NORTHEAST UTILITIES
THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

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September 21, 1987

Docket No. 50-336
A06675
Re: PWR Erosion-Corrosion

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
PWR Erosion - Corrosion Questionnaire

In a letter dated July 16, 1987,(1) the NRC Staff requested, in the form of a questionnaire, specific information regarding water chemistry data and plant-specific design details for Millstone Unit No. 2. This data is to be accumulated by selected utilities and forwarded to the Staff for inclusion into a comprehensive data collection on erosion/corrosion control in nuclear power plants. It was acknowledged in Reference (1) that the information requested was quite extensive and would require diligent efforts to assure accurate and timely completion of the questionnaire.

Northeast Nuclear Energy Company (NNECO), in an effort to support the concerns of both the NRC Staff and the nuclear industry, is providing in this submittal the majority of the information requested. NNECO believes that positive and affirmative actions have been taken at Millstone Unit No. 2 to enhance the safety of plant personnel associated with balance of plant piping susceptible to erosion/corrosion wear. It should be noted that NNECO submitted an unsolicited letter dated June 10, 1987,(2) one month before Bulletin 87-01 was issued, regarding our inspection program plans. In our response to Bulletin 87-01 dated September 11, 1987,(3) NNECO provided comprehensive details of our past inspection programs and future plans to incorporate the NUMARC working group initiative into our current inspection programs.

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(1) D. H. Jaffe Letter to E. J. Mroczka "Millstone Nuclear Station, Unit 2 - Water Chemistry," dated July 16, 1987.

(2) E. J. Mroczka letter to U. S. Nuclear Regulatory Commission, "Piping Inspection Program to Detect Erosion/Corrosion Wear," dated June 10, 1987.

(3) E. J. Mroczka letter to W. T. Russell, "Response to IE Bulletin 87-01," dated September 11, 1987.

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NNECO believes that with our past and current inspection programs, future programmatic initiatives, and information submitted to date and herein, NNECO demonstrates a clear commitment toward addressing erosion/corrosion wear in secondary plant system piping. Consequently, we believe that adequate information has been provided to the NRC Staff.

If the information in this submittal is not sufficient to satisfy NRC Staff needs, please contact us to discuss this matter further.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

E. J. Mroczka

E. J. Mroczka
Senior Vice President

By: C. F. Sears
Vice President

Attachment

cc: W. T. Russell, Region I Administrator
D. H. Jaffe, NRC Project Manager, Millstone Unit No. 2
T. Rebelowski, Resident Inspector, Millstone Unit Nos. 1 and 2

Docket No. 50-336
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Attachment

Millstone Nuclear Power Station, Unit No. 2
PWR Erosion-Corrosion Questionnaire

September 1987

ENCLOSURE

PWR EROSION-CORROSION QUESTIONNAIRE
(Check or Circle All Applicable)

Utility Company: Northeast NEC Unit Name: Millstone 2 MWe 890

Filled by: Northeast Nuclear Energy Company Date: 10/18/87 Phone No. 203-447-1791

In service: 1975... Water Treatment: (AVT) with (ammonia), morpholine, (hydrazine).

Condensate polishers: none, cation, powdex, (mixed bed) 0-100% of feedwater flow;
installed 19 ....; operated in: (H-OH), NH4-OH form.
Cooling water: fresh, (salt), brackish, cooling tower.
Copper alloy condenser tubing: yes, (no) Copper alloy FW heater tubes: (LP), HP, none.
Boric acid used since: 19 ...; during: operation, layup, low load soaks, other N/A...

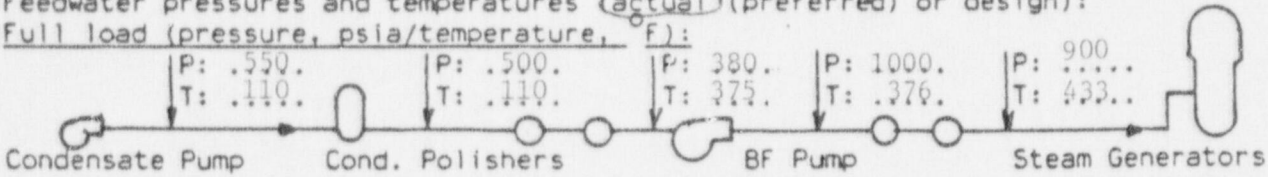
A. EROSION-CORROSION EXPERIENCE

1. Erosion-Corrosion identified in wet steam piping: (yes), no.
2. Erosion-Corrosion of MSR Chevrons or mesh: yes, (no).
   Chevron material: (stainless steel), carbon steel, other .....
3. Erosion-Corrosion of feedwater piping: yes, (no). Date found ..... Small sample inspection
   Feedwater piping materials: Carbon steel.....
4. Erosion-Corrosion of: ..... elbows, ... Ts, ... diffusers, ...: reducers, ... valves, ... orifices, ... other components (specify). N/A.....
5. Erosion-Corrosion of J-Tubes: yes, (no). Visual inspection only
6. Erosion-Corrosion of feedwater distribution ring: yes, no. N/A, no inspections
7. Erosion-Corrosion of turbine: HP, (LP); identify components: Minor bucket.....
8. Erosion-Corrosion of other cycle components (identify) .N/A.....
9. Feedwater temperature range where erosion-corrosion found: from ... to ... °F
10. Inspection frequency for feedwater piping .N/A. years. Steam lines ..1.. years.
11. Inspection methods used: (ultrasonic thickness), radiography, visual, other.....
    New program has just been implemented.

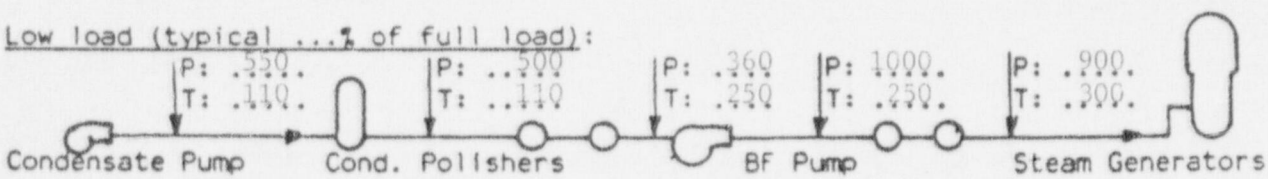
B. PIPING DESIGN

1. Maximum feedwater flow velocity .....23..... feet/second.
2. No. of feed pumps operating at 100% load ...2..., second pump On at ..60..% load.
3. Maximum flow velocity when only 1 pump is operating ..12..... feet/second.
4. No. of feedwater piping components: ..... elbows, ... Ts, ... diffusers, ... reducers, ... valves. ..... orifices, ... other components (specify) Various depending on Line/up.....
5. Maximum flow velocity in wet steam piping ..150..... feet/second.
6. Feedwater pressures and temperatures (actual) (preferred) or design):

Full load (pressure, psia/temperature, °F):



Low load (typical ...% of full load):



Please attach copies of the heat balance diagrams for your actual full load and typical low load.

C. FEEDWATER AND CONDENSATE CHEMISTRY

1. Please complete the attached Table.
2. Feedwater chemistry history (average or typical values, final feedwater):

OPERATING CYCLE (See Table 1 and 2)

Year of oper.:	1st	1974	1976	1978	1980	1982	1983	1985	1986	1987
		1	2	3	4	5	6	7	8	
pH of FW maximum		Nominal	9.20							
minimum		Nominal	8.80							
average		8.83	8.77	8.88	9.03	8.96	8.89	8.80	8.89	
pH of condensate										
maximum		Similar to Feedwater Values								
minimum		"	"	"	"					
average		"	"	"	"					
DO, ppb maximum										
minimum										
average		3.4	3.7	5.3	4.0	2.4	2.3	3.2	0.8	
Cat. Cond. uS/cm		Typical Range	0.06-0.2 MS							
Spec. Cond. uS/cm		Typical Range	2.0-3.0 MS - Varies with PH							
NH_3, ppb		Typical Range	200-300 ppb - Varies with PH							
N_2H_4, ppb Avg		21.1	8.9	11.5	17.9	27.1	18.9	12.0	21.0	
Boron, ppb		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Air Inleakage, SCFM		≤10	≤10	≤10	≤10	≤5	≤5	≤5	≤5	

Please send any water chemistry summary reports and data.

3. Chemical additions

3.1 Ammonia: typical concentration in feedwater 200 - 300 ppb; added at Polisher outlet
3.2 Hydrazine: typical concentration in feedwater 20.0 ppb; added at Polisher outlet
3.3 Boric acid: typical concentration in feedwater N/A ppb as B; added at N/A

D. MATERIALS

1. Feedwater piping - list ASTM or other specification numbers A-106 Gr.C
2. Wet steam piping: A-106B/Some Cr Mo
3. Attach results of chemical analysis by you or pipe vendors.

Table 1

MILLSTONE 2

OPERATING HISTORY

CYCLE NUMBER 1	DECEMBER 1975 - NOVEMBER 1977
CYCLE NUMBER 2	APRIL 1978 - MARCH 1979
CYCLE NUMBER 3	MAY 1979 - AUGUST 1980
CYCLE NUMBER 4	OCTOBER 1980 - NOVEMBER 1981
CYCLE NUMBER 5	MARCH 1982 - MAY 1983
CYCLE NUMBER 6	JANUARY 1984 - FEBRUARY 1985
CYCLE NUMBER 7	JULY 1985 - SEPTEMBER 1986
CYCLE NUMBER 8	DECEMBER 1986 - PRESENT

TABLE 2

SUMMARY OF CONDENSATE AND FEEDWATER CHEMISTRY AT >15 PERCENT POWER

CYCLE NUMBER	CONDENSATE OXYGEN, ppb			FEEDWATER OXYGEN, ppb			FEEDWATER HYDRAZINE, ppb			FEEDWATER pH		
	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN
1	13.5	100	1.0	3.4	80	0.5	21.1	100	0.5	8.83	9.80	7.20
2	10.3	68	2.0	3.7	27	1.0	8.9	50	1.0	8.77	9.10	8.05
3	11.5	75	2.0	5.3	30	1.0	11.5	75	2.0	8.88	9.35	7.90
4	7.2	44	1.0	4.0	35	1.0	17.9	72	3.0	9.03	9.47	8.55
5	8.7	30	3.0	2.4	14	1.0	27.1	96	1.0	8.96	9.42	8.00
6	5.9	44	1.7	2.3	220	0.5	18.9	180	0.5	8.89	9.92	7.12
7	5.9	10	1.0	3.2	10	1.0	12.0	24	1.0	8.80	9.40	6.86