Attachment 2

Marked-up Pages

The integral welded design of the guard pipes precludes leakage from the drywell into the containment portion of the main steam tunnel (see Fig. 3.8-4 for the sleeved penetration design). The electrical penetrations in the primary containment can leak only into the annulus and this leakage is treated by the SGTS.

The maximum inleakage rate across the shield building barrier when the annulus is at a pressure of -3 in W.G. is 2,000 cfm. During normal operation, the annulus inleakage approximately equals the exhaust capability of the annulus pressure control system. The exhaust air is not diverted through the SGTS unless it is radioactive. If the leak rate is actually less than 2,000 cfm, the initial pressure is at a value lower than -3 in W.G. (e.g., -4 in W.G.).

REPLACE WITH INSERT A

~~Two full-capacity SGTS exhaust fans are provided, each powered by a separate standby diesel generator. The DBA is assumed to occur with the annulus at its maximum normal operating conditions, namely, -3 in W.G. and 2,000 cfm inleakage. If a DBA occurs along with loss of offsite power and if a standby diesel generator also fails to start, the other standby diesel generator is available approximately 30 sec later (i.e., when the generator is up to speed). The SGTS fan then receives power from this standby diesel generator and is available within 38 sec after the DBA (i.e., 30 sec plus 8 sec for the fan to get up to speed). The design flow rate of the SGTS in the post-accident mode is 12,500 cfm, which is equal to the maximum estimated flow rate being exhausted from the annulus and the shielded compartments in the auxiliary building during a DBA.~~

6.2.3.2.2 Annulus Mixing System

The annulus mixing system is provided for a thorough mixing of any leakage from the primary containment to the annulus, while the annulus is being maintained at a pressure of -0.50 in W.G. by the SGTS. Upon receipt of a LOCA or high radiation signal from the radiation monitor(s), the annulus mixing system is automatically actuated by starting the annulus mixing fans. For a detailed description of this system and its components, see Section 9.4.6.

6.2.3.2.3 Fuel Building Charcoal Filtration System

The fuel building charcoal filtration system is designed to limit the release of airborne radioactivity to the environment and maintain the building at a pressure of at least -0.25 in W.G. following an accident. Regulatory Guide 1.52 is used as a basis of design for the fuel building

Insert A

Two full-capacity SGTS exhaust fans are provided, each powered by a separate standby diesel generator. The DBA is assumed to occur with the annulus at its maximum normal operating conditions, namely, -3 in W.G. and 2,000 cfm inleakage. If a DBA occurs along with loss of offsite power and assuming the single failure of a standby diesel generator the SGTS fan will reach rated speed within 48 seconds (i.e., 10 sec diesel start time, plus 30 sec until SGTS is loaded, and 8 sec for the fan to get up to speed). The design flow rate of the SGTS in the post-accident mode is 12,500 cfm, which is equal to the maximum estimated flow rate being exhausted from the annulus and the shielded compartments in the auxiliary building during a DBA.

detailed safety evaluation of fuel building charcoal filtration system, see Section 9.4.2.

The results of the post-LOCA pressure response of the secondary containment system are shown on Fig. 6.2-61a, 6.2-61b, and 6.2-62 for the annulus, auxiliary building, and fuel building, respectively. Initial conditions for these analyses are listed in Table 6.2-32.

The assumptions used in the pressure transient analysis for the annulus and the auxiliary building are as follows:

1. External wind speed is zero.

2. Offsite power is lost simultaneously with LOCA.

3. The single active failure is the failure of one standby diesel generator to start.

4. System frictional pressure losses are 21.5 in W.G. at 12,500 cfm flow.

5. The SGTS centrifugal exhaust fan characteristic is shown on Fig. 6.2-59.

•→10

6. The annulus exhaust rate at a 21.5 in W.G. pressure loss is 2,500 cfm and the auxiliary building exhaust rate is 10,000 cfm, with the SGTS exhaust fan operating at 48 sec.

Results of the analysis of the annulus and the auxiliary building indicate that a pressure of -0.25 in W.G. is attained in ~~213~~ 216 and 111 sec, respectively.

Add Insert B

10←•

The assumptions used in the pressure transient analysis for the fuel building are as follows:

1. External wind speed is zero.

2. Offsite power is lost simultaneously with LOCA.

3. The single active failure is the failure of one standby diesel generator to start.

4. System frictional pressure losses are 18 in W.G. at 10,000 cfm flow.

5. The fuel building charcoal filtration system centrifugal exhaust fan characteristic is shown on Fig. 6.2-60.

Insert B

The bounding value of 216 sec is used to determine the post-LOCA dose consequences (see Section 15.6.5).

6. The fuel building exhaust rate at 18 in W.G. is 10,000 cfm beginning at 18 sec (10 sec plus 8 sec for the fan to get up to speed).

Results of the fuel building analysis indicate that a pressure of -0.25 in W.G. will be attained in 31 sec. Add Insert C

•→10

Fig. 6.2-61a indicates that there is a period following a LOCA during which a gauge pressure greater than -0.25 in W.G. exists in the annulus. This period begins approximately ~~24~~ 20.5 sec after the LOCA and lasts for approximately ~~189~~ 195.5 sec. The dose rate analysis during this period indicates that release of contaminated air from the secondary containment is within the limits of 10CFR100.

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The amount of heat transferred to the secondary containment atmosphere (annulus) has no detrimental effect, since no safety equipment is located inside the annulus. No heat transfer is assumed to the environment. The walls of the shield building are reinforced concrete, 2'-6" thick, and do not offer a contribution of heat into the auxiliary building or fuel building during the transient. The analysis for the drawdown time considered all possible heat loads inside the auxiliary building and fuel building. The cubicles containing equipment (e.g., the ECCS pumps and heat exhangers) that operate during post-LOCA operations are provided with recirculation-type-unit coolers. The unit coolers have been conservatively designed to remove the heat at the rate at which it is being generated during full operation of the equipment.

Constant maximum heat load is determined for input to the auxiliary building analysis based on the assumption that all equipment is operating and only the safety related unit coolers powered from the Div. I standby diesel generator are removing heat. The resulting net positive heat load (see Table 6.2-32) is conservatively high because the equipment powered from the failed Div. II standby diesel generator is assumed to be operating while the associated unit coolers are assumed to be unavailable.

A constant heat load for the fuel building analysis is determined by considering hot piping and thermal transmission through walls, floors, and ceilings based on normal operating conditions, plus a residual heat load from electrical equipment that is operating prior to the LOCA. Based upon the assumption that a loss of offsite power has occurred, no electrical equipment (including unit coolers) will be operating immediately after the LOCA. As piping heat load in the fuel building decreases, the fuel building

Insert C

However, the offsite dose analysis uses the bounding value of 216 sec for the annulus (see Section 15.6.5).

TABLE 6.2-32

SECONDARY CONTAINMENT

I. Secondary Containment Design

A.	Free Volume (ft)	
	1. Annulus	357,400
	2. Auxiliary Building	~~1,150,000~~ 1,160,000
	3. Fuel Building	742,000
B.	Pressure, inches of water gauge	
	1. Normal Operation	
	a. Annulus	3 inches negative
	b. Auxiliary Building	Atmospheric
	c. Fuel Building	1/4 inch negative
	2. Post-Accident (long term maximum)	
	a. Annulus	1/2 inch negative
	b. Auxiliary Building	1/4 inch negative
	c. Fuel Building	1/4 inch negative
C.	Leak Rate Normal (cfm)	
	1. Annulus	2,000
	2. Auxiliary Building	0
	3. Fuel Building	1,000

D. Exhaust Fans	SGTS	ABVS	APCS	FBVS	FBCFS
1. Number					
a. Annulus					
(normal operation)			1		
(post-accident)	1*				
b. Auxiliary Building					
(normal)		1**			
(post-accident)	1*				
c. Fuel Building					
(normal operation)				1**	
(post-accident)					1*
2. Type	Centrifugal & Vaneaxial				

E. Filters

1. Number 1
2. Type — Charcoal adsorbers (see Sections 6.5.1 & 6.5.3)

TABLE 6.2-32 (CONT)

II. Transient Analysis

	Shield Building Annulus	Auxiliary Building	Fuel Building
A. Initial Conditions			
1. Pressure (in W.G.)	-3	0	0
2. Temperature (°F)	~~90~~ 120	122	96
3. Outside air temperature (°F)	~~95~~ 25	~~95~~ ***	~~95~~ ***
4. Thickness of shield building wall (dome is 2 ft)	2'-6"	NA	NA
5. Thickness of primary containment wall, nominal	1.50"	NA	NA
B. Thermal Characteristics			
1. Primary Containment Wall			
a. Coefficient of linear expansion (in/in °F)	8.4×10^{-6}	NA	NA
b. Modulus of elasticity (psi)	3.0×10^{7}	NA	NA
c. Density (lbm/ft)	490	NA	NA
d. Specific heat (Btu/lbm-°F)	0.10	NA	NA
2. Heat Transfer Coefficients			
a. Primary containment atmosphere to primary containment wall (Btu/hr-ft-°F)	307	NA	NA
b. Primary containment wall to annulus atmosphere (Btu/hr-ft-°F)	5.0	NA	NA
3. Constant heat addition rate (Btu/hr)	~~0~~	~~2.785×10^6~~	~~1.243×10^6~~
a. $0 < t \leq 18$ sec	0	3.576×10^6	1.243×10^6
b. $t > 18$ sec	0	2.785×10^6	1.243×10^6

* On ESF or high radiation signal two trains are available; one is required for system operation.

** Durine normal operation two trains are available; one is required for system operation.

ADD INSERT D

Insert D

*** The auxiliary and fuel building analyses assumed an outside temperature of 95°F which clearly demonstrated that the post-LOCA pressure response of the shield building annulus was bounding. However, use of 25°F for the annulus remains bounding.

TABLE 6.2-34

SECONDARY CONTAINMENT OPERATION
FOLLOWING A DESIGN BASIS ACCIDENT

General	Shield Bldg.	Aux. Bldg.	Fuel Bldg.
Type of structure	Reinforced Concrete	Reinforced Concrete	Reinforced Concrete
Free volume (cu ft)	357,400	~~1,150,000~~ 1,160,000	742,000
Annulus width (ft)	5	NA	NA
Location of fission product removal system	Aux. Bldg. El 141'-0"	Aux. Bldg. El 141'-0"	Fuel Bldg. El 148'-0"

Time-Dependent Parameters			
Leak rate (cfm) (in. W.G.)	2,000 at -3.0	5,000 at -0.25	10,000 at -0.55
Total recirculation flow (max)	50,000	NA	NA
Exhaust flow (cfm)	2,500 (max)	10,000 (max)	10,000 (max)
System pressure at exhaust flow (in W.G.)	21.5	21.5	18
Effectiveness of fission product removal systems	Refer to Section 6.5		Refer to Section 9.4.2
Exhaust fan at full flow (sec)	~~38~~ 48	~~38~~ 48	18

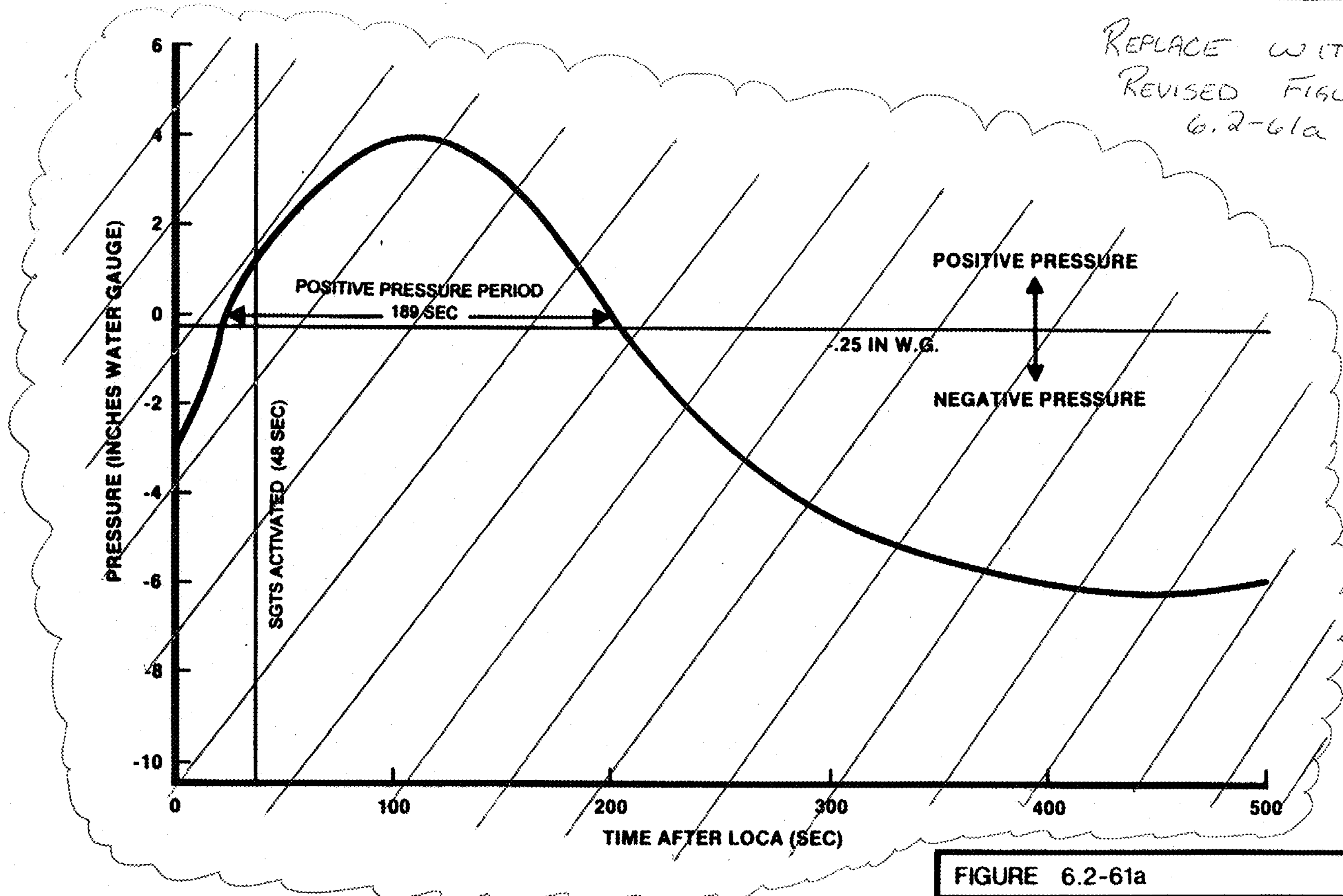
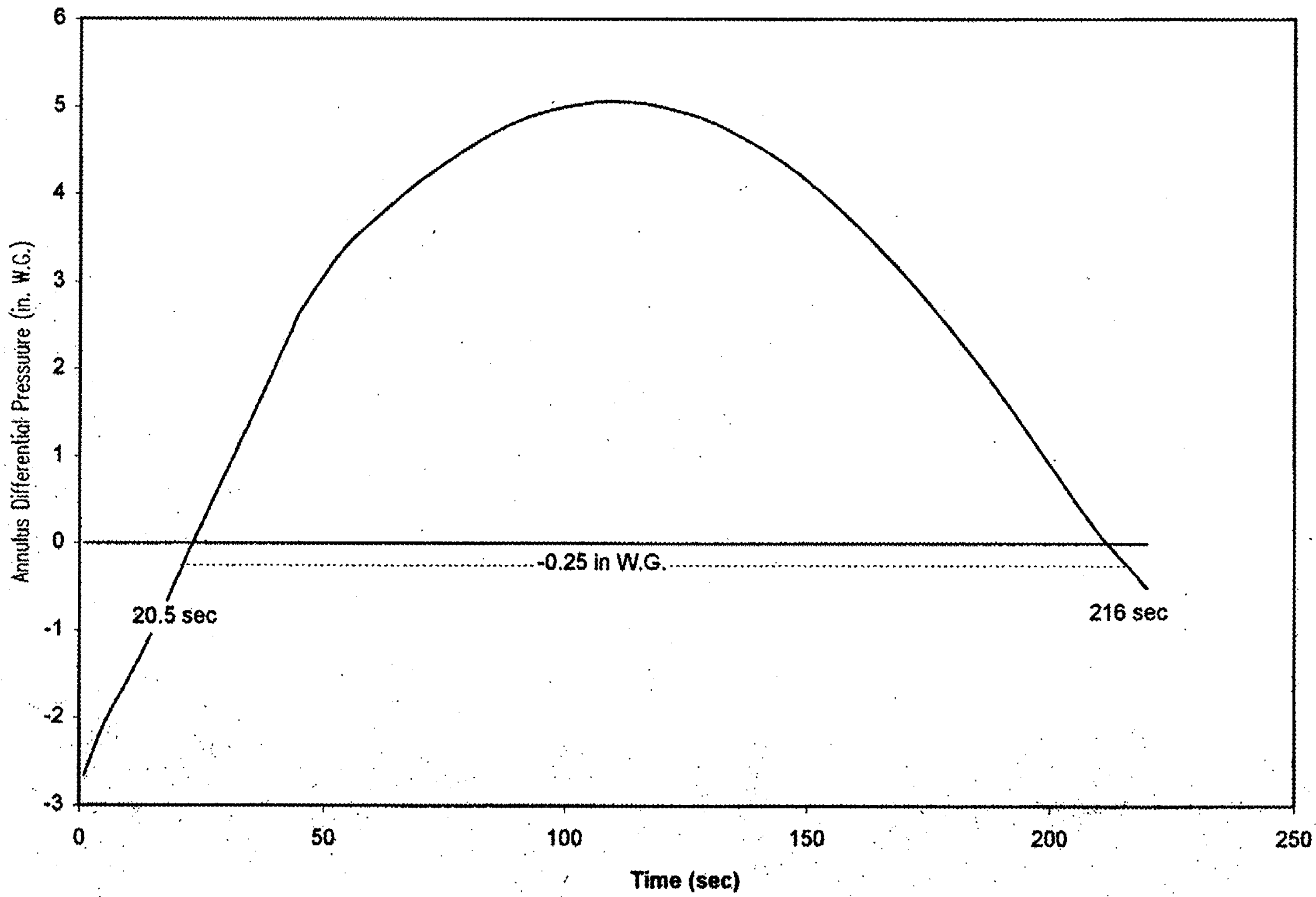


FIGURE 6.2-61a

PRESSURE IN SHIELD BUILDING ANNULUS VS TIME

RIVER BEND STATION
UPDATED SAFETY ANALYSIS REPORT

PRESSURE IN SHIELD BUILDING ANNULUS VS TIME



REVISED FIGURE 6.2-61a

mechanisms and the leakage from ESF components in the auxiliary building, as follows:

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1. Containment leakage - The design basis leak rate of the primary containment (excluding main steam lines and secondary containment bypass (SCB) lines) is 0.26 percent of the containment volume per day for the duration of the accident, and is assumed to be released entirely to the secondary containment. In addition, the leakage of 170,000 cc/hr at P_a through the SCB lines listed in Table 6.2-40 is considered as bypass leakage circumventing the secondary containment. This leakage continues for the duration of the accident. The containment leakage paths are described as follows:

REPLACE WITH INSERT E

a. ~~For a period of 24 sec following the accident the secondary containment is below a pressure of -0.25 WG and all containment leakage, except the annulus bypass leakage of 13,500 cc/hr, is retained in the containment annulus. Activity entering the annulus during this time period is mixed with 50% of the annulus volume and is exhausted at a rate of 2500 cfm during SGT drawdown.~~

During the next ~~189~~ 195.5 seconds, the annulus is at a positive pressure and the entire 0.26 percent per day is discharged directly to the environment without treatment. No credit is taken for mixing, dilution, or holdup.

b. After ~~213~~ 216 sec, 13,500 cc/hr of the total 0.26 percent per day leakage is treated as annulus bypass leakage through containment isolation valves and containment air locks. This leakage is assumed to go to the auxiliary and fuel buildings where it is treated by the SGTS and FBVS prior to discharge to the environment. Credit is taken for mixing in 50% of the auxiliary and fuel building volumes prior to treatment and discharge.

The remainder of the 0.26 percent per day leakage is assumed to be released to the annulus, treated by the SGTS, and

10←•

Insert E

For a period of 20.5 sec following the accident the annulus is below a pressure of -0.25 in W.G. (see Figure 6.2-61a). However, since the auxiliary and fuel buildings exceed -0.25 in W.G., holdup in all of secondary containment is neglected.

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2. Leakage from ESF components - Systems which circulate contaminated fluids outside the primary containment are assumed to leak at a total combined rate of 60 gph into the auxiliary building with an iodine partitioning factor of 0.1. ~~Resultant~~ airborne contaminants are then discharged to the environment via the SGTS. No credit is taken for ~~mixing, dilution, or holdup in the auxiliary building volume or for~~ pumpback to the suppression pool.

Replace with Insert F

Add Insert G

Fission product release to the environment based on the above assumptions is given in Table 15.6-6.

15.6.5.5.3 Results

The calculated exposures for the design basis analysis are presented in Table 15.6-7 and are well within the guidelines of 10CFR100.

15.6.6 Feedwater Line Break - Outside Containment

In order to evaluate large liquid process line pipe breaks outside containment, the failure of a feedwater line is assumed to evaluate the response of the plant design to this postulated event. The postulated break of the feedwater line, representing the largest liquid line outside the containment, provides the envelope evaluation relative to this type of occurrence. The break is assumed to be instantaneous, circumferential, and downstream of the outermost isolation valve.

A more limiting event from a core performance evaluation standpoint (feedwater line break inside containment) has been quantitatively analyzed in Section 6.3. Therefore, the following discussion provides only new information not presented in Section 6.3. All other information is covered by cross-referencing to appropriate Section 6 sections.

Insert F

Prior to 216 seconds, all activity is assumed to be released directly to the environment with no credit being taken for holdup, dilution, or decay in the auxiliary building. Following 216 seconds, the resultant

Insert G

3. NRC Information Notice (IN) 91-56 documented concerns where liquid leakage could potentially bypass secondary containment and be released directly to the environment. A detailed review of the IN 91-56 concerns and plant design were performed and no credible paths were identified. However, an additional leakage term was added for conservatism.

   The IN 91-56 leakage term was modeled as a failure of a passive component outside of secondary containment. A leakage rate of 50 gpm was assumed to occur 24 hours post-LOCA for 30 minutes duration in accordance with SRP 15.6.5, Appendix B.[1]

[footnote]

(1) SRP 15.6.5, Appendix B states that this term is required for plants without an ESF emergency filtration system. Although River Bend Station has safety-related filtration systems, this term was included to conservatively represent IN 91-56 concerns.

TABLE 15.6-5

LOSS-OF-COOLANT ACCIDENT PARAMETERS
TABULATED FOR POSTULATED ACCIDENT ANALYSIS

	Design Basis Assumptions
I. Data and assumptions used to estimate radioactive source from postulated accidents	
A. Power level	3,039 MWt
B. Burn-up	NA
C. Fuel damaged	100%
D. Release of activity by nuclide	Table 15.6-6
•→10	
E. Iodine fractions	
1. Organic	0.04
2. Elemental	0.91
3. Particulate	0.05
F. Reactor coolant activity before the accident	NA
II. Data and assumptions used to estimate activity released	
A. Primary containment leak rate (%/day)	0.26
B. Secondary containment ventilation rate (cfm)	10,000
C. Annulus bypass leakage to auxiliary and fuel buildings (percent of primary containment leak rate) (%/day)	0.37 (13,500 cc/hr at P_a)
D. Leakage bypassing secondary containment (cc/hr at P_a)	170,000
E. Secondary containment positive pressure time period (sec)	~~189~~ 216
F. Valve movement times	NA
G. Adsorption and filtration efficiencies (%)	
1. Organic iodine	99
2. Elemental iodine	99
3. Particulate iodine	99
4. Particulate fission products	-
10←•	

TABLE 15.6-5 (Cont)

	Design Basis Assumptions
•→10	
H. Recirculation system parameters	
1. Flow rate (CPM)	NA
2. Mixing efficiency	NA
3. Filter efficiency	NA
I. Containment free air volumes	
1. Drywell (ft^3)	2.36×10^5
2. Containment (ft^3)	1.19×10^6
J. ESF leakage outside primary containment	
1. ESF systems leak rate (GPH)	60
2. Iodine partition factor (air/water)	0.1
•→11	
3. Suppression pool water volume (ft^3)	1.25×10^5 *
11←•	
K. All other pertinent data and assumptions	
1. Suppression pool Decontamination Factor	10
2. Auxiliary Building free volume (ft3)	1.16×10^6
3. Fuel Building free volume (ft3)	742,000
4. Annulus free volume (ft3)	357,400
III. Dispersion data	
A. EAB and LPZ distance (m)	914/4023
B. X/Qs (sec/m^3) for time intervals of	
1. 0-2 hr - EAB	8.58-4
2. 2-8 hr - LPZ	1.13-4
3. 8-24 hr - LPZ	7.89-5
4. 1-4 days - LPZ	3.65-5
5. 4-30 days - LPZ	1.21-5
IV. Dose data	
A. Method of dose calculation	Regulatory Guide 1.3, Standard Review Plan 15.6.5, Rev. 1, and SRP 6.5.5
B. Dose conversion assumptions	ICRP 30
C. Doses	Table 15.6-7
V. Main Control Room	
A. Volume (ft^3)	240,702
B. Ventilation rate (cfm)	1947.6
10←•	

•→11

* The value used for containment portion volume (versus the drywell portion) of the suppression pool in the radiological analyses did not have an allowance for water displacement due to submerged equipment (e.g., structure, strainers, quenchers, etc.). The minimum value should be 122,614 ft^3 corresponding to a total suppression pool volume of 135,500 ft^3 at a water level of 19.5 ft which bounds the as-built minimum suppression pool volume. THE VALUE IN THE ACTUAL ANALYSIS WAS 1.2×10^5 FT^3 FOR ESF LEAKAGE.

11←•

TABLE 15.6-6

•→10

LOSS-OF-COLLANT ACCIDENT (DESIGN BASIS ANALYSIS)
ACTIVITY RELEASE TO ENVIRONMENT (CURIES)

Isotope	Total Curies Released
BR-82	~~3.70E+00~~ 1.4E+01
BR-83	~~1.25E+01~~ 1.4E+01
BR-84	~~6.65E+00~~ 8.3E+00
BR-85	~~3.13E+00~~ 4.4E+00
I-131	~~6.62E+03~~ 1.2E+04
I-132	~~1.59E+02~~ 1.7E+02
I-133	~~1.81E+03~~ 8.0E+03
I-134	~~1.33E+02~~ 1.6E+02
I-135	~~5.49E+02~~ 1.6E+03
KR-83M	~~2.73E+03~~ 2.7E+03
KR-85M	~~2.40E+04~~ 2.4E+04
KR-85	~~9.73E+04~~ 9.7E+04
KR-87	~~9.32E+03~~ 9.3E+03
KR-88	~~3.50E+04~~ 3.5E+04
KR-89	~~5.35E+02~~ 5.4E+02
XE-131M	~~2.96E+04~~ 3.0E+04
XE-133M	~~3.71E+04~~ 3.7E+04
XE-133	~~3.38E+06~~ 3.4E+06
XE-135M	~~7.37E+02~~ 7.4E+02
XE-135	~~2.26E+05~~ 2.3E+05
XE-137	~~7.70E+02~~ 7.8E+02
XE-138	~~2.51E+03~~ 2.5E+03

10←•

NOTE: 6.8E+03 = 6.8×10^3

TABLE 15.6-7

•→11

LOSS-OF-COOLANT ACCIDENT (DESIGN BASIS ANALYSIS)
RADIOLOGICAL EFFECTS*

11←• •→10

	Whole Body Gamma Dose (rem)	Beta Dose (rem)	Thyroid Dose (rem)
Exclusion area	4.6	~~4.2~~ N/A	~~32.8~~ 37.8
Low population zone	2.8	~~3.2~~ N/A	~~50.3~~ 115.1
Main control room	0.4	8.8	~~5.6~~ 6.3

10←•

•→11

~~* The value used for containment portion volume (versus the drywell portion) of the suppression pool in the radiological analyses did not have an allowance for water displacement due to submerged equipment (e.g., structure, strainers, quenchers, etc.). The effect on the doses reported above is a difference of less than 0.1%.~~

11←•