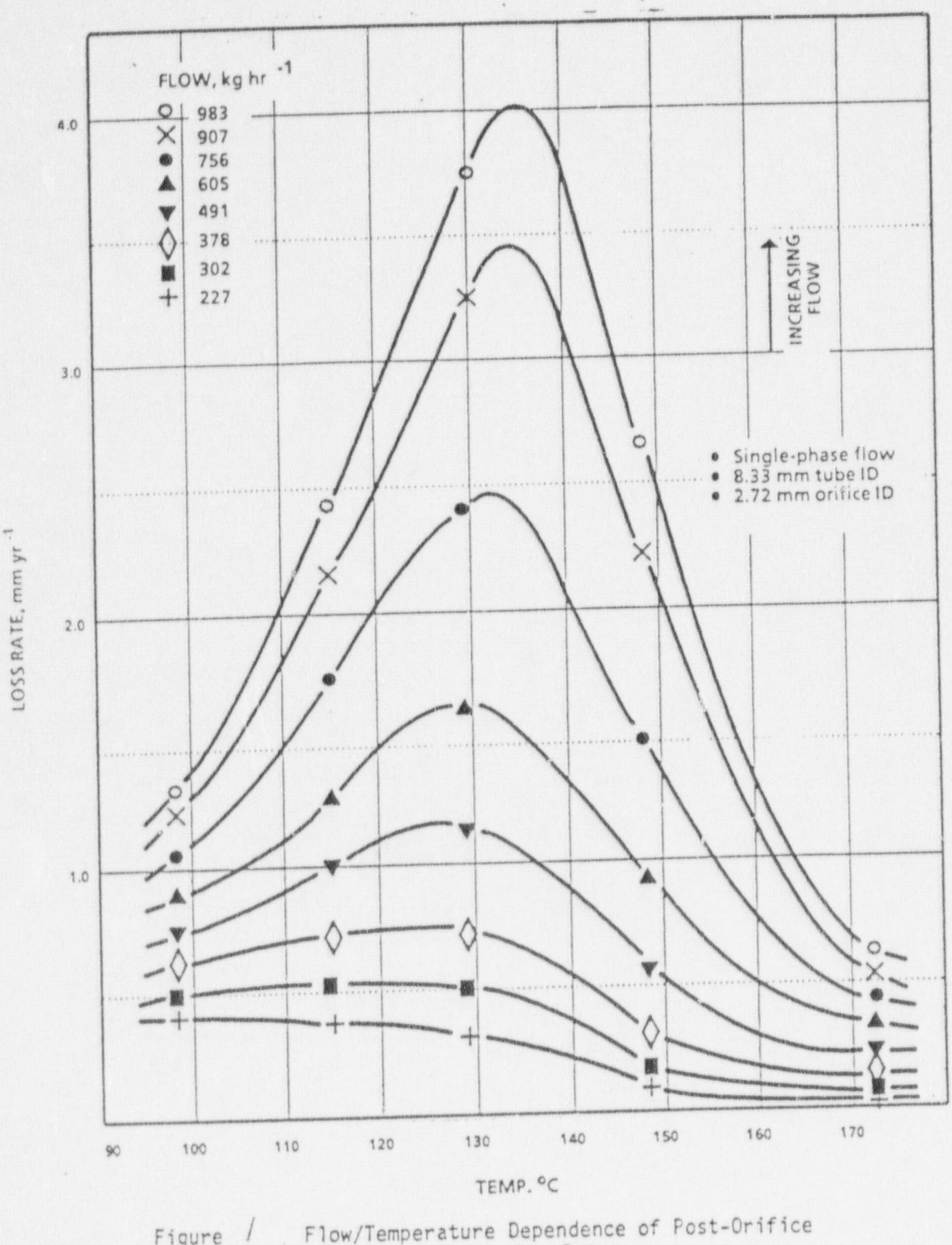

Figure / Flow/Temperature Dependence of Post-Orifice Erosion/Corrosion Rates

Ref. EPRI Report NP-3944 April 1985

Table I

Pipe Systems Inspected for
Erosion/Corrosion Damage

A. Two Phase Flow - Systems to be defined

B. Single Phase Flow - (Bulk velocity)

1. Feedwater piping* (11-19 feet/sec.)

2. Condensate piping (11-15 feet/sec.)

3. Feedwater heater drain piping (3-10 feet/sec.)

4. Moisture separator drain piping (2-7 feet/sec.)

Piping designed in accordance with ANSI B31.1 1971
Pipe materials are A106 Grade B
Fitting materials are A234 Grade WPB

*Portions of system are designed in accordance with ASME Section III Class 1 and 2 1971 Edition with Addenda through Winter 1971.

Class 1 Pipe materials are SA333 Grade 6
Class 1 fitting materials are SA420 Grade WPL

Class 2 Pipe materials are A106 Grade B
Class 2 fitting materials are A234 Grade WPB

PRB/pd08218707

TABLE II

LIMERICK GENERATING STATION UNIT 1

SINGLE PHASE INSPECTION POINTS**

DATE	AREA DESIGNATION SYSTEM LOCATION	NOM DIA/NOM THICK (IN/IN)	MINWALL* (IN)	THICKNESS RANGE (IN)	COMMENTS
	END OF FUEL CYCLE ONE				
6/87	FW PIPING 2ND TO 3RD FW HEATER	20/0.594	0.464	.580-.710	ELBOW
6/87	FW PIPING 3RD TO 4TH HEATER	20/0.594	0.464	.570-.940	ELBOW
6/87	FW PIPING 4TH TO 5TH FW HEATER	20/0.594	0.464	.580-1.020	ELBOW
6/87	FW PIPING FW PUMP TO 6TH HEATER	20/1.5	1.390	1.560-2.200	REDUCER
				1.400-2.000	ELBOW
		16/1.21	0.980	2.500-3.400	VALVE BODY
6/87	FW PIPING 6TH HEATER TO CONTAINMENT WALL	20/1.5	1.211	1.750-2.000	ELBOW
6/87	MOIST SEP OR MOIST SEP TO U/S OF 4TH FW HEATER	8/0.332	0.187	.290-.450	REDUCER
		6/0.280	0.162	.260-.350	REDUCER
6/87	HEATER DRAIN 4TH HEATER TO U/S OF 3RD HEATER	14/0.375	0.134	1.000-1.200	VALVE BODY
		16/0.375	0.141	.370-.500	ELBOW
6/87	HEATER DRAIN 6TH HEATER TO U/S OF 5TH HEATER	6/0.280	0.162	.300-.580	ELBOW
		8/0.322	0.187		

* MIN. WALL BASED UPON ANSI B31.1 PAR. 104.1.2. FOR PIPE GREATER THAN OR EQUAL TO 1" DIAMETER, THE MIN. WALL VALUE INCLUDES A CORROSION ALLOWANCE OF 0.080". FOR PIPE LESS THAN 1" DIAMETER, THE CORROSION ALLOWANCE IS 0.030".

** THESE MEASUREMENTS WERE MADE AFTER THE FIRST FUEL CYCLE WAS COMPLETED. THEY THEREFORE REPRESENT BASELINE DATA.