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TELEPHONE
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June 21, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Ms. E. G. Adensam, Chief
Licensing Branch No. 4

Re: Catawba Nuclear Station
Docket Nos. 50-413 and 50-414

Dear Mr. Denton:

As a result of preoperational testing of the Annulus Ventilation System at Catawba, it was determined that reactor building in-leakage was higher than previously assumed. This higher in-leakage was attributed primarily to the use of foam fire stops in electrical penetrations as opposed to the multi-cable transits previously used at McGuire.

Appropriate FSAR sections have been revised to reflect the observed higher in-leakage. As shown on Table 15.0.12-1, these changes resulted in higher off-site doses for certain accidents. All doses remain well below 10 CFR 100 limits.

These revised pages will be included in Revision 11 to the FSAR.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

ROS/php

Attachment

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

NRC Resident Inspector
Catawba Nuclear Station

Mr. Robert Guild, Esq.
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cc: Palmetto Alliance
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Mr. Jesse L. Riley
Carolina Environmental Study Group
854 Henley Place
Charlotte, North Carolina 28207

vided in Table 6.2.3-3. The structural outline of the Reactor Building is furnished in Figure 3.8.1-1. Additional plans and sections are shown in Figures 1.2.2-8 through 1.2.2-16.

6.2.3.3 Design Evaluation

The results of an analysis of the functional capability of the Annulus Ventilation System to depressurize and maintain a uniform negative pressure of ≥ 0.5 in. H_2O in the annulus following a design basis accident are provided in Table 6.2.3-2.

The pressure, temperature, and mass of annulus air is calculated by the Fortran IV program CANVENT for the entire accident transient, including the steady state conditions prior to the initiating event. The containment is divided into three regions, where standard equations of heat transfer are applied. No heat or mass transfer between regions is assumed except in the annulus. The steady state, pre-accident temperatures are determined by an interactive process until successively calculated temperatures differ by less than some small predetermined amount. The post-DBA transient conditions are calculated using the finite differences technique.

The following assumptions are made for simplification and/or conservatism:

1) The containment is divided into three regions. The temperature of each region is uniform within that region.

2) There are no temperature gradients in the vertical or circumferential directions. Thus, the model is one dimensional with heat transfer occurring only in the radial directions.

3) All physical properties (e.g., heat capacity, thermal conductivity, emissivity, and density) are independent of temperature, except the density of air in the annulus.

4) The air in the annulus behaves as an ideal gas and is uniformly mixed.

5) The air in the annulus has a transmissivity of unity. Therefore, energy is transfered to and from the air only by natural convection.

6) Radiative heat transfer occurs between the concrete reactor building and the steel containment building. The surfaces are treated as gray bodies with a parallel, flat plate geometry,

7) The equation for the heat transfer coefficient for the upper containment to annulus air, treating the dome as a horizontal plate, is $h = .22\ (\Delta t)^{1/3}$. Similarly, treating the ice condenser and lower containment sections as vertical plates, the heat transfer coefficient to annulus air is $h = .19\ (\Delta t)^{1/3}$.

8) For the transfer of heat from the containment air to the containment shell, a heat transfer coefficient that increases linearly in time from 8 Btu/hr -

ft^2 - °F to some maximum value is assumed, followed by exponential decay at a rate of .025 sec^{-1} to some long-term value. The steady-state calculations are based on the natural convection heat transfer coefficients previously mentioned.

9) Circulation of refrigerating air in the ice condenser air ducts ceases at the initiation of the accident. Therefore, before the accident, heat is transferred to the refrigerating air by forced convection; whereas, after the accident the mechanism is natural convection. The use of a forced convection heat transfer coefficient is eliminated by assuming the ice condenser walls are at the same temperature as the refrigerating air.

10) The annulus ventilation fan comes on instantaneously at full speed at a time determined by signal response times and fan characteristics. Partial flow before this time is not considered. At a later time, the fan flow capacity is decreased 15% due to an increased differential pressure across the annulus filter train.

11) A portion of the annulus ventilation fan flow is exhausted to the atmosphere and the remainder is returned to the annulus. The full fan flow is exhausted until the annulus pressure is reduced to -1.0 inches w.g. From that point, the amount of air exhausted is that amount required to maintain the annulus pressure at -1.0 inches w.g.

12) Leakage of air across the concrete reactor building will be a maximum at -1.0 inches w.g. This leakage is conservatively assumed to exist whenever the annulus is at a negative pressure. No credit is taken for out leakage when the annulus pressure is greater than zero.

13) Thermal contact resistances are neglected.

14) For each of the three regions, heat transfer areas are lumped into one of three categories based on the inside radius of the containment shell, the midpoint of the annulus, and the midpoint of the reactor building. This is assumed in order to avoid the continuous variation of area with radius associated with cylindrical geometry.

15) Outside temperatures remain unchanged during the course of the accident. For steady-state calculations, the surface of the reactor building is at the outside temperature. For the post-accident transient, the Reactor Building is considered an adiabatic wall.

16) The expansion of the containment shell, due to the pressure and temperature increase within, is calculated assuming each region is freestanding and independent of any other region.

6.2.3.4 Tests and Inspections

Preoperational and periodic tests are described in Chapter 14 and the Technical Specifications respectively.

Table 6.2.3-2 (Page 1)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
1.	498.94	0.550	0.	0.	690.33
2.	498.95	0.570	0.	0.	690.33
3.	498.96	0.598	0.	0.	690.33
4.	498.97	0.632	0.	0.	690.33
5.	498.98	0.671	0.	0.	690.33
6.	498.99	0.716	0.	0.	690.33
7.	499.00	0.764	0.	0.	690.33
8.	499.01	0.816	0.	0.	690.33
9.	499.02	0.871	0.	0.	690.33
10.	499.03	0.929	0.	0.	690.33
11.	499.05	0.988	0.	0.	690.33
12.	499.06	1.049	0.	0.	690.33
13.	499.08	1.111	0.	0.	690.33
14.	499.09	1.174	0.	0.	690.33
15.	499.11	1.239	0.	0.	690.33
16.	499.13	1.304	0.	0.	690.33
17.	499.16	1.369	0.	0.	690.33
18.	499.18	1.436	0.	0.	690.33
19.	499.21	1.503	0.	0.	690.33
20.	499.23	1.571	0.	0.	690.33
21.	499.27	1.639	0.	0.	690.33
22.	499.30	1.708	0.	0.	690.33
23.	499.33	1.650	9000.	0.	690.33
24.	499.37	1.592	9000.	0.	690.33
25.	499.41	1.534	9000.	0.	690.33
26.	499.45	1.475	9000.	0.	690.33
27.	499.50	1.416	9000.	0.	690.33
28.	499.54	1.357	9000.	0.	690.33
29.	499.59	1.298	9000.	0.	690.33
30.	499.65	1.239	9000.	0.	690.33
31.	499.70	1.181	9000.	0.	690.33

Table 6.2.3-2 (Page 2)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
32.	499.75	1.124	9000.	0.	690.33
33.	499.81	1.067	9000.	0.	690.33
34.	499.87	1.010	9000.	0.	690.33
35.	499.93	0.954	9000.	0.	690.33
36.	500.00	1.898	9000.	0.	690.33
37.	500.06	0.843	9000.	0.	690.33
38.	500.13	0.789	9000.	0.	690.33
39.	500.19	0.734	9000.	0.	690.33
40.	500.26	0.681	9000.	0.	690.33
41.	500.33	0.627	9000.	0.	690.33
42.	500.41	0.574	9000.	0.	690.33
43.	500.48	0.522	9000.	0.	690.33
44.	500.55	0.470	9000.	0.	690.33
45.	500.63	0.418	9000.	0.	690.33
46.	500.71	0.371	9000.	0.	690.33
47.	500.79	0.325	9000.	0.	690.33
48.	500.86	0.279	9000.	0.	691.16
49.	500.94	0.234	9000.	0.	691.97
50.	501.03	0.189	9000.	0.	692.76
51.	501.11	0.145	9000.	0.	693.54
52.	501.19	0.101	9000.	0.	694.30
53.	501.27	0.058	9000.	0.	695.05
54.	501.36	0.015	9000.	0.	695.79
55.	501.44	-0.014	9000.	0.	695.48
56.	501.52	-0.037	9000.	0.	695.19
57.	501.60	-0.060	9000.	0.	694.89
58.	501.68	-0.084	9000.	0.	694.61
59.	501.75	-0.107	9000.	0.	694.33
60.	501.83	-0.130	9000.	0.	694.05
61.	501.91	-0.153	9000.	0.	694.30
62.	501.99	-0.176	9000.	0.	694.54

Table 6.2.3-2 (Page 3)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
63.	502.08	-0.198	9000.	0.	694.78
64.	502.16	-0.220	9000.	0.	695.02
65.	502.24	-0.243	9000.	0.	695.25
66.	502.32	-0.264	9000.	0.	695.48
67.	502.41	-0.291	9000.	0.	695.70
68.	502.49	-0.317	9000.	0.	695.92
69.	502.58	-0.343	9000.	0.	696.14
70.	502.66	-0.369	9000.	0.	696.36
71.	502.75	-0.394	9000.	0.	696.57
72.	502.83	-0.420	9000.	0.	696.78
73.	502.92	-0.445	9000.	0.	696.73
74.	503.01	-0.470	9000.	0.	696.41
75.	503.09	-0.495	9000.	0.	696.10
76.	503.18	-0.520	9000.	0.	695.79
77.	503.27	-0.545	9000.	0.	695.48
78.	503.36	-0.570	9000.	0.	695.18
79.	503.45	-0.595	9000.	0.	694.89
80.	503.53	-0.620	9000.	0.	694.59
81.	503.62	-0.645	9000.	0.	694.30
82.	503.71	-0.669	9000.	0.	694.02
83.	503.80	-0.694	9000.	0.	693.74
84.	503.89	-0.718	9000.	0.	693.46
85.	503.98	-0.743	9000.	0.	693.18
86.	504.07	-0.767	9000.	0.	692.91
87.	504.16	-0.792	9000.	0.	692.64
88.	504.25	-0.816	9000.	0.	692.37
89.	504.34	-0.841	9000.	0.	692.11
90.	504.44	-0.865	9000.	0.	691.85
91.	504.53	-0.889	9000.	0.	691.59
92.	504.62	-0.914	9000.	0.	691.34
93.	504.71	-0.938	9000.	0.	691.09

Table 6.2.3-2 (Page 4)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
94.	504.80	-0.962	9000	0	690.84
95.	504.89	-0.987	9000	0	690.59
96.	504.99	-1.000	7436	1564	690.35
97.	505.08	-1.000	7285	1715	690.11
98.	505.17	-1.000	7283	1717	689.87
99.	505.26	-1.000	7282	1718	689.63
100.	505.35	-1.000	7280	1720	689.40
150.	509.93	-1.000	7026	1974	679.96
200.	514.28	-1.000	6724	2276	680.35
250.	518.34	-1.000	6367	2633	682.52
300.	522.11	-1.000	6011	2989	684.00
350.	525.59	-1.000	5658	3342	682.79
400.	528.76	-1.000	5311	3689	682.09
450.	531.64	-1.000	4983	4017	681.96
500.	534.24	-1.000	4680	4320	681.85
550.	536.57	-1.000	4402	4598	681.75
600.	538.67	-1.000	4158	4842	681.65
650.	540.54	-1.000	3871	5129	674.10
700.	542.18	-1.000	3600	5400	667.11
750.	543.57	-1.000	3334	5666	662.85
800.	544.73	-1.000	3106	5894	661.04
850.	545.68	-1.000	2937	6063	659.35
900.	546.46	-1.000	2772	6228	657.75
950.	547.09	-1.000	2631	6369	656.23
1000.	547.60	-1.000	2521	6479	656.49
1100.	548.35	-1.000	2380	6620	657.26
1200.	548.88	-1.000	2302	6698	657.95
1300.	549.29	-1.000	2259	6741	658.19
1400.	549.62	-1.000	2220	6780	657.82
1500.	549.90	-1.000	2193	6807	657.48
1600.	550.13	-1.000	2172	6828	657.16

Table 6.2.3-2 (Page 5)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
1700.	550.32	-1.000	2156	6844	656.86
1800.	550.47	-1.000	2113	6887	652.85
1900.	550.52	-1.000	2049	6951	649.06
2000.	550.46	-1.000	1984	7016	645.46
2100.	550.30	-1.000	1951	7049	644.91
2200.	550.09	-1.000	1945	7055	644.39
2300.	549.88	-1.000	1958	7042	643.89
2400.	549.69	-1.000	1972	7028	643.41
2500.	549.54	-1.000	1995	7005	642.95
2600.	549.43	-1.000	2024	6976	642.52
2700.	549.37	-1.000	2052	6948	642.09
2800.	549.36	-1.000	2078	6922	641.69
2900.	549.40	-1.000	2105	6895	642.40
3000.	549.50	-1.000	2096	6904	643.04
3100.	549.52	-1.000	1994	7006	641.98
3200.	549.38	-1.000	1948	7052	640.96
3300.	549.17	-1.000	1926	7074	639.97
3400.	548.92	-1.000	1920	7080	639.01
3500.	548.68	-1.000	1925	7075	638.65
3600.	548.45	-1.000	1937	7063	638.31
3700.	548.24	-1.000	1952	7048	637.97
3800.	548.06	-1.000	1965	7035	637.65
3900.	547.91	-1.000	1978	7022	637.33
4000.	547.78	-1.000	2075	6925	637.02
4100.	548.40	-1.000	3001	5999	640.23
4200.	550.26	-1.000	3368	5632	643.35
4300.	552.57	-1.000	3440	5560	646.40
4400.	554.90	-1.000	3300	5700	649.39
4500.	557.06	-1.000	3180	5820	652.30
4600.	558.97	-1.000	3052	5948	655.15
4700.	560.65	-1.000	2935	6065	657.94

Table 6.2.3-2 (Page 6)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
4800.	562.11	-1.000	2841	6159	660.67
4900.	563.41	-1.000	2778	6222	663.35
5000.	564.61	-1.000	2734	6266	665.31
5500.	569.05	-1.000	2479	6521	665.67
6000.	571.17	-1.000	2266	6734	666.01
6500.	572.04	-1.000	2216	6784	666.17
7000.	572.57	-1.000	2190	6810	665.20
7500.	572.91	-1.000	2180	6820	664.30
8000.	573.21	-1.000	2178	6822	663.46
8500.	573.49	-1.000	2179	6821	662.67
9000.	573.77	-1.000	2180	6820	661.93
9500.	574.06	-1.000	2181	6819	661.22
10000.	574.34	-1.000	2182	6818	660.56
11000.	574.89	-1.000	2183	6817	659.32
12000.	575.43	-1.000	2184	6816	658.18
13000.	575.95	-1.000	2185	6815	657.14
14000.	576.44	-1.000	2185	6815	656.17
15000.	576.92	-1.000	2186	6814	655.28
16000.	577.37	-1.000	2186	6814	654.44
17000.	577.80	-1.000	2187	6813	653.65
18000.	578.20	-1.000	2187	6813	652.90
19000.	578.58	-1.000	2187	6813	652.20
20000.	578.94	-1.000	2187	6813	651.53
30000.	581.45	-1.000	2188	6812	646.25
40000.	582.58	-1.000	2187	6813	642.51
50000.	582.93	-1.000	2186	6814	639.60
60000.	582.88	-1.000	2184	6816	637.23
70000.	582.61	-1.000	2183	6817	635.22
80000.	582.25	-1.000	2181	6819	633.48
90000.	581.84	-1.000	2179	6821	631.95
100000.	581.42	-1.000	2178	6822	630.57

Table 6.2.3-2 (Page 7)

Annulus Conditions vs. Time Following Design Basis Accident

TIME (SEC)	ANNULUS TEMP (°R)	ANNULUS PRESSURE (IN. WATER)	PURGE FLOW RATE (CFM)	RECIRCULATION FLOW (CFM)	LOWER CONTAINMENT[1] TEMPERATURE (°R)
110000.	581.66	-1.000	2183	6817	630.57
120000.	581.99	-1.000	2184	6816	630.57
130000.	582.36	-1.000	2185	6815	630.57
140000.	582.72	-1.000	2187	6813	630.57
150000.	583.07	-1.000	2188	6812	630.57
160000.	583.42	-1.000	2189	6811	630.57
170000.	583.77	-1.000	2191	6809	630.57
180000.	584.13	-1.000	2192	6808	630.57
190000.	584.47	-1.000	2193	6807	630.57
200000.	584.81	-1.000	2194	6804	630.57
250000.	586.41	-1.000	2200	6800	630.57
300000.	587.85	-1.000	2205	6795	630.57

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[1] The lower containment temperature shown is not a calculated value but is input from straight line approximations. See Figure 6.2.1-6 for the calculated lower compartment temperatures for a LOCA.

Table 6.2.3-3 (Page 1)

Dual Containment Characteristics

I. Secondary Containment Design Information	
A. Free Volume, ft^3	484,090
B. Pressure, inches of water, gauge	
1. Normal Operation	0.0
2. Postaccident	≤ -0.5
C. Leak Rate at Postaccident Pressure (weight %/day)	0.2
D. Exhaust Fans	See Figure 9.4.9-1
E. Filters	See Figure 9.4.9-1
II. Transient Analysis	
A. Initial Conditions	
1. Pressure, inches of water, gauge	0.0
2. Temperature, °F	81.1
3. Outside Air Temperature, °F	95
4. Thickness of Secondary Containment, in	
Wall	36
Dome	27
5. Thickness of Primary Containment, in	
Wall	0.75
Dome	0.688
B. Thermal Characteristics	
1. Primary Containment Wall	
a. Coefficient of Thermal Expansion, 1/°F	8.4E-06
b. Modulus of Elasticity, psi	2.9E+07
c. Thermal Conductivity, Btu/hr-ft-°F	25
d. Specific Heat, Btu/lb-°F	0.113
2. Secondary Containment Wall	
a. Thermal Conductivity, Btu/hr-ft-°F	0.92
b. Specific Heat, Btu/lb-°F	0.21

radioisotopes following a LOCA by filtering and recirculating a large volume of annulus air relative to the volume discharged for negative pressure maintenance; and (3) provide long-term fission product removal capacity by decay and filtration.

This system is provided with two independent, 100 percent capacity ventilation filter systems complete with fans, filters, dampers, ductwork, supports and control systems for each unit. This meets the single failure criteria. Switchover between redundant trains is accomplished manually by the operator. Electrical and control component separation is maintained between trains.

All essential system components, including fans, filter trains, dampers, ductwork, and supports are designed to withstand the Safe Shutdown Earthquake.

Essential electrical components required for ventilation of the annulus during accident conditions are connected to emergency Class 1E standby power.

9.4.9.2 System Description

The Annulus Ventilation System is shown on Figure 9.4.9-1 and consists of redundant ventilation subsystems for each unit. Each ventilation subsystem consists of a filter train, fan, dampers, associated ductwork, supports and control systems. The Annulus Ventilation System filter trains are described in Section 12.3.3.

The Annulus Ventilation System functions to discharge sufficient air from the annulus to effect a negative pressure with respect to the containment and the atmosphere 60 seconds following a LOCA. Subsequent to attaining a negative pressure, additional air is discharged as necessary to maintain the pressure at or below -0.5 inches water gauge. In order to mix the inleakage in as large a volume as possible, a large flow of air is displaced from the upper level of the annulus and passed through the filter train before being returned to the annulus at a low level. Both the suction and return air flow is accomplished using ring-type distribution headers in the annulus.

The Annulus Ventilation System is activated by the safety injection signal (Ss). Upon receipt of this signal the recirculation dampers and discharge dampers are aligned to exhaust 9000 cfm to the unit vent until the annulus negative pressure is ≥0.5 inches water gauge. The recirculation dampers and discharge dampers then modulate to exhaust air as required to maintain the annulus negative pressure at -0.5 inches water gauge.

Computer code CANVENT has been developed by Duke Power Company to analyze the thermal effects of a loss-of-coolant accident (LOCA) in a Westinghouse "ice condenser" containment. CANVENT is capable of evaluating the following factors:

(a) Steady state (pre-LOCA) radial temperature distributions corresponding to fixed outside Reactor Building and inside containment temperatures.

(b) Radial temperature distributions in the steel containment and concrete Reactor Building during post-LOCA transient.

TABLE 15.0.12-1 (Page 1)

OFFSITE DOSES (Rem)

Accident	FSAR Section	Exclusion Area Boundary		Low Population Zone	
		Whole Body	Thyroid	Whole Body	Thyroid
Main Steam Line Break	15.1.5				
Case 1 (No iodine spike)		8.6E-2	7.6	4.4E-3	2.6E-1
Case 2 (Pre-spike)		7.4E-3	2.8	5.3E-4	9.6E-2
Case 3 (Coincident spike)		7.4E-3	2.4	5.3E-4	8.5E-2
Loss of Power	15.2.6				
Case 1 (No iodine spike)		4.5E-3	7.0E-2	5.9E-4	6.5E-3
Case 2 (Pre-spike)		4.5E-3	7.3E-2	5.9E-4	7.6E-3
Case 3 (Coincident spike)		4.5E-3	7.2E-2	5.9E-4	8.2E-3
Rod Ejection Accident	15.4.8				
Primary Side Release		5.1E-2	4.8	1.1E-2	2.1
Secondary Side Release		3.3E-2	1.2	1.1E-3	3.8E-2
Instrument Line Break	15.6.2				
Case 1 (No iodine spike)		1.6E-1	3.2E-1	5.1E-3	1.0E-2
Case 2 (Pre-spike)		1.8E-1	1.9E+1	6.0E-3	6.3E-1
Case 3 (Coincident spike)		1.8E-1	5.2	6.0E-3	1.7E-1
Steam Generator Tube Rupture	15.6.3				
Case 1 (No iodine spike)		6.4E-1	1.5	2.1E-2	8.8E-2
Case 2 (Pre-spike)		7.1E-1	4.4E+1	2.4E-2	1.5
Case 3 (Coincident spike)		7.0E-1	1.2E+1	2.3E-2	4.6E-1
Design Basis Accident	15.6.5				
Case 1 (With ECCS leakage)		3.0	1.2E+2	7.6E-1	5.1E+1
Case 2 (Without ECCS leakage)		3.0	1.0E+2	7.6E-1	4.6E+1
Waste Gas Decay Tank	15.7.1				
Rupture		5.0E-1	-	1.6E-2	-

The following conservative assumptions are used in the analysis of the release of radioactivity to the environment in the event of a postulated rod ejection accident. A summary of parameters used in the analysis is given in Table 15.4.8-2.

1. Ten percent of the gap activity is released to the containment atmosphere.
2. 50 percent of the iodines and 100 percent of the noble gases in the melted fuel are released.
3. 50 percent of the iodine released are deposited in the sump.
4. Annulus activity, which is exhausted prior to the time at which the annulus reaches a negative pressure of -0.25 in.w.g., is unfiltered.
5. ECCS leakage occurs at twice the maximum operational leakage.
6. ECCS leakage begins at the earliest possible time sump recirculation can begin.
7. Bypass leakage is 7 percent.
8. The effective annulus volume is 50 percent of the actual volume.
9. The annulus filters become fouled at 900 seconds resulting in a 15 percent reduction in flow.
10. Elemental iodine removal by the ice condenser begins at 600 seconds and continues for 3328.3 seconds with a removal efficiency of 30 percent.
11. One of the containment air return fans is assumed to fail.
12. The containment leak rate is fifty percent of the Technical Specifications limit after 1 day.
13. Iodine partition factor for ECCS leakage is 0.1 for the course of the accident.
14. No credit is taken for the auxiliary building filters for ECCS leakage.
15. The redundant hydrogen recombiners fail; therefore, purges are required for hydrogen control.

(The following assumptions apply to the secondary side analysis).

16. All the activity released is mixed instantaneously with the entire reactor coolant volume.

17. The primary to secondary leak rate is 1 gal/min.

18. The iodine partition factor is 0.1.

19. The steam release terminates in 120. seconds.

20. All noble gases which leak to the secondary side are released.

21. The primary and secondary coolant concentrations are at the maximum allowed by technical specifications.

Based on the foregoing model, the primary and secondary side releases may be calculated as well as the offsite doses. The doses, given in Table 15.4.8-2, are well below the limits of 25 rem whole body and 300 rem thyroid established in 10CFR100.

15.4.8.4 Conclusions

Even on a pessimistic basis, the analysis indicate that the described fuel and clad limits are not exceeded. It is concluded that there is no danger of sudden fuel dispersal into the coolant. Since the peak pressure does not exceed that which would cause stresses to exceed the faulted condition stress limits, it is concluded that there is no danger of further consequential damage to the Reactor Coolant System. The analyses have demonstrated that upper limit in fission product release as a result of a number of fuel rods entering DNB amounts to ten percent.

Parameters recommended for use in determining the radioactivity released to atmosphere for a rod ejection accident are given in Table 15.4.8-2. The Reactor Coolant System integrated break flow to Containment following a rod ejection accident is shown in Figure 15.4.8-5.

TABLE 15.4.8-2 (Page 3)

Parameters for Postulated Rod Ejection Accident Analysis

		Conservative	Realistic
b.	Dose conversion assumptions	Regulatory Guides 1.4 and 1.109	same
c.	Doses (Rem)		
	Primary side		
	Exclusion area boundary		
	Whole body	5.1E-02	
	Thyroid	4.8	
	Low population zone		
	Whole body	1.1E-02	
	Thyroid	2.1	
	Secondary side		
	Exclusion area boundary		
	Whole body	3.3E-02	
	Thyroid	1.2	
	Low population zone		
	Whole body	1.1E-03	
	Thyroid	3.8E-02	

3. Annulus activity which is exhausted prior to the time at which the annulus reaches a negative pressure of -0.25 in.w.g. is unfiltered.
4. ECCS leakage begins at the earliest possible time sump recirculation can begin.
5. ECCS leakage occurs at twice the maximum operational leakage.
6. Bypass leakage is 7 percent.
7. The effective annulus volume is 50 percent of the actual volume.
8. The annulus filters become fouled at 900 seconds resulting in a 15 percent reduction in flow.
9. Elemental iodine removal by the ice condenser begins at 600 seconds and continues for 3328.3 seconds with a removal efficiency of 30 percent.
10. One of the containment air return fans is assumed to fail.
11. The containment leak rate is fifty percent of the Technical Specification limit after 1 day.
12. Iodine partition factor for ECCS leakage is 0.1 for the course of the accident.
13. No credit is taken for the auxiliary building filters for ECCS leakage.
14. The redundant hyrdogen recombiners fail; therefore, purges are required for hydrogen control.

The resulting offsite doses presented in Table 15.6.5-10 are below the limits of 25 rem whole body and 300 rem thyroid established in 10CFR100.

15.6.5.4.2 Control Room Operator Dose

The maximum postulated dose to a control room operator is determined based on the releases of a Design Basis Accident. In addition to the parameters and assumptions listed in Section 15.6.5.4.1, the following apply:

1. The control room pressurization rate is 4,000 cfm; the filtered recirculation rate is 2,000 cfm.
2. The unfiltered inleakage into the control room is 10 cfm.
3. Other assumptions are listed in Table 15.6.5-11.

TABLE 15.6.5-10 (Page 3)

Parameters for Postulated Design Basis Accident Analysis

	Conservative	Realistic
c. Doses (Rem)		
Case 1 (With ECCS leakage)		
Exclusion Area Boundary		
Whole Body	3.0	
Thyroid	1.2E+02	
Low Population Zone		
Whole Body	7.6E-01	
Thyroid	5.1E+01	
Case 2 (Without ECCS leakage)		
Exclusion Area Boundary		
Whole Body	3.0	
Thyroid	1.0E+02	
Low Population Zone		
Whole Body	7.6E-01	
Thyroid	4.6E+01	

TABLE 15.6.5-11 (Page 2)

Parameters for Postulated Design Basis Accident Control Room Analysis

	Conservative	Realistic
3. Dispersion data		
a. Control room intake χ/Q (sec/m^3)		
0-8 hrs	9.9E-04	
8-24 hrs	7.2E-04	
1-4 days	5.1E-04	
4 + days	2.8E-04	
4. Dose data		
a. Method of dose calculations	Standard Review Plan 6.4	
b. Dose conversion assumptions	Regulatory Guides 1.4, 1.109	
c. Doses (Rem)		
Whole body	4.6E-01	
Thyroid	2.1E+01	
Skin	9.0	