PSNH

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July 29, 1986

SBN-1174
T.F. B7.1.2

United States Nuclear Regulatory Commission
Washington, DC 20555

Attention: Mr. Vincent S. Noonan, Project Director
PWR Project Directorate No. 5

References: (a) Construction Permit CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444.

(b) PSNH Letter (SBN-1166), dated July 21, 1986 "Temporary Onsite Storage of Low Level Radioactive Waste (LLRW)" G. S. Thomas to V. S. Noonan

Subject: Maximum Expected Waste Generated by Steam Generator Blowdown Evaporators

Dear Sir:

In response to NHY's letter of July 21, 1986, Reference (b), additional information was requested by your staff regarding the volume of waste that could be generated from the operation of the Steam Generator Blowdown (SGBD) evaporators.

The volume of waste generated from the SGBD evaporators, at the maximum primary to secondary leak rate allowed by Seabrook Station Technical Specification 3.4.6.2.(c), is expected to be approximately $7ft^3$ per day. Additionally, Seabrook Station's Secondary Chemistry Program would restrict plant operations after seven days as a result of exceeding action level chemistry parameters. The anticipated total volume of waste for Seabrook Station, using a cement solidification factor of 1.4, would not be expected to exceed $71ft.^3$.

The attached enclosure provides the calculations to support the expected total volume of waste. If you have any questions regarding this matter, please contact Dr. Jerry Kwasnik at (603) 474-9574, extension 4053.

Very truly yours,

George S. Thomas

Enclosure

cc: ASLB Service List

B001
1/1

ENCLOSURE TO SBN-1174

CALCULATION - WASTE VOLUME FROM STEAM GENERATOR BLOWDOWN EVAPORATORS

Parameters

1. Primary to Secondary leakage at maximum allowed by Technical Specification 3.4.6.2.(c) 500 gal/day

2. Major contribution to evaporator solids

   a) Boric Acid - from leak:
   Reactor Coolant Boron 500 PPM

   b) Filterable Solids - Predominantly iron and copper sludge:
   1800 lbs/yr.
   Reference - EPRI reports
   NP-2977
   NP-516

   c) Dissolved Solids - ionic constituents:
   limited by Secondary Chemistry Program.
   Cation conductivity limit would
   restrict significant dissolved solids to
   <<0.1PPM

3. Solids are concentrated to 12% W/O
   Reference - FSAR Chapter 11.2

4. Cement solidification volume increase factor 1.4

5. Secondary Chemistry Program would restrict power operations after seven days as a result of the action level parameter for cation conductivity with boric acid in the Steam Generator in excess of 4PPM.

Calculation

a) Boric Acid Contribution (lbs/day)

$$= \frac{(.35\text{GPM})(500\text{PPM Boron})\left(\frac{6.1}{\text{Boric Acid Conversion}}\right)(3.78\ ^{1}/\text{gal})(1440\text{min/day})}{(4.54.\text{x}\ 10^{5}\ \text{mg/lb})}$$

$$= 12.8\ \text{lbs/day}$$

b) Filterable Solids Contribution (lbs/day)

$$= \frac{(1800\ \text{lbs/yr})}{(365\ \text{day/yr})}$$

$$= 4.9\ \text{lbs/day}$$

c) Dissolved Solids contribution (lbs/day)

$$= \frac{(0.1 \text{mg/l})(3.78 \text{ l/gal})(32{,}000 \text{GPM})(1440 \text{ min/day})}{(4.54 \times 10^5 \text{ mg/lb})}$$

$$= 38.3 \text{ lbs/day}$$

d) Concentrates Volume (ft^3/day)

$$= \frac{(12.8 + 4.9 + 38.3) \text{ lbs solids/day}}{\left(\frac{0.12 \text{ lbs solids}}{\text{lb solution}}\right) \times (62.4 \text{ lbs water/ft}^3)(1.04)}$$

$$= 7.2 \text{ ft.}^3\text{/day}$$

e) Seven Day Generation

$$= 7.2 \text{ ft}^3\text{/day} \times 7 \text{ days}$$

$$= 50.4 \text{ ft}^3$$

f) Solidified Volume

$$= 50.4 \text{ ft}^3 \times 1.4 \text{ (volume increase)}$$

$$= 70.6 \text{ ft}^3$$

Table 2-4

ESTIMATES OF THE QUANTITY OF SECONDARY SYSTEM CORROSION PRODUCTS[1]

PLANT RATING[2]	CORROSION PRODUCT TRANSPORT IN FEEDWATER PER TEN MONTH'S OPERATION[3]					CARBON STEEL (CS) CORROSION[4]	
MWE	FEEDWATER FLOW LBS/HR x 10^6	IRON CONC.[5] (Fe) ppb	COPPER CONC.[5] (Cu) ppb	IRON OXIDE[6] (Fe_3O_4) LBS/YR	COPPER OXIDE[6] (CuO) LB/YR	ESTIMATE CS AREA[7] Ft^2	IRON OXIDE[6] (Fe_3O_4) LBS/YR
1100	15	10	2	1511	274	114,000	642
900	11	10	2	1108	201	100,000	564
500	7	10	2	705	128	68,000	384

NOTES:

(1) The corrosion product estimates in this table are hypothetical. They are intended to illustrate the range of iron and copper corrosion products that may be produced in secondary systems.

(2) Plant ratings are representative of PWR plants.

(3) The feedwater iron and copper constituents are assumed to enter the steam generator.

(4) These data were calculated assuming a corrosion rate of 0.1 mil/yr.

(5) Typical iron (Fe) and copper (Cu) concentrations recorded in operating logs for normal operation are: <10 ppb Fe, <2 ppb Cu.

(6) Feedwater corrosion products are primarily magnetite and copper oxide; steam generator sludge is primarily magnetite and elemental copper.

(7) Estimated areas based on detail study of one plant and adjusted for plants of different rating. Piping and equipment are assumed to be carbon steel and the surface areas are assumed to vary as the power rating ratio raised to the two thirds exponent. Heat transfer tubing is assumed to be copper alloy and the surface areas are assumed to vary directly with the power rating. The heat transfer surface area is approximately 14 x the pipe and equipment carbon steel area.

TABLE 8.2A

PRAIRIE ISLAND 1 & 2

COMPOSITION OF STEAM GENERATOR BLOWDOWN FILTERABLES

Steam Generator	11	11	12	12	21	22	22
Chromium	0.31%	0.30%	0.27%	0.27%	0.46%	0.57%	0.45%
Manganese	0.43%	0.32%	0.70%	0.31%	0.27%	0.36%	0.56%
Iron	81%	79%	81%	73%	94%	89%	87%
Cobalt	<330.	<257.	<277	<238.	<317.	<286.	<305.
Nickel	1.2%	0.66%	1.2%	0.62%	0.56%	0.70%	0.91%
Copper	0.21%	0.45%	0.13%	0.19%	0.15%	0.18%	0.19%
Zinc	508.	432.	693.	361.	0.10%	808.	488.
Mercury	<29.	<22.	<26.	<21.	<23.	<25.	<24.
Lead	0.12%	0.14%	696.	0.13%	727.	0.11%	454.
Arsenic	<27.	<24.	<23.	<20.	<21.	<23.	<21.
Silver	<145.	287.	<139.	≤246.	≤100.	<171.	<200.
Cadmium	≤194.	<105.	<139.	<150.	<100.	<171.	<200.
Titanium	<895.	<908.	<823.	<720.	1.2%	1.6%	1.9%
Tin	<205.	<215.	<255.	<190.	<250.	<470.	<366.
Sample Period	11/28 to 11/30/75	1/9 to 1/11/76	11/13 to 11/15/75	11/21 to 12/24/75	11/19 to 11/20/75	11/15 to 11/17/75	1/28 to 1/30/76

Concentrations in ppm unless otherwise stated.