Don Benson

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUNE 7 1978

Serial No. 343/060778

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Docket Nos. 50-280
and 50-281

NOTED JUN 12 1978 W.L.P.

Virginia Electric & Power Company
ATTN: Mr. W. L. Proffitt
Senior Vice President - Power
Post Office Box 26666
Richmond, Virginia 23261

Gentlemen:

As part of our generic review of secondary system fluid flow instabilities at nuclear power plants, we have reviewed your submittals dated May 10, 1976, and December 2, 1977, for the Surry Power Station, Unit Nos. 1 and 2.

Based on our review, we find that the provisions which you have made for minimizing the likelihood of water hammer events due to the rapid condensation of steam in the feedwater systems at Surry are acceptable. Enclosed is our Safety Evaluation Report supporting our finding.

Sincerely,

A. Schwencer

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Enclosure:
Safety Evaluation Report

cc w/encl:
See next page

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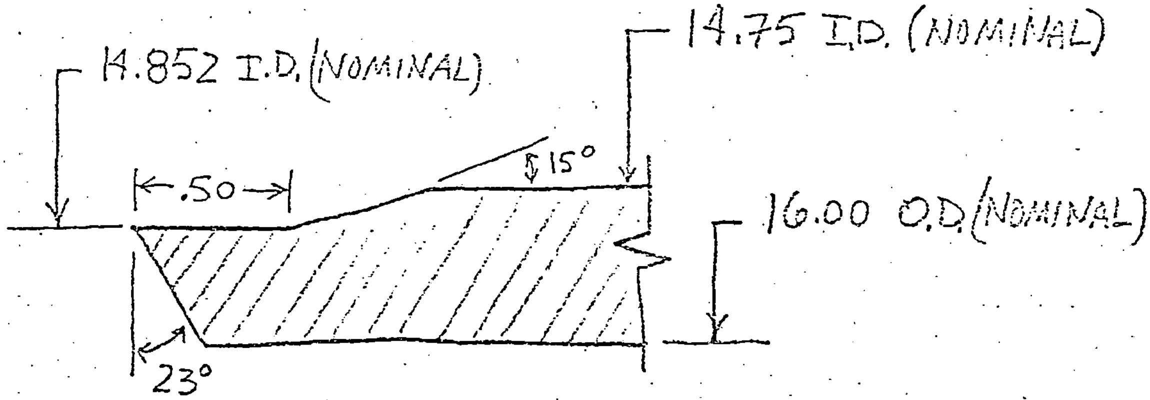
SURRY UNITS 1 & 2

STEAM GENERATOR FEEDWATER NOZZLE
WELD PREP DETAILS



Model 51 Feedwater nozzle 23° WELD PREP
not to scale

CHEMISTRY CONTROL DATA

Refer to Tables 7-2, 7-3 and 7-4 for a comprehensive display of the chemical treatment specifications for various operating and test conditions.

These specifications in general are based on:

1. The use of ammonium hydroxide or an amine for feedwater and steam pH control. Ammonium hydroxide is preferred; however, morpholine and cyclohexylamine are acceptable provided they do not reduce the sensitivity of the free hydroxide determination.
2. The use of non-catalyzed hydrazine for oxygen scavenging in the feedwater train.
3. Continuous blowdown and continuous chemical addition.
4. Limiting the concentrations of contaminants in the feedwater and in the steam generator.

Each chemistry parameter is discussed in detail in the following sections.

7.2.2 Feedwater Chemistry Control Parameters

Both the feedwater and steam systems are once-through systems requiring that any chemical treatment of these systems be based on the AVT concept regardless of the chemistry used in the steam generator. This concept has been adhered to by Westinghouse in its previous and present specifications relating to feedwater chemistry control. Any discrepancy between the specifications stated in Table 7-2 and those required by the equipment supplier must be brought to the attention of Westinghouse and the equipment supplier.

Dissolved Oxygen

For corrosion prevention, oxygen must be eliminated as far as possible from the feedwater entering the steam generator. There must be no detectable oxygen (<0.005 ppm) present in the blowdown under any operating or test condition. Oxygen is controlled by the addition of hydrazine at the discharge of the condensate pumps. THE USE OF SULFITE FOR THIS PURPOSE IS PROHIBITED.

For hot functional testing and hot standby, the concentration of oxygen in the feedwater can be 0.1 ppm or less provided the concentration of hydrazine injected into the steam generator is 3 to 5 times the oxygen concentration in the feedwater source.

Hydrazine

Hydrazine is added to the feedwater to control oxygen as mentioned above. The concentration of hydrazine in the steam drum during hydro and wet layup must be in the range 75 - 150 ppm. For hot functional testing and hot standby the hydrazine concentration in the feedwater should be maintained at 3 to 5 times the oxygen concentration in the feedwater source. For power operation, it is recommended that a hydrazine residual of $\geq$0.005 ppm in excess of the feedwater oxygen be maintained downstream of the highest pressure feedwater heater.

7.2.3 Steam Generator Chemistry Control Parameters

pH

When controlling steam generator chemistry on AVT chemistry it must be recognized that 1) AVT provides no buffering capacity for contaminants entering the steam generator and 2) the steam generator bulk water pH is at or slightly in excess of the neutral pH for water at the operating temperature of the steam generator. The absence of alkalinity in the steam generator at its operating temperature is due to the low ionization of the feedwater pH control amines at these temperatures. Therefore, contaminants entering the steam generator that are more strongly ionized than the feedwater pH control amines have the potential for producing major perturbations to the bulk water either in the form of free hydroxide (from fresh waters) or acidity (sea water or treated circulating water - cooling towers).

Clearly then, the objectives of the steam generator pH control parameters stated in Tables 7-2, 7-3 and 7-4 are to provide a means for controlling free hydroxide or free acidity in the steam generator bulk water to minimize corrosion of the steam generator materials and turbine cycle and to provide a means whereby perturbations to the steam generator chemistry from sources such as condenser leakage can be recognized. Such a determination is possible for alkaline producing fresh water using the relationship between the pH and the concentration of the control amine at a sample temperature of 25°C. Figure 7-1 presents such a relationship for ammonium hydroxide.

In the case of a sea water intrusion into a steam generator on AVT chemistry control a blowdown pH depression is expected. The magnitude of the pH depression at temperature was calculated from data developed by D. J. Turner

WESTINGHOUSE PROPRIETARY

Table 7-2

AVT Steam Generator Steam Side & Feedwater Chemistry Specifications

Chemistry Parameter/10	Cold Hydro/Cold Wet Layup/1	Hot Functional/Hot Shutdown/Hot Standby/3		Startup From Hot Standby				Normal Power Operation/8			
	Blowdown	Blowdown		Feedwater		Blowdown		Feedwater		Blowdown	
	Control	Control	Expected	Expected	Control	Control	Expected	Expected	Control	Control	Expected
pH @ 25°C	10.0 - 10.5	*8.8 - 9.2	*8.8 - 9.2	*8.8 - 10.0/5		*8.5 - 10.0/5	*8.5 - 10.0/5	*8.8 - 9.2/9		*8.5 - 9.0/9	*8.5 - 9.0/9
Free Hydroxide as ppm $CaCO_3$	N/D	0.15	<0.15			*0.15	*<0.15	N/A		0.15	<0.15
Cation Conductivity μmhos/cm @ 25°C	N/A	*2.0	*<2.0			*7/7	*<7/7	N/A		*2.0	*<2.0
Total Conductivity μmhos/cm @ 25°C	N/A		N/A				N/A	*≤[illegible]			N/A
Sodium, ppm	N/A		<0.1	Not Applicable	Not Applicable		<0.5	N/A	Not Applicable		*<0.1
Chloride, ppm	<0.5		<0.15				<0.5	N/A			<0.15
NH_3, ppm	As pH Requires.		≤0.5				<10.0	≤0.5			≤0.25
Hydrazine, ppm	75 - 150/2		N/A	*[O_2] + 0.005/5	*[O_2] + 0.005/6		N/A	*[O_2] + 0.005	*[O_2] + 0.005		N/A
Dissolved Oxygen, ppb	<100		<5	*<100	*<100	Not Applicable	<5	*<5	*<5		<5
SiO_2, ppm	N/A	Not Applicable	<1.0	N/A			<5	N/A		Not Applicable	<1.0
Fe, ppb	N/A		N/A	<100			N/A	<10			N/A
Cu, ppb	N/A		N/A	<50			N/A	<5	Not Applicable		N/A
Suspended Solids, ppm	N/A		<1/4	N/A	Not Applicable		N/A	N/A			<1.0
Blowdown Rate, gpm/SG	N/A		As Required.	N/A		Maximum	Maximum	N/A		As required to Maintain control parameters.	

*Instrumented Measurement Recommended.

N/A Not Applicable.

Comments: /1 Condensate quality makeup water shall be used exclusively in achieving these conditions.

/2 During Cold Hydro, some decomposition of hydrazine is anticipated; sufficient hydrazine should be added with the makeup to re-establish the Cold Wet Layup conditions at completion of the test.

/3 Feedwater (Auxiliary Feedwater) shall be of condensate makeup quality to which ammonium hydroxide and hydrazine are added at the inlet into the steam generator for pH and dissolved oxygen control. The hydrazine shall be added at a rate to achieve a hydrazine concentration equivalent to 3 - 5 [O_2].

/4 During hot functional testing, higher than normal suspended solids are anticipated; blowdown should be maximized to reduce the steam generator solids content to the concentration specified.

/5 Departure from the normal 8.8 - 9.2 pH range allows for increased NH_3 resulting from decomposition of hydrazine used for feedwater system layup.

/6 Hydrazine level should exceed oxygen level by 5 ppb.

/7 During startups, up to 48 hours from the initiation of plant loading, additional latitude from normal operating specifications is provided because increased levels of contaminants are anticipated.

/8 Operation outside the control parameters specified for normal power operation is governed by the limiting conditions specifications.

/9 If the fluid in the condensate, feedwater and steam systems does not come in contact with copper or its alloys, the allowable feedwater pH may be increased to 9.6. Conductivity, pH and NH_3 concentrations in all cases are governed by Figure 7-1.

/10 The frequency of analyses are identified in Table 9-1.

TABLE 3-2 (CONT'D)

SURRY POWER STATION, UNIT 1

NOZZLE AND PENETRATION SUMMARY

System and Prob. No.	Total No. of Nozzles and Pene-trations	No. Accep-table Evaluation (Complete)	No. Under Evaluation	Modifi-cations or Additions Required	Comment	
322B	1/1	1/*	N/A/0		Original ARS	3.11
334B	1/1	1/*	N/A/0		SSI/ARS	3.13
Aux. Feedwater						3.16
417	0	N/A	N/A	N/A	SSI-ARS	3.18
607	3	2	1	0	SSI-ARS	3.21
Pressurizer Spray & Relief						3.24 3.25
636	1	0	1		Incomplete	3.27
630	5	*	*		Incomplete	3.29
Residual Heat Removal						3.32 3.33
540	0	N/A	N/A	N/A		3.35
508	4	0	4		Incomplete	3.37
Service Water						3.40
465	4	4	0	0	SSI-ARS	3.42
Component Cooling						3.45
488/480	4	*	*		Incomplete	3.47
507/481	4	*	*		Incomplete	3.50
614	0	N/A	N/A			3.52
512	0	N/A	N/A			3.54
603A	1				Incomplete	3.56

*Stress analysis not complete; loads not available
N/A not applicable

TABLE 3-2 (CONT'D)

SURRY POWER STATION, UNIT 1

NOZZLE AND PENETRATION SUMMARY

System and Prob. No.	Total No. of Nozzles and Penetrations	No. Acceptable Evaluation (Complete)	No. Under Evaluation	Modifications or Additions Required	Comment	
546/5600						2.25
546/5620						2.27
548C						2.29
547	0	N/A	N/A	N/A	Original ARS	2.31
744/754	1	0	1		Incomplete	2.33
548A	0	N/A	N/A	N/A	SSI-ARS	2.35
548B	1	1	0	0	SSI-ARS	2.37
544	2/2	2/2	0/0	0/0	SSI-ARS	2.39
544A	2	2	0	0	SSI-ARS	2.41
544B	2	1	1	0	Original ARS	2.43
751	2	2	0	0	Original ARS	2.45
562/546	0	N/A	N/A	N/A		2.47
745	1	0	1		Incomplete	2.49
Main Steam						2.52
323A	1/1	1/*	0/0	0/0	SSI-ARS	2.54
322A	1/1	1/*	0/0		SSI-ARS	2.57
334A	1/1	1/*	0/0		SSI-ARS	3.1
346	0/3	*	*		Incomplete	3.3
Feedwater						3.6
323B	1/1	1/*	N/A/0		SSI-ARS	3.8

*Stress analysis not complete; loads not available
N/A not applicable