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October 10, 1975

Mr. Benard C. Rusche
Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. R. A. Purple, Chief
Operating Reactors Branch 1

Re: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Mr. Rusche:

With regard to your letter of September 8, 1975 concerning the need for additional information relative to assumptions made in Topical Report BAW-10103, the attached response is provided.

Very truly yours,

William O. Parker, Jr.

William O. Parker, Jr.

MST:vr

Attachments

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
FORWARDED BY MR. R. A. PURPLE'S LETTER OF
SEPTEMBER 8, 1975

Question

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.

RESPONSE

A summary of the gross containment internal volume and the internal structures and equipment volumes are presented in Table 1. The Oconee values were calculated from the as-built information and contain a minimum of uncertainty. The 20 percent conservatism in the Oconee volume as compared to the BAW-10103 is more than adequate to account for uncertainties which may exist.

Question

Passive Heat Sinks - Provide the actual passive heat sink structures for your plant. Discuss the method of determining the passive containment heat sinks. Identify each heat sink by category (i.e., cable tray, equipment support, 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.

RESPONSE

The passive heat sink data was calculated based upon a review of as-built design information. In support of these calculations, the containment heat sink data for Duke Power Company supplied components is described in Table 2 and the heat sink data for Babcock and Wilcox supplied equipment is described in Table 3. A summarization of the total Oconee heat sink data in comparison to those values provided in BAW-10103 is presented in Table 4. The slight variations in the values of Table 4 relative to the July 9, 1975 ECCS submittal are the result of further refinement of the calculations of Babcock and Wilcox supplied equipment.

Question

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

Topical Report BAW-10103 assumes a starting time of zero for the Reactor Building cooling units. This is compatible with Oconee operation since the Technical Specifications require operation of the Reactor Building cooling units during reactor operation.

With regard to the Reactor Building Spray System, BAW-10103 assumes a starting time of 65 seconds assuming no loss of off-site power. The actual time delay, including ESF time delay, pump starting time and the time necessary to fill the spray headers has been calculated to be 83.6 seconds for Oconee. Therefore, the Oconee units are quite conservative relative to the generic model utilized in BAW-10103.

Question

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

The initial containment temperature, pressure and relative humidity used in BAW-10103 were derived from measured data at Oconee Unit 1. These initial conditions continue to be conservative for this analysis.

Question

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 and that the spray flow rate used is suitably conservative.

RESPONSE

The containment spray water temperature assumed in BAW-10103, $40^{o}F$, is the lowest temperature which is permitted by Oconee Technical Specifications. Therefore, the values assumed are suitably conservative. The Oconee spray flow rate is less than the 1800 gpm assumed in BAW-10103.

Question

Fan-Cooler Heat Removal Rate - Compare the maximum fan-cooler heat removal rate for your plant with that assumed in BAW-10103. Show that minimum operational values of service water temperature have been used.

RESPONSE

The maximum fan-cooler heat removal rate obtained from data presented in the FSAR and modified for 40F cooling water temperature is compared to that used in BAW-10103, in Figure 1. As can be seen from this comparison, the fan cooler heat removal rate assumed in BAW-10103 is equal to or greater than that for Oconee at any given containment (RB) atmosphere temperature. The service water temperature used in both cases is 40F, however, the minimum operational value stated in the FSAR is 45F thereby adding additional conservatism.

Question

If any of the above parameters are less conservative for your plant than used in the generic evaluation of BAW-10103, provide the sensitivity of these parameters to the overall containment pressure response. This evaluation should demonstrate the overall conservatism of your containment parameters to those used in BAW-10103.

RESPONSE

In the preceding responses, it has been shown that containment volume, Reactor Building Cooling System initiation times and capacities, initial atmospheric conditions, and spray water temperatures for the Oconee units are conservative in relation to the generic model used in BAW-10103.

With regard to containment heat sink data, Table 4 reflects variations between Oconee Nuclear Station and BAW-10103 data; however, the net effect is conservative. This is clearly evident by a comparison of the total internal steel volume and concrete area used at Oconee (5979 ft^3 and 152,791 ft^2) as opposed to that assumed in the generic model (9219 ft^3 and 245,785 ft^2). Since the values of steel and concrete used at Oconee are very conservative and several orders of magnitude more than any other heat sinks, the overall conservatism of the Oconee heat sinks plus the smaller net free containment volume will yield a higher containment backpressure than calculated in BAW-10103.

TABLE 1

OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK DATA

Volume Information

1. Gross Volumes	
Lower Compartment (ft^3)	730,958
Upper Compartment (ft^3)	1,314,947
Total Containment (ft^3)	2,045,905
2. Internal Structures Volume	
Lower Compartment	
Civil Items (ft^3)	142,567
Electrical Items (ft^3)	5,122
Mechanical Items (ft^3)	7,878
Upper Compartment	
Civil Items (ft^3)	34,669
Babcock and Wilcox Co. Supplied Equipment	
Volume of Primary Equipment (Fluid Volume Only)(ft^3)	12,185.3
Volume of Secondary Side Equipment (Steam Generators)(ft^3)	6,982.7
Volume of Passive Heat Sinks (ft^3)	1,568.0
Fluid Volume of 2 CFT's and Piping (ft^3)	2,900.0
TOTAL	213,872 ft^3
3. Net Free Containment Volume (ft^3)	1,832,033

NOTE: The dividing line between the upper and lower compartments is the operating floor, Elevation 844 + 6.

TABLE 2

OCONEE NUCLEAR STATION
REACTOR CONTAINMENT BUILDING
VOLUME AND HEAT SINK INFORMATION

Passive Heat Sink Information

Note:
1. The dividing line between the lower and upper compartments is the operating floor, Elevation 844 + 6.
2. The thermal conductivity (BTU/Ft. Hr. ^oF) shown is for the material only, it does not include that of the surface coating.
3. Coating information is for type and thickness for its thermal conductivity and specific heat as follows:

   Type A = .04/Mil (BTU/FT. Hr. ^oF) and 23.5 (BTU/Ft^3 ^oF)
   Type B = .18/Mil (BTU/Ft. Hr. ^oF) and 28.8 (BTU/Ft^3 ^oF)
   Type X = No Coating

4. Material Designations:

   Steel = Carbon Steel
   S. Steel = Stainless Steel
   Al. = Aluminum
   Copper
   Concrete

5. Material Properties:

Type	Thermal Conductivity (BTU/Ft. Hr. ^oF)	Density (#/Ft^3)	Specific Heat (BTU/# ^oF)
Carbon Steel	32.0	490	.12
Stainless Steel	9.4	501	.11
Aluminum	95.0	174	.211
Concrete	1.05	150	.213
Copper	223.0	554	.091

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
I. LOWER COMPARTMENT				
A. Civil Items				
1. Reactor Building Exterior Wall				
a. Liner Plate (Backed with Concrete)	Steel	22,330	.25"	A = 10 Mil
b. Wall (Faced with ¼" Steel)	Concrete	22,330	3'-9"	X
c. Shielding	Concrete	2,976	5'-3"	A = 10 Mil
2. Reactor Building Exterior Slab				
a. Liner Plate (Backed with Concrete)	Steel	8,890	.25"	A = 7 Mil
b. Slab (Backed with ¼" Steel)	Concrete	8,890	8'-6"	X
3. Grating	Steel	33,324	.093"	X
4. Handrail	Steel	3,869	.15"	A = 8 Mil
5. Columns	Concrete	1,215	9"	B = 10 Mil
	Concrete	810	12"	B = 10 Mil
6. Elevator Siding	Al.	8,886	.016"	X
7. Floors	Concrete	5,190	4"	B = 7 Mil
	Concrete	630	1'-0"	B = 7 Mil
	Concrete	6,636	1'-6"	B = 7 Mil
8. Floors				
a. Liner Plate (Backed with Concrete)*	Steel	833	.25"	X
b. Slab (Faced with ¼" Steel)	Concrete	833	4'-0"	X

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
9. Miscellaneous Shielding	Concrete	269	1'-0"	B = 7 Mil
	Concrete	96	4"	B = 7 Mil
	Concrete	385	4½"	B = 7 Mil
	Concrete	6	5"	B = 7 Mil
	Concrete	268	6"	B = 7 Mil
10. Liner Plate (Backed with Concrete)*	Steel	8,741	.25"	X
11. Walls				
a. Walls (Faced with ¼" Steel)*	Concrete	760	1'-3"	X
	Concrete	1,724	2'-0"	X
*Note: Plate is Lukens MN-3	Concrete	3,982	2'-3"	X
Clad, with A-36 Backing.	Concrete	2,275	2'-6"	X
b. Walls — Clad is Type 304	Concrete	760	1'-3"	B = 10 Mil
Stainless at 20% of	Concrete	164	1'-6"	B = 10 Mil
Total Thickness	Concrete	19,993	2'-0"	B = 10 Mil
	Concrete	1,382	2'-3"	B = 10 Mil
	Concrete	4,274	2'-6"	B = 10 Mil
12. Tank	S. Steel	1,369	.50"	B = 15 Mil
13. Miscellaneous				
a. Rod	Steel	63	1.00"Ø	A = 7 Mil
	Steel	197	.75"Ø	A = 7 Mil
b. Winch	Steel	22	9"Ø	A = 7 Mil
c. Hoist	Steel	12	6"Ø	A = 7 Mil

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
14. Miscellaneous	Steel	280	.09"	A = 7 Mil
	Steel	983	.10"	A = 7 Mil
(Columns, Beams, Flat Plate,	Steel	10,564	.11"	A = 7 Mil
Ladders, Rail, etc.)	Steel	7,957	.12"	A = 7 Mil
	Steel	2,116	.13"	A = 7 Mil
	Steel	423	.14"	A = 7 Mil
	Steel	16,547	.15"	A = 7 Mil
	Steel	2,516	.16"	A = 7 Mil
	Steel	1,041	.17"	A = 7 Mil
	Steel	2,441	.18"	A = 7 Mil
	Steel	4,836	.19"	A = 7 Mil
	Steel	2,530	.20"	A = 7 Mil
	Steel	1,091	.22"	A = 7 Mil
	Steel	3,384	.25"	A = 7 Mil
	Steel	2,286	.26"	A = 7 Mil
	Steel	213	.27"	A = 7 Mil
	Steel	836	.29"	A = 7 Mil
	Steel	2,904	.33"	A = 7 Mil
	Steel	1,195	.37"	A = 7 Mil
	Steel	579	.38"	A = 7 Mil
	Steel	3,976	.40"	A = 7 Mil
	Steel	473	.43"	A = 7 Mil
	Steel	466	.46"	A = 7 Mil
	Steel	2,012	.47"	A = 7 Mil
	Steel	51	.49"	A = 7 Mil
	Steel	706	.50"	A = 7 Mil
	Steel	1,409	.57"	A = 7 Mil
	Steel	1,463	.75"	A = 7 Mil
	Steel	1,965	.84"	A = 7 Mil
	Steel	758	1.00"	A = 7 Mil
	Steel	1,261	1.25"	A = 7 Mil
	Steel	224	1.75"	A = 7 Mil
	Steel	1,425	2.00"	A = 7 Mil
	Steel	11	3.50"	A = 7 Mil
	Steel	720	.06"	A = 7 Mil

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
B. Electrical Items				
15. Miscellaneous Cable Tray, Terminal Boxes, Junction Boxes, etc.	Steel	5,485	.06"	X
	Steel	113	.09"	X
	Steel	2,950	.12"	X
	Steel	882	.15"	X
	Steel	753	.18"	X
	Steel	4,168	.09"	A = 7 Mil
	Steel	57	.18"	A = 7 Mil
	Steel	223	.37"	A = 7 Mil
	Steel	21	.50"	A = 7 Mil
16. Plate	Al.	1,006	.12"	X
17. Cable	Copper	43	.40"	X
	Copper	260	.53"	X
	Copper	424	.81"	X

Note: All Electrial Items to be in Lower Compartment.

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
C. Mechanical Items				
18. Piping, Valves, Tanks, etc.	S. Steel	2,599	.120"	X
	S. Steel	374	.134"	X
	S. Steel	1,046	.148"	X
	S. Steel	253	.165"	X
	S. Steel	357	.280"	X
	S. Steel	32	.322"	X
	S. Steel	350	.375"	X
	S. Steel	48	.437"	X
	S. Steel	9	.531"	X
	S. Steel	478	1.000"	X
	S. Steel	495	1.125"	X
	S. Steel	37	1.406"	X
	S. Steel	364	3.205"	X
	S. Steel	168	.187"	X
	Steel	124	.203"	A = 7 Mil
	Steel	295	.216"	A = 7 Mil
	Steel	146	.237"	A = 7 Mil
	Steel	1,094	.508"	A = 7 Mil

Note: All Mechanical Items to be in Lower Compartment.

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
II. UPPER COMPARTMENT (ALL CIVIL ITEMS)				
1. Reactor Building External Wall				
a. Liner Plate (Backed with Concrete)	Steel	36,047	.25"	A = 7 Mil
b. Wall (Faced with ¼" Steel)	Concrete	36,047	3'9"	X
2. Reactor Building External Dome				
a. Liner Plate (Backed with Concrete)	Steel	16,230	.25"	A = 7 Mil
b. Dome (Faced with ¼" Steel)	Concrete	16,230	3'-3"	X
3. Walls	Concrete	4,200	1'-6"	B = 10 Mil
	Concrete	7,560	2'-0"	B = 10 Mil
4. Shielding				
a. Plate (Backed with Concrete)	Steel	903	.25"	A = 7 Mil
b. Plate (Backed with Concrete)	Steel	903	1.0"	A = 7 Mil
c. Slab (Faced with Plate Both Sides)	Concrete	1,806	1'-6"	X
5. Floors	Concrete	1,100	4"	B = 7 Mil
6. Grating	Steel	10,646	.093"	X
7. Handrail	Steel	214	.15"	A = 8 Mil
8. Polar Crane	Steel	7,247	2.0"	A = 7 Mil

TABLE 2
OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK
PASSIVE HEAT SINK INFORMATION
LOWER COMPARTMENT (A)

Structure (Item and Remarks)	Material	Area (Ft^2)	Thickness	Coating
9. Miscellaneous	Steel	1,249	.12"	A = 7 Mil
	Steel	551	.16"	A = 7 Mil
(Beams, Columns, Flat Plate, Ladders, Rails, etc.)	Steel	768	.20"	A = 7 Mil
	Steel	165	.22"	A = 7 Mil
	Steel	93	.25"	A = 7 Mil
	Steel	430	.26"	A = 7 Mil
	Steel	854	.28"	A = 7 Mil
	Steel	1,691	.29"	A = 7 Mil
	Steel	2,343	.31"	A = 7 Mil
	Steel	1,864	.40"	A = 7 Mil
	Steel	1,715	.43"	A = 7 Mil
	Steel	1,009	.50"	A = 7 Mil
	Steel	.644	.63"	A = 7 Mil
	Steel	41	.75"	A = 7 Mil
	Steel	68	.19"	A = 7 Mil

TABLE 3

OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK DATA
B&W SUPPLIED EQUIPMENT

Item	Weight (lb.)
Auxiliary Systems (Valves, Coolers, Etc.)	28,235
RC Pump Motor Housings	200,000
Control Rod Drive Mechanisms	42,780
Fuel Handling and Reactor Service Equipment	231,816
Reactor Vessel Support Skirt	30,322
Mirror Insulation (1/7 of total)	1,760
Steam Generator Support Skirt	31,388
Core Flood Tanks	156,486
Reactor Building Coolers	35,400
Liquid Waste Disposal System	10,014
Reactor Building Spray Nozzles	135

TABLE 4

OCONEE NUCLEAR STATION
CONTAINMENT VOLUME AND HEAT SINK DATA

Parameter	Oconee	BAW-10103
Reactor Building Free Volume (ft^3)	1.832×10^6	2.205×10^6
Building Cylinder		
Surface Area (ft^2)	61,353	67,410
Thickness		
Concrete (ft)	3.75	4.0
Steel (ft)	0.0208	0.05504(1)
Paint (mils)	7-10	10
Building Dome		
Surface Area (ft^2)	16,230	18,375
Thickness		
Concrete (ft)	3.25	3.0
Steel (ft)	0.0208	0.06546(1)
Paint (mils)	7	10
Building Base		
Surface Area (ft^2)	8,890	
Thickness		
Concrete (ft)	8.5	
Steel (ft)	0.0208	
Paint (mils)	7	
Internal Concrete		
Surface Area (ft^2)	66,318	160,000
Thickness		
Concrete (ft)	1.76	1.0
Paint (mils)	7-10	10
Internal Steel (Painted)		
Surface Area (ft^2)	162,013	249,000
Thickness		
Steel (ft)	0.0306	0.03125
Paint (mils)	7	10
Internal Steel (Unpainted)		
Surface Area (ft^2)	63,727	36,000
Thickness (ft)	0.0097	0.03125

TABLE 4 (CONTINUED)

	Oconee	BAW-10103
Stainless Steel		
Surface Area (ft^2)	10,824	10,000
Thickness (ft)	0.0373	0.03125
Thermophysical Properties		
Concrete		
Density (lb/ft^3)	150.0	145.0
Specific heat (BTU/lb°F)	0.213	0.156
Thermal Conductivity (BTU/hr-ft-°F)	1.05	0.92
Carbon Steel		
Density (lb/ft^3)	490.0	490.0
Specific Heat (BTU/lb°F)	0.12	0.12
Thermal Conductivity (BTU/hr-ft-°F)	32.0	27.0
Stainless Steel		
Density (lb/ft^3)	501.0	493.3
Specific Heat (BTU/lb°F)	0.11	0.11
Thermal Conductivity (BTU/hr-ft-°F)	9.4	9.1836

(1) Includes the liner anchors

FIGURE 1
FAN COOLER HEAT REMOVAL RATES