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DESCRIPTION:
Ltr per our 11-4-74 ltr....trans the following:-

ENCLOSURES:
Addl info concerning the review of the ECCS evaluation model........

ACKNOWLEDGED

DO NOT REMOVE

PLANT NAME: Kewaunee

FOR ACTION/INFORMATION 11-29-74 ehf

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WISCONSIN PUBLIC SERVICE CORPORATION

Public Service

P.O. Box 1200, Green Bay, Wisconsin 54305

December 2, 1974

Mr. Robert A. Purple, Chief
Operating Reactors Branch #1
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Purple:

Subject: Docket 50-305
Operating License DPR-43
ECCS Evaluation Model Parameters

In accordance with the request dated November 4, 1974 for information in regards to information associated with the review of the ECCS Evaluation Model, we submit the following:

Request

Net Free Containment Volume - Justification should include the total gross internal containment volume and the internal structures and equipment and their volumes which are subtracted to obtain the net free containment volume. A discussion of the uncertainties should be provided.

Reply

Table 14.3-2b of the Kewaunee Nuclear Power Plant FSAR Amendment 35, submitted September 4, 1974 states the containment net free volume to be 1,370,000 ft^3. Additional investigation employing the as-built drawing indicate that:

Total Containment Volume	1,563,300 ft^3
Gross Concrete Placed Inside Containment (Including Rebar)	152,550 ft^3
Structural Steel	850 ft^3
NSSS Equipment Support	980 ft^3
Polar C rane	920 ft^3
NSSS Equipment (Steam Generators, Accumulations, Reactor Coolant Pumps, Pressurizer, Reactor Vessel, Reactor Coolant Drain Tanks, Pressurizer Relief Tank)	28,300 ft^3

Piping	7,000 ft^3
Misc. Equipment (Elec., Cables, Motors, Etc.)	6,000 ft^3
Calculated Net Free Volume	1,363,040 ft^3

The volume of the Prairie Island Unit 1 containment which is of the same dimensions as the Kewaunee containment was measured during the leak rate testing program. Its measured volume was 1,364,000 ft^3 $\pm$ 2.5%. Due to internal construction differences, the Kewaunee containment has 23,935 ft^3 additional net free volume. The resultant net free volume at Kewaunee determined by measurement data at Prairie Island and known variations is 1,386,435 ft^3 which is with the measurement accuracy of the calculated net free volume. A value of 1,370,000 ft^3 was employed in the ECCS analysis.

Request

Passive Heat Sinks - Discuss the method of determining the passive containment heat sinks. Identify each heat sink by category (i.e., cable tray, equipment supports, floor grating, crane wall, etc.) and provide surface area, thickness, materials of construction, thermal conductivity and volumetric heat capacity, by component category used in the containment transient analysis code.

Responde

Table 14.3-2b of the FSAR addresses the passive containment heat sinks considered in the ECCS blowdown analysis. Table 14C-7 of the FSAR denotes the structural heat sinks employed in the containment pressure transient analysis by thickness, surface area and category. The information presented on these two tables provides the identification by category, surface area, thickness and material, as requested. To assure that no confusion as to this identification exists, Table 1, attached, is presented. The information presented is the result of an evaluation utilizing as-built drawings, shipping weight information, and purchase order documentation.

Table 14.3-4 of the FSAR presents the thermodynamic properties of the heat sinks within the containment. Table 1 also includes tabulation of these parameters.

Request

Starting Time of Containment Cooling System(s) - Discuss the factors that show that the start time(s) assumed in the containment response analysis represent the earliest possible initiation of system(s) operation.

Response

Table 14.3-2b of the FSAR identifies the minimum starting time of the containment fan coolers. Page 8.2-12 of the FSAR addresses the loading sequence with and without loss of off-site power. Figure 8.2-1 of the FSAR presents the time frame of sequential loading the safeguard buses in case of an accident, with time zero being at energization of the safeguard 4160 volt bus. If the bus is energized, time zero is the initiation of the safety injection signal. The preoperational test program verified that the loading sequence presented in Figure 8.2-1 of the FSAR is accurate.

Request

Containment Initial Conditions - Compare the initial values of temperature, pressure and relative humidity in the containment with the range of values that will be permitted during plant operation.

Response

Operating experience at Kewaunee indicates that the temperature and pressure valves stated on Table 14.3-2b are minimum values. Nominal operating average temperature for the Kewaunee containment is approximately 120°F. Containment internal pressure typically is above 14.7 psia due to its isolation from the outside environment and the continual in-leakage from instrument and control air regulators. Vapor pressure within the containment is determined by fan cooler temperature which results in approximately a 0.3 psia vapor pressure. Sensitivity studies of vapor pressure effect upon the blowdown analysis indicate a negligible effect exists.

Request

Containment Spray Water Temperature - Show that the value of containment spray water temperature used in the containment response analysis is the lower bound temperature consistent with plant operating conditions.

Response

The refueling water storage tank which supplies containment spray water is enclosed within the heated auxiliary building. The average auxiliary building temperature is approximately 75°F due to heat losses of piping within the building. The ECCS analysis value specified on Table 14.3-2b of the FSAR is realistically conservative.

Request

For the most severe break provide the following information:

a) Fan-cooler heat removal rate as a function of containment atmosphere temperature. Show that minimum operational values of service water temperature have been used in determining the fan-cooler heat removal rate.

b) Mass and energy release rates to the containment as a function of time during the blowdown, refill, and reflooding periods of the accident. Include any spilled ECCS water.

Response

a) Figure 1, attached provides the fan cooler heat removal rate as a function of containment atmosphere temperature. The variation between the 35°F cooling water temperature and analysis value of 32°F temperature is negligible.

b) Table 2, attached, provides the blowdown mass and energy releases as a function of time for the most severe break. Table 3, attached, provides the reflood mass and energy releases as a function of time. Table 4, attached, provides the broken loop accumulator flow to the containment as a function time.

Amendment 35 to the FSAR, submitted September 4, 1974 in addition to the attached, should provide the information requested to permit the review of Kewaunee's compliance with the criteria set forth in paragraph 50.46(b), "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Cooled Nuclear Power Reactors", of 10 CFR Part 50.

Yours very truly,

M E Stone For

E. W. James
Senior Vice President
Power Generation & Engineering

EWJ/ml

Attach.

TABLE 1

Linings	Material	Exposed Area, Ft^2	Thickness (In.)
Containment Cylinder	Carbon Steel	41,300	1.5
Containment Dome	Carbon Steel	17,300	0.75
Reactor Vessel Liner	Carbon Steel	1,260	0.25
	Concrete Backup		12.00
Refueling Canal	Stainless Steel	1,100	0.25
	Concrete Backup		12.0
	Stainless Steel	5,500	0.25
	Concrete Backup		12.0

Steel Structures

The following items have been grouped according to the indicated thickness:

HVAC Duct	Carbon Steel	32,000	0.25
NSS Support	Carbon Steel	44,000	0.5
Crane & Crane Rail	Carbon Steel	14,700	0.75
Handrails	Carbon Steel	1.695	0.145
Grating	Carbon Steel	12,400	0.09
Exposed Pipe		6,800	0.375
Exposed Conduit and Cable Trays	Carbon Steel	6,000	0.1
Ductwork	Carbon Steel	22,000	0.1875
Accumulators	Carbon Steel	2,200	1.44
Ventilation Equip.	Carbon Steel	13,125	0.1875

Concrete structures inside containment used in the calculation include:

Heavy Walls	40,800 ft^2	12 in. thick
Heavy Floors	25,070 ft^2	6 in. thick
Light Floors	7,570 ft^2	3 in. thick

Material	Thermal Conductivity $\frac{BTU}{hr\ ft\ °F}$	Heat Capacity $\frac{BTU}{ft^3\ °F}$
Steel	26.0	56.2
Concrete	0.8	32.0

TABLE 2

BLOWDOWN MASS AND ENERGY RELEASES FOR WPS DECLG FOR $C_D = 0.4$

TIME (SECONDS)	MASS FLOW (10^3 lb_m/sec)	ENERGY FLOW (10^6 BTU/sec)
0	9.47	5.06
0.5	49.2	26.15
1.0	45.07	23.97
1.4	40.74	21.77
1.6	39.11	20.97
2.0	35.35	19.11
2.5	30.26	16.48
3.0	26.1	14.28
4.0	20.12	11.04
5.0	19.12	10.49
6.0	18.23	10.15
7.0	16.99	9.84
8.0	14.40	9.03
9.0	9.96	7.20
10.0	7.95	6.17
12.0	6.39	4.94
14.0	7.31	4.69
16.0	4.82	2.81
18.0	3.42	1.35
20.0	0.017	0.024

TABLE 3

REFLOOD MASS AND ENERGY RELEASES FOR WPS

DECLG FOR C_D = 0.4

Time (Seconds)	Total Mass* Flowrate (lbm/sec)	Total Energy* Flowrate (10^5 BTU/sec)	Spilling Mass Flowrate (lbm/sec)	Spilling Energy Flowrate (10^5 BTU/sec)
33.5	0	0	0	0
34.0	0	0	0	0
34.5	0.4414	0.00571	0	0
38.6	33.64	0.435	0	0
47.9	179.75	0.942	136.0	0.302
63.6	232.8	1.018	156.6	0.344
83.65	240.92	1.001	195.9	0.417
106.37	245.23	0.975	201.5	0.415
131.2	248.57	0.953	207.2	0.415
187.1	254.43	0.892	216.7	0.403
252.4	260.3	0.889	226.02	0.388

*Total mass and energy flowrate includes spilling mass and energy flowrate.

TABLE 4

Broken Loop Accumulator Flow To The Containment For WPS DECLG For $C_D = 0.4$

TIME (Seconds)	MASS FLOW RATE (10^3 lbm/sec)	ENERGY FLOW RATE (10^3 BTU/sec)
0	0	0
1.0	4.46	258.68
2.0	4.19	243.02
4.0	3.78	219.24
6.0	3.48	201.84
8.0	3.24	187.92
11.0	2.95	171.1
12.0	2.87	166.46
14.0	2.74	158.92
16.0	2.61	151.38
18.0	2.51	145.58
20.0	2.41	139.78

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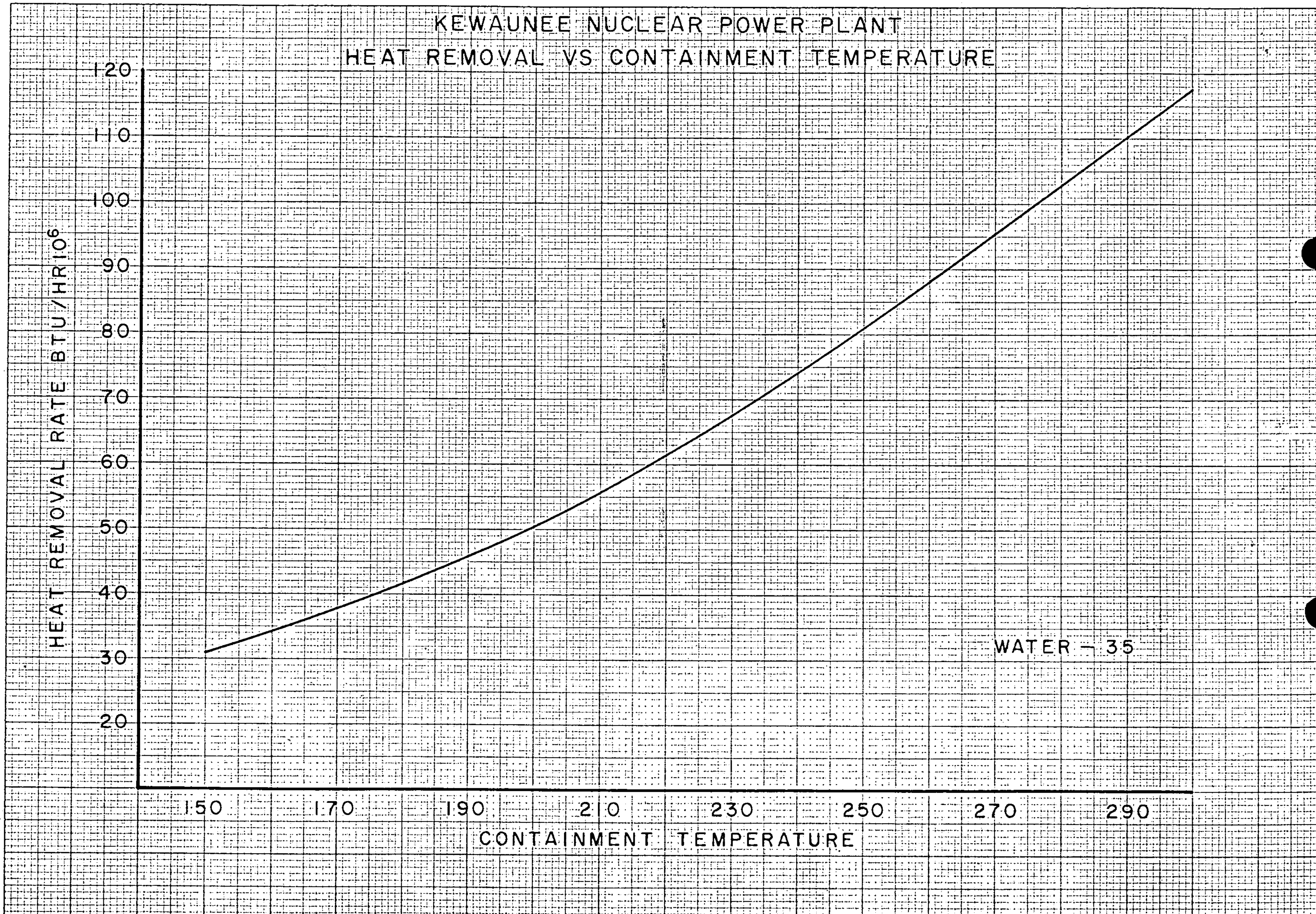

FIGURE 1