Attachment 5

LOCA Dose Analysis with Revised Source Terms
XC-Q1111-98017, Revision 0

DESIGN ENGINEERING CALCULATION GRAND GULF NUCLEAR STATION UNIT ONE	CALC NO.: XC-Q1111-98017 REVISION: 0 PAGE i of iii

TITLE: LOCA Dose Analysis with Revised Source Terms

REVISION STATUS	SUPERSEDED BY:	SUPERSEDES:	
[ ] Pending	[X] N/A	[X] N/A	[X] Safety Related
[X] Final	Calc.	Calc.	[ ] Non Safety
[ ] Canceled	Rev.:	Rev.:	[ ] Appendix B

ORG CODE: NPE-Safety Analysis | **CALC TYPE** NUCSAFE

KEYWORD(S):
ACCIDENT
DOSE

AFFECTED COMPONENT(S): (add sheets as needed)
N/A

SYSTEM(s): N/A

COMMENT(s): N/A

SOFTWARE USED FOR CALCULATION: [X] Yes [ ] No

Software Manufacturer:	GGNS Safety Analysis	Software Name/ Program No:	TRANSACT	Version/ Release No:	2.0

REVIEW AND APPROVAL

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PREPARED BY:	G.E. Broadbent (Signature) / G.E. Broadbent (Name)	8/19/99
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REVISION STATUS SHEET

ENGINEERING CALCULATION REVISION SUMMARY

REVISION	DATE	DESCRIPTION
0	8/24/99	Issue for use

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SHEET REVISION STATUS

SHEET NO.	REVISION	SHEET NO.	REVISION	SHEET NO.	REVISION
i	0	11	0	23	0
ii	0	12	0	24	0
iii	0	13	0	25	0
1	0	14	0	26	0
2	0	15	0	27	0
3	0	16	0	28	0
4	0	17	0	29	0
5	0	18	0	30	0
6	0	19	0	31	0
7	0	20	0	32	0
8	0	21	0	33	0
9	0	22	0		
10	0				

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APPENDIX/ATTACHMENT REVISION STATUS

APPENDIX NO.	REVISION	ATTACHMENT NO.	REVISION
A	0	1	0
B	0	2	0
C	0	3	0
D	0	4	0
E	0	5	0
		6	0

CONTENTS

1.0 PURPOSE

This calculation evaluates the offsite and control room radiological doses for the DBA LOCA with the revised source term reported in NUREG-1465 [1]. The previous calculation [2] applied the TID-14844 methodology while the revised source term makes the following major changes:

- timed source term releases,
- revised iodine chemical form distribution,
- updated release fractions, and
- six additional nuclide groups over the 2 groups (halogens and nobles) used in TID.

In addition to these source term changes, this calculation is similar to the previous LOCA analysis with the following significant model modifications:

- MSIV leakage rates are increased from a total leakage rate of 100 scfh to 250 scfh with a maximum of 100 scfh for a steamline
- Containment leak rate is increased from 0.35% per day to 0.385% per day
- MSIV and containment leakage are assumed to decrease by a factor of 2 after 96 hours
- Secondary containment drawdown time is increased from 2 minutes to 3 minutes
- No significant releases are assumed for the first 121 seconds associated with the coolant release duration
- Control room inleakage is increased from 590 cfm to 1200 cfm
- SGTS bypass flow reduced from 50 cfm to 1 cfm due to recent design changes to the SGTS filter trains
- Control Room Fresh Air system is not credited including the automatic isolation of the control room intakes
- Control room and offsite χ/Q values have been revised based on current meteorological data
- The two unsprayed containment volumes are combined into a single volume for model simplification
- Suppression pool scrubbing is not credited
- Spray removal lambdas have been re-calculated based on NRC guidance
- Aerosol and elemental iodine removal mechanisms from NRC research are applied.
- Containment thermal-hydraulics have been revised consistent with the proposed radiological scenario.

2.0 PLANT DESCRIPTION

GGNS is a BWR/6 plant with a Mark-III pressure suppression containment. The reactor vessel is located within a drywell which is connected to the containment via three rows of horizontal vents submerged in the suppression pool. Steam released in a line break is directed through these vents and quenched before release into the containment. A small bypass flow may leak through the drywell structure, bypassing the suppression pool, and enter the containment atmosphere without quenching. This drywell bypass flow is controlled by the drywell $A/\sqrt{k}$ value of 0.9 ft^2, which would permit a flow of 35,000 cfm to bypass the suppression pool at a differential pressure of 3 psi.

Containment leakage is directed into the secondary containment which completely encloses the primary containment and is composed of the Auxiliary Building and the Enclosure Building. All ECCS pumps are located in the Auxiliary Building, into which all ECCS leakage would be released. On a LOCA signal, the secondary containment is drawn down to a 0.25-inch w.g. negative pressure within minutes of a LOCA to prevent any exfiltration. The Enclosure Building recirculation fans draw air from the Auxiliary Building into the Enclosure Building and recirculate air within the Enclosure Building. The Enclosure Building atmosphere is then processed by the Standby Gas Treatment System (SGTS) such that all secondary containment leakage is passed through the SGTS charcoal/filter trains before release to the SGTS outlet on the roof of the Auxiliary Building. The SGTS charcoal adsorbers remove 99% of the elemental and organic iodine while the HEPA filters remove 99% of the particulate source terms. An exfiltration rate of 1 cfm from the secondary containment from unidentified sources is also assumed.

Leakage past the MSIVs is released into the Turbine Building until the MSIV Leakage Control System (MSIV LCS) is manually initiated after 20 minutes. MSIV LCS will depressurize the steamlines and direct this activity into the Auxiliary Building.

To protect the containment from over-pressurization, the RHR system is automatically directed to spray suppression pool water into the containment through spargers located in the upper elevations of the containment dome after a 10-minute time delay. The GGNS Severe Accident Procedures also call for initiation of containment spray to reduce containment airborne radiation levels.

The GGNS control room is located in the Control Building. The control room HVAC system normally draws 2000 cfm of outside air from an intake on the roof of the Control Building. Although this intake is automatically isolated on a LOCA signal or high radiation detected in the intake, manual isolation is assumed in this calculation. Upon isolation, the Control Room Fresh Air Supply (CRFAS) system is automatically initiated and recirculates 4000 cfm of control room atmosphere through a charcoal filter train before release back into the control room atmosphere. The CRFAS charcoal adsorbers remove 95% of the elemental and organic iodine while the HEPA filters remove 99% of the particulate source terms. The impact of this filtration is also neglected in this calculation. The control room can remain in this isolated mode for longer than 72 hours. For fresh air after the isolation period, the control room HVAC system can be re-aligned to take 2000 cfm of fresh air from the normal roof intake, securing CRFAS operation or the CRFAS system can be aligned to draw 4000 cfm from the Safeguard

Switchgear and Battery Room Ventilation intakes, passing this flow through the CRFAS charcoal filter train before discharge into the control room HVAC system.

The GGNS containment layout is illustrated in Figure 2-1.

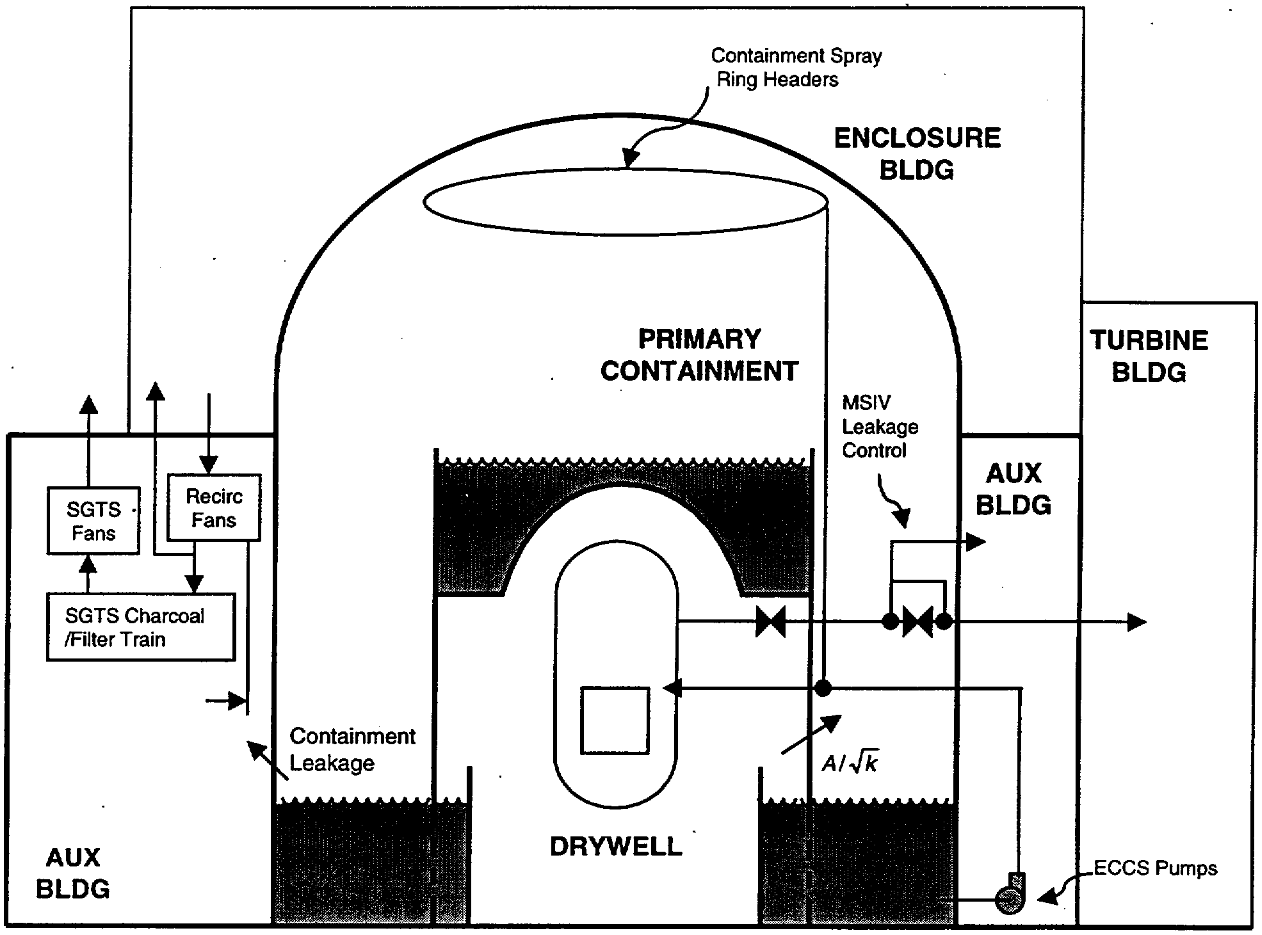


Figure 2-1 GGNS Containment Illustration

3.0 GIVEN

3.1 Core Source Terms and Releases

The GGNS core source terms have been developed with the ORIGEN2 code in Calculation XC-Q1J11-95009 [4] based on End of Cycle conditions. The Ci/MW multipliers developed in this calculation are applied to generate the core source terms at the onset of the event. These multipliers are identical or larger than those applied by RADTRAD in NUREG/CR-6604 [26]. A reactor power level of 3910 MW will be considered based on 102% [12] of the rated 3833 MW defined in Technical Specification 1.1 [13].

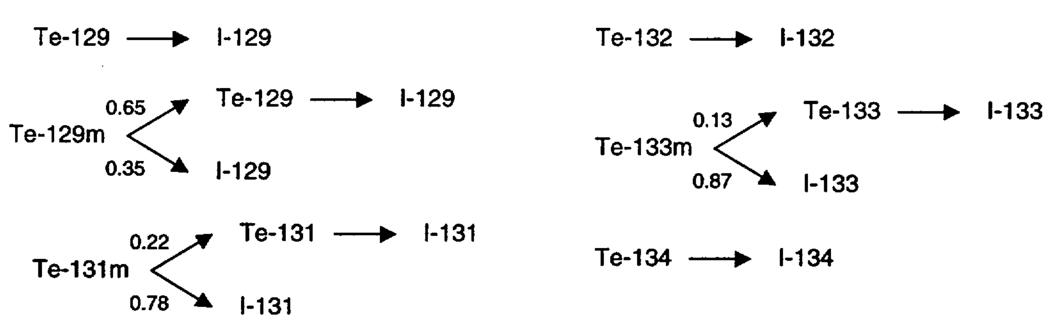
3.2 Suppression Pool Iodine Re-evolution

The post-accident suppression pool pH is demonstrated in Calculation XC-Q1111-98013 [6] to remain above a value of 7 for the duration of the radiological analysis. As discussed in NUREG-1465 and Engineering Report GGNS-98-0039 [3], iodine evolution is effectively precluded for pools in which the pH is maintained above a value of 7. As such, this analysis will not consider any impact to the offsite or control room doses due to iodine re-evolution from the suppression pool.

3.3 Dose Conversion Factors

The effective dose conversion factors for the TEDE and thyroid calculations are based on FGR 11 [10] and 12 [11]. In most cases, these DCFs are taken directly from FGR 11 and 12; however, in some cases, the DCFs applied in this calculation include the DCFs of the isotope's decay products consistent with RADTRAD as noted in NUREG/CR-6604 [26] Table 1.4.3.3-2. These dose conversion factors are reported in the TRANSACT output.

Since, unlike RADTRAD, TRANSACT does not model the production of daughter products, the production of certain significant daughter products will also be considered. Specifically, the decay of the Tellurium isotopes into Iodine isotopes will be modeled by increasing the dose conversion factors of the tellurium isotopes to also account for the iodine decay products. For each modeled Tellurium isotope, the dose conversion factor is calculated assuming exposure to its daughter products up to Iodine isotopes, including any intermediate Tellurium isotopes. The decay chains illustrated below are calculated in Attachment 1 for Te-129, Te-129m, Te-131m, Te-132, Te-133m, and Te-134.



3.4 Atmospheric Dispersion Factors

The GGNS dispersion factors have been revised with the latest six years of hourly site meteorological data. The control room χ/Q values were determined for the various GGNS release points in Calculation XC-Q1111-98011 [7] with the ARCON96 code. The offsite χ/Q values were determined in Calculation XC-Q1C84-92009 [8] with the PAVAN (1992) code. The control room and offsite dispersion factors are listed below. The release and receptor points in the control room calculation are illustrated in Figure 3-1.

Table 3-1 GGNS Dispersion Factors (s/m^3)

			CONTROL ROOM			
	EAB	**LPZ**	**Sec. Cont. Exfiltration to CR Intake**	**SGTS Vent to CR Intake**	**SGTS Vent to SSBRV Intake**	**Turbine Bldg. Vent to CR Intake**
0 to 2 hours	9.56E-04	1.94E-04	7.71E-03	7.78E-04	6.41E-04	6.05E-04
2 to 8 hours		1.06E-04		5.28E-04	4.44E-04	4.17E-04
8 to 24 hours		7.86E-05		1.54E-04	1.30E-04	1.28E-04
1 to 4 days		4.09E-05		1.31E-04	1.10E-04	1.01E-04
4 to 30 days		1.60E-05		1.04E-04	8.91E-05	8.58E-05

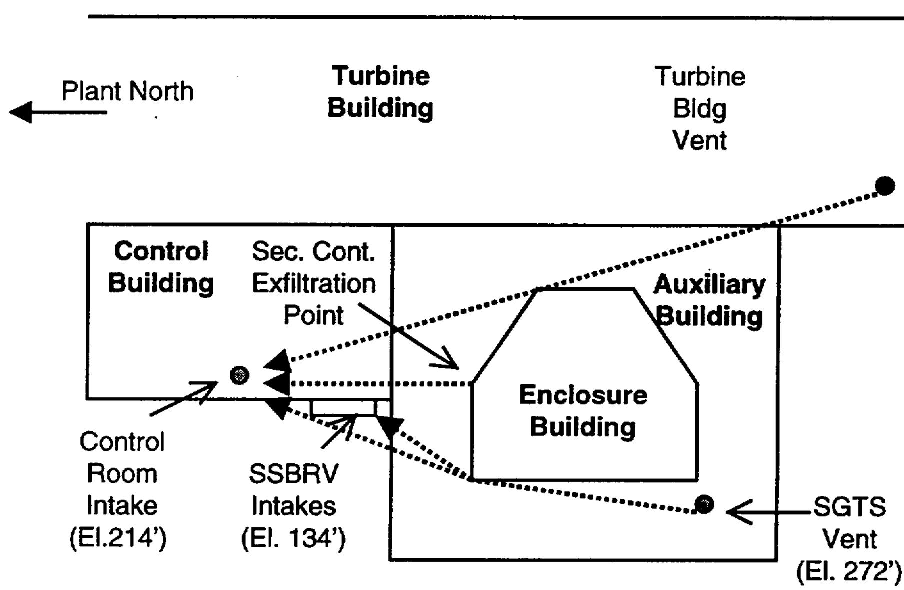


Figure 3-1 Control Room Dispersion Paths

3.5 Computer Code Methodology

The TRANSACT (Rev. 2) code will be used to calculate the offsite and control room doses. As described in CPDP X-98/0002 [9], this code has recently been revised to:

- calculate the TEDE dose as the sum of the whole body and inhalation doses,
- provide more complete output of nuclide file inputs,
- consider up to 200 different isotopes, and
- consider up to 9 different nuclide groups.

3.6 Breathing Rate and Occupancy Factors

The breathing rates applied in the calculation of the inhalation dose are based on the values reported in Section 2.c of Regulatory Guide 1.3 [17].

Table 3-2 Breathing Rates (m^3/s)

Time Period	EAB	LPZ	Control Room
0 to 8 hours	3.47E-4	3.47E-4	3.47E-4
8 to 24 hours		1.75E-4	3.47E-4
1 to 30 days		2.32E-4	3.47E-4

The control room occupancy factors are based on Reference 18 and are tabulated below.

Table 3-3 Control Room Occupancy Factors

Time Period	Occupancy Factor
0 to 24 hours	1.0
1 to 4 days	0.6
4 to 30 days	0.4

3.7 SGTS Model

A SGTS flow of 4000 cfm (per TSPS 376 and 378 in Supplement 6 to Reference 16) is applied with an additional 1 cfm bypassing the charcoal filter train from unidentified sources. The charcoal bed is tested to a 99% removal efficiency for both elemental and organic iodine, while the HEPA filter is tested to remove 99% of the particulates. With these inputs, the effective SGTS efficiency can be calculated to be 98.975% based on a 4001-cfm flow rate.

$$eff = 1.0 - \frac{(4000\,\text{cfm}) \cdot (1-0.99) + (1\,\text{cfm}) \cdot (1-0.00)}{4001\,\text{cfm}} = 0.98975$$

Previous analyses have applied a bypass leakage rate of 50 cfm based on the potential for flow bypassing the charcoal/filter unit through small openings in the fan control vane arm. Design changes have been implemented to completely seal these openings such that this bypass path no longer exists.

4.0 ASSUMPTIONS

4.1 Control Room Fresh Air System

Technical Specification 3.7.3 requires that both trains of the control room fresh air systems be operable in Mode 1. The operation of this system will not be credited in this calculation. In addition, since this system provides the automatic isolation of the control room intakes on a LOCA signal, this automatic isolation will not be credited in this analysis. Manual operator action to isolate the intake and start the CRFAS is assumed after 20 minutes in this calculation consistent with ANSI/ANS-58.8-1994 [41], which was endorsed by the NRC in draft Regulatory Guide DG-1052 [42]. As such, the normal flow of 2000 cfm [30] of outside air is assumed from the intake on the roof of the control building for the first 20 minutes.

4.2 Control Room Inleakage

Although the GGNS Operating License Condition #38 [13] reports a maximum allowable control room inleakage of 590 cfm, a value of 1200 cfm will be applied in this analysis. An additional 10 cfm will be assumed due to opening doors consistent with the guidance in Regulatory Guide 1.78 [19] for a total inleakage rate of 1210 cfm.

4.3 Containment Leakage Rate

The maximum allowable GGNS primary containment leakage rate, L_a, is 0.437% per day per Technical Specification 1.1 [13]. As described in SAR Table 6.2-1, this value is based on 0.35% per day from the containment and an additional 100 scfh through the steamlines.

$$\frac{\frac{0.0035}{\text{day}} * 1.4\text{E}6\ \text{ft}^3 + 100\frac{\text{ft}^3}{\text{hr}} * 24\frac{\text{hr}}{\text{day}}}{1.67\text{E}6\ \text{ft}^3} = 0.437\frac{\%}{\text{day}}$$

Instead of the 0.35% per day containment leak rate, this calculation assumes a value of 0.385% per day.

4.4 MSIV Leakage Rate

Technical Specification 3.6.1.3 reports the maximum allowable total leakage rate through all four steamlines as 100 scfh. This calculation will assume a total leakage of 250 scfh with no more than 100 scfh from a single steamline. With these assumptions, the maximum allowable primary containment leakage rate, L_a, becomes 0.682% per day.

$$\frac{\frac{0.00385}{\text{day}} * 1.4\text{E}6\ \text{ft}^3 + 250\frac{\text{ft}^3}{\text{hr}} * 24\frac{\text{hr}}{\text{day}}}{1.67\text{E}6\ \text{ft}^3} = 0.682\frac{\%}{\text{day}}$$

4.5 Source Term Release

The gap and in-vessel release phases are only considered in this calculation per the draft NRC guidance in Reference 49. The radiological consequences of a 121-second [15] coolant release phase are negligible based on the results of the GGNS rebaselining [14]. Also, the containment is not routinely purged per Technical Specification 3.6.1.3, which permits purging only for pressure control, ALARA, air quality considerations for personnel entry, and for surveillances or special testing. The containment will be completely isolated prior to the onset of the gap release with the exception of the RHR and LPCS test return isolation valves which have 144-second stroke times per TRM Table TR3.6.1.3-1. No significant activity transport is expected through these lines during their isolation since they (i) are normally closed, (ii) isolate penetrations that terminate below the suppression pool surface, and (iii) communicate with closed systems outside containment.

The core source terms are assumed to be released at a constant rate such that the release is completed by the end of the appropriate release period. The release is modeled with the TRANSACT command "RELEASE FRACTION" which releases a certain percentage of the core inventory per hour. These inventories are calculated below based on the release fractions and timing in Table 3.12 of NUREG-1465.

		GAP RELEASE		IN-VESSEL RELEASE	
		Duration (hr) = 0.5		Duration (hr) = 1.5	
Group Num	Nuclide Group	Fraction	Fraction/Hr	Fraction	Fraction/Hr
1	Noble Gases	0.05	1.000E-01	0.95	6.333E-01
2	Halogens	0.05	1.000E-01	0.25	1.667E-01
3	Alkali Metals	0.05	1.000E-01	0.20	1.333E-01
4	Tellurium Group	0.00	0.000E+00	0.05	3.333E-02
5	Barium, Strontium	0.00	0.000E+00	0.02	1.333E-02
6	Noble Metals	0.00	0.000E+00	0.0025	1.667E-03
7	Lanthanides	0.00	0.000E+00	0.0002	1.333E-04
8	Cerium Group	0.00	0.000E+00	0.0005	3.333E-04

TRANSACT models this release somewhat different than the RADTRAD code. TRANSACT considers the release based on the core inventory at the time of the start of the release while RADTRAD is more realistic and considers the core decay of the applicable isotope during the release phase. Appendix A demonstrates this difference for two iodine isotopes.

5.0 ACCIDENT SCENARIO AND CHRONOLOGY

-121 seconds to 0 minutes

A design basis double-ended guillotine break occurs in a recirculation suction line, releasing reactor coolant to the drywell. No ECCS injection occurs and the vessel level drops below the core exposing the reactor fuel. The BWROG has demonstrated that, under this scenario, the fuel rods would not fail for 121 seconds for BWRs [15].

The offsite and control room consequences of the reactor coolant activity are assumed to be negligible relative to the proposed acceptance criteria and are consequently ignored for this calculation. The NRC's rebaselining of GGNS in SECY-98-154 [14] made this conclusion and the Staff's recent technical guidance in DG-1081 [49] also supports this conclusion. As such, the reactor source terms are decayed for 121 seconds and the airborne calculation begins with the onset of the gap release. By 121 seconds, the containment is isolated and the MSIVs are closed, leaking at their maximum allowable rates.

0 minutes to 1 minute

The reactor core continues steaming, pressurizing the drywell and driving drywell atmosphere out the MSIVs and into containment via the drywell bypass. The gap release begins by releasing the gap source terms into the GGNS drywell at a constant rate over the 30-minute release period. The control room and offsite dose points begin to accumulate dose from the MSIV and containment leakage. The control room intake is not isolated on the LOCA signal and the normal flow of outside air is drawn into the control room.

1 minute to 8 minutes

The SGTS system achieves a 0.25-inch vacuum in the secondary containment and draws 4000 cfm of secondary containment atmosphere through a HEPA filter and charcoal bed before release to the environment.

8 minutes to 18 minutes

ESF leakage is assumed to begin, leaking contaminated suppression pool water into secondary containment.

18 minutes to 30 minutes

Drywell leakage past the MSIVs continues to enter the turbine building until 18 minutes when the MSIV leakage control system is manually initiated, directing all MSIV leakage into secondary containment. Also, at 18 minutes, the control room intake is manually isolated, reducing inleakage to 1200 cfm plus an addition 10 cfm for ingress and egress. No credit is taken for the Control Room Fresh Air Supply system that would start on control room isolation.

30 minutes to 2 hours

The in-vessel release begins at 30 minutes by releasing the in-vessel source terms into the GGNS drywell at a constant rate over the 90-minute release period. Automatic initiation of containment spray is also assumed based on the expected high containment pressure.

<u>2 hours to 3 days</u>
The source term release from the vessel is terminated at 2 hours with the actuation of ECCS, which results in large amounts of steam evolution and large flows out of the drywell into the containment. Releases to the environment continue for 30 days through the SGTS vent.

<u>3 days to 30 days</u>
The control room HVAC system is aligned to direct outside air into the control room. This mode is assumed for the duration of the analysis.

6.0 MODEL DEVELOPMENT

This analysis considers the following three pathways through which source terms can be released from the containment.

- ESF liquid leakage outside of containment
- MSIV leakage
- Containment airborne leakage

These pathways are consistent with the original GGNS SER [16] and no additional pathways have been identified. These three pathways are analyzed separately below. NRC Information Notice 91-56 was evaluated in Engineering Report GGNS-93-0002 [5] and concluded that there are no credible leak paths at GGNS capable of releasing activity to the Condensate Storage Tank.

6.1 ESF Liquid Leakage

6.1.1 Source Terms

All of the released iodine is conservatively assumed to be dissolved in the suppression pool upon its release consistent with SRP 15.6.5, Appendix B [23]. With Reg. Guide 1.3 source terms, this inventory represented 50% of the core iodine; however, with NUREG-1465 source terms, this inventory is 30% of the core iodine. Although Section 3.5 of NUREG-1465 predicts that 3% of the elemental iodine would be converted to the organic species, which is not soluble in water, the organic species is conservatively neglected in the ESF liquid leakage calculation and all 30% of the core iodine is assumed to be dissolved in the suppression pool water. This iodine is released to the drywell atmosphere over a two-hour period and is assumed to be immediately dissolved in the suppression pool.

Only halogens are modeled in this analysis. All other species are not soluble (such as the noble gases) or are in the particulate chemical form and are not anticipated to become airborne upon release.

6.1.2 Volumes

The smallest suppression pool inventory expected during the LOCA will be assumed. Considering the suppression pool makeup from the upper containment pool reported in Calculation MC-Q1E30-90112 [25], the modeled suppression pool volume can be calculated to be 170,954 ft^3. This volume is consistent with that applied in the suppression pool pH analysis in Reference 6.

Description	Volume (ft^3)
Min suppression pool volume	135,291
Upper containment pool minimum volume	36,163
less ECCS suction strainer volume	- 500
Total	**170,954**

No credit is taken for holdup in the Auxiliary Building where the ECCS systems are located. As discussed in Section 2, source terms in the Auxiliary Building are drawn into the Enclosure Building by the Enclosure Building recirculation fans where they are held before release to the environment through the SGT system. Only the enclosure building is conservatively credited for secondary containment and a 50% mixing efficiency is assumed. The effective volume of secondary containment is therefore 300,000 ft^3 based on the calculation in Appendix B.

6.1.3 Flows

As described in Section 5, the ESF systems are assumed to be unavailable for mitigating the core damage for approximately 2 hours after the accident. However, the containment spray system could potentially be automatically initiated to spray the containment within 10 minutes of the accident if high containment pressure is sensed. As such, this calculation conservatively assumes that the ESF system leakage begins at 10 minutes after the LOCA (or 8 minutes after the beginning of the gap release).

All potential contaminated liquid leak paths from the containment have been identified and quantified in Calculation XC-Q1J11-96007 [24] for inclusion in the LOCA dose analysis. This calculation concluded that a total liquid leakage rate from the full complement of ESF systems in their recirculation phase and containment isolation valves was 2.32E5 cc/hr. This leakage rate corresponds to 1.02 gpm based on 3785.4 cc/gal or 0.1364 cfm based on 0.13368 ft^3/gal. Consistent with SRP 15.6.5, Appendix B, the gross failure of a passive component is not assumed since an ESF atmosphere filtration system is provided by SGTS and is unaffected by the relaxations in this calculation.

When the ESF leakage begins 10 minutes after the accident, leakage is directed from the suppression pool to secondary containment, where the ECCS pumps and piping are located. At this time, secondary containment will have been established with the SGTS directing 4001 cfm of secondary containment atmosphere through the SGTS charcoal-filter unit as described in Section 3.7.

6.1.4 Removal Mechanisms

Since the suppression pool temperature will not exceed its design temperature of 185 °F during the accident, ten percent of the iodine in this leakage is assumed to become airborne consistent with SRP 15.6.5, Appendix B. Natural removal mechanisms in the secondary containment are conservatively neglected. Consistent with the draft regulatory guidance in DG-1081, these airborne source terms are assumed to be in the elemental chemical species.

6.1.5 Release Points

The release point for all source terms associated with the ESF liquid leakage is the SGTS vent.

6.1.6 Model

The ESF liquid leakage model is illustrated below. The ESF liquid leakage is evaluated with a separate TRANSACT run, which is reported in Attachment 2.

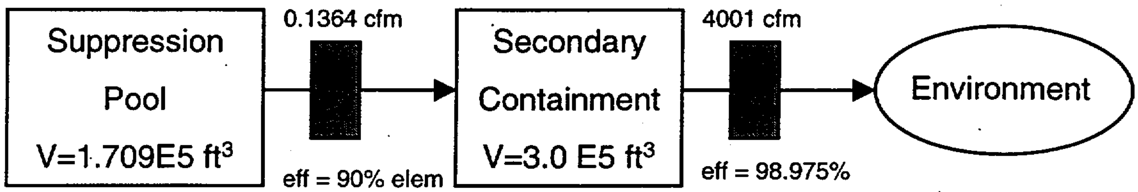


Figure 6-1 ESF Liquid Leakage Model

6.1.7 Results

The radiological doses for this transport path are reported in Section 7.

6.2 MSIV Leakage

6.2.1 Source Terms

As discussed in Section 3.1, the GGNS core source terms have been developed with the ORIGEN methodology. These source terms are released into the drywell based on the release fractions and timing reported in Table 3.12 of NUREG-1465.

6.2.2 Volumes

Consistent with the current GGNS LOCA dose analysis, one of the eight GGNS MSIVs is assumed to fail open. Leakage past the inboard MSIVs on the other three steamlines is directed into a volume between the closed inboard and outboard MSIVs. This volume is calculated to be 433.7 ft^3 based on the 144.562 ft^3 per line calculated in Reference 20.

6.2.3 Flows

As discussed in Section 4.4, GGNS Technical Specification 3.6.1.3.8 limits the total MSIV leakage through all four main steamlines to 100 scfh when tested at pressures greater than or equal to P_a, which is 11.5 psig per the associated Technical Specification Basis. This calculation will apply a total leak rate of 250 scfh with the worst-case MSIV leaking no more than 100 scfh.

The drywell atmosphere will not be at standard conditions after the reactor blowdown. Since TRANSACT applies a flow rate from one volume to another without regard to thermal-hydraulic conditions, this MSIV leakage rate must be converted to a flow at the drywell conditions. Since the local temperatures at the MSIVs may be significantly higher than the drywell average temperature due to the steamline insulation, the temperature of this MSIV leakage is assumed to be 500 °F at the onset of the accident consistent with the current LOCA dose analysis. As expected, this temperature is somewhat less than the saturation temperature at the rated steam dome pressure of 1040 psia. Considering the well-insulated steamline, this temperature will conservatively be assumed for the MSIV leakage for the duration of the accident.

As calculated below at the tested pressure of 11.5 psig, the 100-scfh MSIV leakage rate would result in a nominal flow of 103.6 ft^3/hr at the steamline conditions[1]. A lower drywell pressure would result in a lower differential pressure across the MSIV and, consequently, a lower leakage rate.

$$100 \text{ standard} \frac{ft^3}{hr} * \frac{459.67\ °R + 500\ °F}{459.67\ °R + 60\ °F} * \frac{14.696\ psi}{14.696\ psi + 11.5\ psi} = 103.6 \frac{ft^3}{hr} \text{ at steamline conditions}$$

The GGNS containment analysis in ABD-4 [21] demonstrates that, although the drywell pressure reaches a peak of ~23 psig during the early phases of the blowdown (~1 second), drywell pressure drops significantly below 11.5 psig after the blowdown ends (~100 seconds).

The worst-case post-LOCA drywell pressurization transient would occur in the case of minimum ECCS[2], in which the containment pressure is expected to reach 11.5 psig after approximately 5 hours (per Figure 15 of Reference 21). As discussed later (in Section 6.3), the drywell is not assumed to be leak-tight and suppression pool scrubbing of flows out of the drywell is ignored. At this time, the core will be covered by the available ECCS complement minimizing steam generation and rejecting decay heat to the pool via sensible energy in the ECCS flow out the break. Considering the small steam generation and the relatively low flow of the single drywell purge compressor that would be available (1000 cfm per Technical Specification 3.6.3.3), no significant drywell pressurization (over the containment) is anticipated at this time and the leak rate calculated above (based on 11.5 psig) is considered to remain appropriate.

On these bases, a conservatively high drywell pressure of 11.5 psig will be assumed at the onset of the accident resulting in a leak rate of 103.6 ft^3/hr (100 scfh) for the worst-case steamline. Considering the drywell volume of 2.7E5 ft^3, this leakage represents a rate of 0.9209 %/day. The remaining steamlines will be modeled with a leak rate of 155.4 ft^3/hr (150 scfh) or 1.381 %/day.

Consistent with the draft regulatory guidance in DG-1081 and as discussed in Appendix E, this leak rate is reduced by a factor of 2 after 96 hours. At a drywell pressure of 5.75 psig, the 125 scfh would become 165.9 ft^3/hr as calculated below. Considering the drywell volume of 2.7E5 ft^3, this leakage represents a rate of 1.475 %/day.

$$125 \text{ standard} \frac{ft^3}{hr} * \frac{459.67\ °R + 500\ °F}{459.67\ °R + 60\ °F} * \frac{14.696\ psi}{14.696\ psi + 5.75\ psi} = 165.9 \frac{ft^3}{hr}$$

For the first 20 minutes, all leakage past the outboard MSIVs is assumed released to the environment without consideration of plateout or additional decay in the steamlines. No credit is taken for the seismically-qualified portion of the steamline past the outboard MSIVs or the main

1 The standard cubic foot is defined at 60 °F and 14.696 psia [40].

2 Although this assumption represents a second active failure (of an electrical division) in addition to the MSIV failure already taken, this failure will be conservatively assumed to avoid analysis of a separate case. If maximum ECCS were assumed, containment pressure does not approach 11.5 psig.

steam shutoff valves. In the steamline with the failed MSIV, all leakage past the closed MSIV is directed to the environment. In the other three steamlines, the closed inboard and outboard MSIVs create a volume to delay the source term release down the steamline. Consistent with Reg. Guide 1.96 [22], the MSIV Leakage Control System (LCS) is assumed to be actuated 20 minutes after the accident (18 minutes after gap release begins).

The GGNS MSIV LCS is composed of independent inboard and outboard systems. The inboard system evacuates the volume between the inboard and outboard MSIVs while the outboard system draws from the volume downstream of the outboard MSIV. Although the outboard MSIV LCS is the preferred system, this calculation will conservatively assume that the inboard MSIV LCS is actuated, releasing the source terms from the volume between the isolated MSIVs on the three steamlines. If the outboard system was actuated, the holdup volume between the isolated MSIVs on three steamlines would continue to act as a holdup volume for the duration of the accident. The three isolated steamlines are modeled with a separate node with a volume equal to the volume between the isolated MSIVs for three steamlines.

The contaminated drywell atmosphere is modeled with plug flow between the isolated MSIVs[3]. Considering the maximum MSIV leakage of 100 scfh (103.6 ft^3/hr) for a single steamline and the holdup volume of 144.562 ft^3, a period of 1.4 hours would be required to completely fill this holdup volume based on the average fluid velocity. For fully developed laminar flow, the maximum fluid velocity is twice the average such that contaminated steam may reach the outboard MSIV as early as 0.70 hours. Since MSIV LCS is assumed to be actuated at 18 minutes (0.3 hours), no source terms from this holdup volume are assumed released to the environment during the 18-minute period before MSIV LCS is operating.

In addition to the leakage through the MSIVs, the drywell will also continue to leak source terms into the containment over this 18 minute period. This calculation will assume a leakage rate of 3000 cfm for this drywell bypass flow consistent with the GGNS MELCOR results reported in the Perry SER [33] (p. 6) and the draft regulatory guidance.

6.2.4 Removal Mechanisms

The only removal mechanisms credited in this model are decay and natural removal mechanisms in the drywell. These natural removal mechanisms are calculated in Section 6.3.4. All leakage past the outboard MSIV is assumed released to the environment without consideration of plateout or additional holdup in the steamlines or turbine building.

6.2.5 Release Points

All MSIV leakage past the outboard MSIV is assumed to enter the turbine building and be released via the turbine building vent. When MSIV LCS is initiated, the MSIV leakage is directed to the secondary containment and the SGTS release point is applied as discussed in the airborne analysis reported in Section 6.3.

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3 Although the Perry SER (p. 8) [33] and the draft regulatory guidance require a well-mixed model to address settling in the main steamline, a plug flow model is considered appropriate for this application since the GGNS model is only demonstrating that the contaminated steam does not leak past the outboard MSIV in this 18-minute period and does not credit any aerosol removal mechanisms in the steamline.

6.2.6 Model

The TRANSACT model applied for this leakage path is illustrated below. Since TRANSACT allows only a single release point (and associated χ/Q), the impact of MSIV leakage through the turbine building is evaluated with a separate TRANSACT run as documented in Attachment 3. This model is executed for 30 days even though the release ends at 18 minutes so that the long-term dose impacts of the source terms already in the control room at 18 minutes can be fully evaluated. The impact of MSIV leakage after 18 minutes is considered in the containment airborne leakage analysis in Section 6.3.

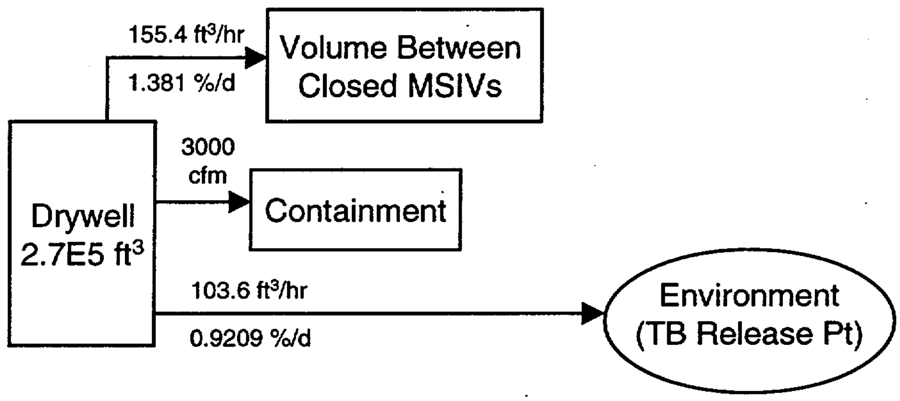

Figure 6-2 MSIV Leakage Model (0 – 18 minutes)

6.2.7 Results

The radiological doses for this transport path are reported in Section 7.

6.3 Containment Airborne Leakage

6.3.1 Source Terms

As discussed in Section 3.1, the GGNS core source terms have been developed with the ORIGEN methodology. These source terms are released into the drywell based on the release fractions and timing reported in Table 3.12 of NUREG-1465.

6.3.2 Volumes

The following volumes are applied in the LOCA airborne calculation.

Table 6-1 LOCA Volumes

Number in Model	Name in Model	Description	Volume (ft^3)	Reference
1	Drywell	Drywell	2.70E+05	Appendix B
2	Sprayed	Sprayed Region of the Containment above the Operating Floor at El. 208'10"	8.40E+05	Appendix B
3	Unsprayd	Unsprayed Region of the Containment	5.60E+05	Appendix B
4	Sec_Cont	Secondary Containment (Enclosure Building Only - with 50% mixing)	3.00E+05	Appendix B
5	MSIV_Vol	Volume between the inboard and outboard MSIVs of 3 steamlines	4.337E+02	Section 6.2.2
N/A	Control Room	Control Room	2.53E+05	31

6.3.3 Flows

From Drywell Volume Into Steamlines (MSIV Leakage)
As discussed in Section 6.2, a total MSIV leak rate of 250 scfh is modeled. While 100 scfh leaks to the environment, 150-scfh is directed to a volume between the isolated MSIVs. After 18 minutes, this closed volume is released immediately to the secondary containment by the actuation of the MSIV Leakage Control System. After 18 minutes, all 250 scfh of MSIV leakage is directed to the secondary containment.

This airborne model considers the impacts of MSIV leakage after the initiation of MSIV LCS. The release from the volume between the isolated MSIVs and the 250-scfh total leak rate are considered in this section. The impact of MSIV leakage before the initiation of MSIV LCS is calculated in Section 6.2.

From Drywell Volume Into Containment (Suppression Pool Bypass)
Consistent with the GGNS MELCOR results reported in the Perry SER (p. 6) and the draft regulatory guidance, a pool bypass flow of 3000 cfm will be applied at the onset of the analysis, which implies that (i) there is insufficient vaporization to reject all the core decay heat per Calculation XC-Q1J11-97006 [28] and (ii) there is no suppression pool scrubbing per the GGNS design value of $A/\sqrt{k}$. This bypass flow will be assumed until the release ends after two hours.

When ECCS is injected onto the hot core, the core debris are quickly quenched and significant amounts of steam are vaporized in a very short period. At this time, the drywell and unsprayed portion of the containment will be assumed to become instantly well-mixed without credit of suppression pool scrubbing. This assumption of a non-mechanistic homogenous mixing of the drywell and containment volumes is consistent with the GGNS SER [16] (Table 15-2) which effectively used this approach by assuming the source term was instantly released to both the drywell and containment weighted by the volumes of each node.

From Unsprayed and Sprayed Containment Volumes to Environment

By the time the gap release begins 121 seconds after the break, the containment is completely isolated and a containment leak rate of 0.385% per day is assumed, representing a 10% increase over the current allowable leak rate. Since secondary containment is not completely drawn down for another minute, a one minute positive pressure period is assumed in which all containment leakage is assumed to immediately leak to the environment. The control room χ/Q value applied for this leakage is based on leakage from the nearest point on the metal siding of the enclosure building to the control room intake consistent with the position in AECM-84/0051 [50].

From Unsprayed and Sprayed Containment Volumes to Secondary Containment

A containment leak rate of 0.385% per day is assumed for the first 4 days. This leak rate is based on the calculated peak containment pressure, P_a, of 11.5 psig. After 96 hours, the containment pressure has dropped to approximately 4.3 psig with minimum ECCS based on the design basis containment pressure transient reported in Figure 15 of ABD-4. After 96 hours, a containment leak rate of 0.193% per day is assumed consistent with the draft regulatory guidance in DG-1081 [49].

From Unsprayed Containment Volume to Sprayed Containment

Consistent with the guidance in SRP 6.5.2 [57], a minimum exchange rate of 2 unsprayed volumes per hour is assumed with the sprayed containment volume. This flow is therefore 4800% per day. Considering the unsprayed volume of 5.60E5 ft^3, this flow can be calculated to be 18,667 cfm. When sprays are actuated, this mixing rate increases to 70,000 cfm (1.8E4% per day) as described in Appendix D.

From Sprayed Containment Volume to Unsprayed Containment

An equivalent flow (in cfm) to that flow directed into the sprayed volume from the unsprayed volume is returned to the unsprayed volume. Without containment spray, the 18,667-cfm flow can be calculated to be 3200% per day based on the sprayed volume of 8.40E5 ft^3. With containment spray, the 70,000-cfm flow can be calculated to be 1.2E4% per day.

From Secondary Containment

The only flow from secondary containment is via the SGT system which draws 4000 cfm through a charcoal-filter unit with an additional 1 cfm bypass. The effective efficiency of this unit for all chemical species is calculated in Section 3.7 as 98.975% with a flow of 4001 cfm.

From MSIV Holdup Volume

As discussed in Section 6.2.3, no source term inventory from the holdup volume between the isolated MSIVs of the three steamlines is leaked into the turbine building over the 18 minutes that MSIV LCS is not operating. At 18 minutes, the MSIV LCS directs the source terms in this volume to secondary containment. This calculation applies a large flow out of the holdup volume at this time to represent the actuation of the MSIV LCS system.

6.3.4 Removal Mechanisms

As discussed in Section 2, the GGNS containment design provides for a number of different mechanisms for removing source terms from the atmosphere including:

- suppression pool scrubbing
- containment spray
- natural removal mechanisms

Although the previous LOCA analysis credits the impact of suppression pool scrubbing, the scenario proposed in this calculation does not result in large flows (with entrained source terms) being directed through the suppression pool. Consequently, suppression pool scrubbing is not credited in this calculation. As discussed below, containment spray and natural removal mechanisms are credited in this calculation.

Containment Spray

The GGNS containment spray is automatically initiated with all of the following signals:

- LOCA signal (high drywell pressure or low-low-low reactor water level),
- high containment pressure, and
- a 11.44-minute delay timer (per Tech Spec Table 3.3.6.3-1) has timed-out.

Considering the initial blowdown will cause a large fraction of the drywell air to enter the containment and the 3000 cfm of drywell atmosphere that bypasses the suppression pool, it is anticipated that a high containment pressure signal will be generated and containment spray will be entering the containment atmosphere within 30 minutes of the onset of the accident consistent with the existing LOCA analysis. Containment spray is modeled to begin at 32 minutes after the onset of the accident or 30 minutes after the gap release begins. The initial spray removal constants are calculated in Appendix C as 9.51 hr^{-1} for aerosols and 20 hr^{-1} for elemental iodine.

As discussed in SRP Section 6.5.2, the maximum decontamination factors for aerosols and elemental iodine are 50 and 200, respectively. After the aerosol mass[4] has been depleted by a factor of 50, the spray removal lambda is assumed to decrease by a factor of 10. After the elemental iodine activity has been depleted by a factor of 200, the elemental iodine removal is assumed to end completely. Section 6.3.7 reports when these DFs were determined to occur. As discussed in the regulatory guidance in DG-1081 [49], these DFs are based on the inventories at the end of the in-vessel release phase since the release is assumed as a linear ramp over the duration of the release. Containment spray is assumed to end at 24 hours and the aerosol removal by containment spray is terminated.

Natural Removal Mechanisms

Natural removal mechanisms for elemental iodine and aerosols will be applied in this calculation using NRC correlations. Elemental iodine removal is credited in the drywell and containment

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4 The aerosol mass is assumed to be proportional to the total aerosol activity.

volumes. Aerosol removal is credited only in the drywell since containment spray will adversely impact the particle size distribution in the containment.

Elemental Iodine
Elemental iodine is removed by deposition to the walls in the drywell and containment. As reported in Section 5.1.2 of NUREG/CR-0009 [27], this process is driven by the temperature differences between the surfaces and the atmosphere. The removal factor is reported in NUREG/CR-0009 by the following equation.

$$\lambda = \frac{k_g A}{V}$$

where:

λ = removal rate constant due to surface deposition,
k_g = average mass transfer coefficient (0.137 cm/s),
A = surface area for wall deposition, and
V = volume of contained gas.

This formula is also reported in Standard Review Plan 6.5.2 for calculating the total elemental iodine removal capability. These removal constants are applied until a DF of 200 has been obtained as discussed above for containment spray. Using the wall areas and volumes developed in Appendix B, the removal rate constants are given below.

Table 6-2 Elemental Iodine Removal Factors

Node	Volume (ft^3)	Wall Area (ft^2)	Removal factor (hr^{-1})
Drywell	2.700E+05	1.445E+04	8.660E-01
Sprayed Containment	8.40E+05	3.542E+04	6.823E-01
Unsprayed Containment	5.60E+05	3.779E+04	1.092E+00

Aerosol Removal Mechanisms
The aerosol removal mechanisms are modeled with a first-order removal factor consistent with those supplied with RADTRAD in Table 2.2.2.1-3 of NUREG/CR-6604. The conservative 10% lambda values are applied to conservatively consider the lowest possible removal efficiencies and are consistent with the draft NRC guidance in DG-1081 [49]. These values are assumed constant over a given period and are given by the following equation.

$$\lambda = A \cdot e^{\frac{-B}{Power(MW_{th})}}$$

Table 6-3 Aerosol Natural Removal Factors

Time Period	Phase	A	B	Lambda (hr^{-1}) based on 3910 MW_{th}
0-0.5h	Gap	1.285	2119	7.474E-01
0.5-2h	Gap	1.161	2274	6.490E-01
0.5-2h	Early In-vessel	0.520	2173	2.983E-01
2-5h	Gap + Early In-vessel	1.551	1507	1.055E+00
5-8.33h	Gap + Early In-vessel	0.836	1051	6.390E-01
8.33-12h	Gap + Early In-vessel	0.780	1316	5.571E-01
12-19.4h	Gap + Early In-vessel	0.778	1548	5.236E-01
19.4-24h	Gap + Early In-vessel	0.780	1686	5.068E-01

Since TRANSACT does not track the release phase of the activity, the lower value of the gap and early in-vessel removal factors will be applied for the 0.5 to 2 hour period.

6.3.5 Release Points

All source terms released via containment leakage are released via the SGTS vent on the roof of the Auxiliary Building.

6.3.6 Model

The containment airborne model is illustrated in Figure 6-4 which is based on the time at which the gap release begins. This figure also includes both the MSIV leakage and ESF leakage transport pathways.

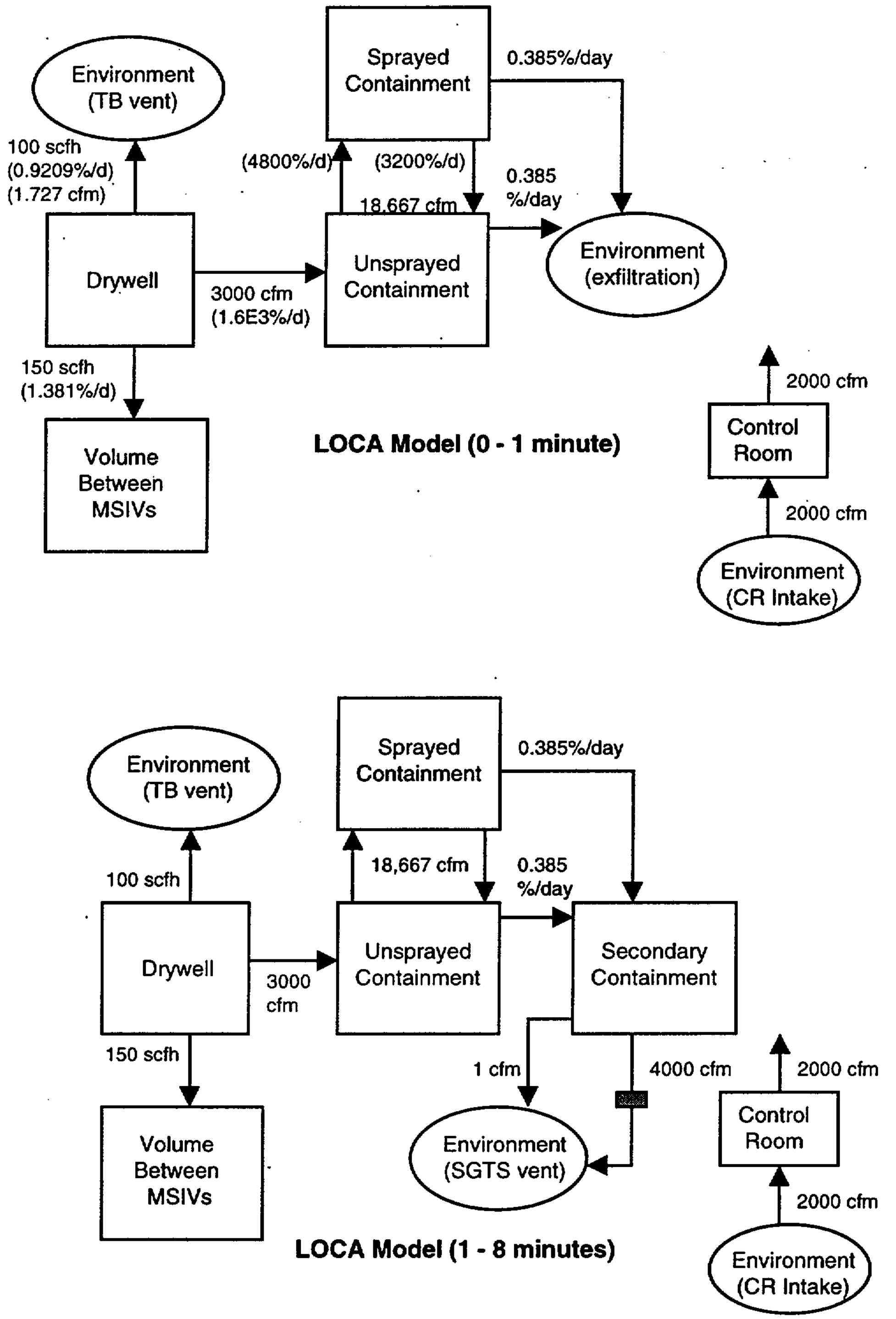
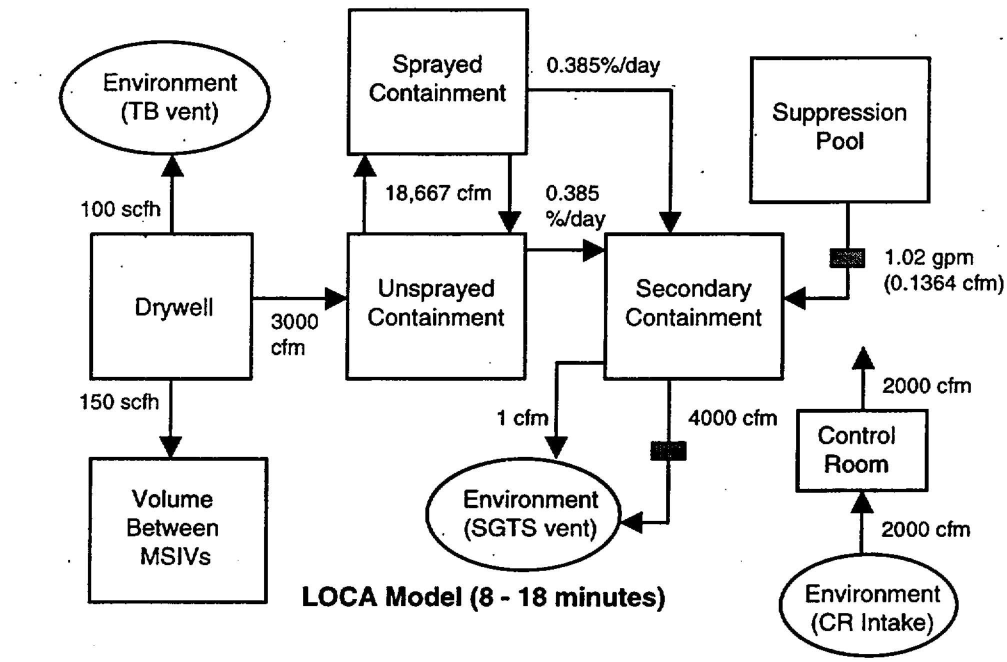
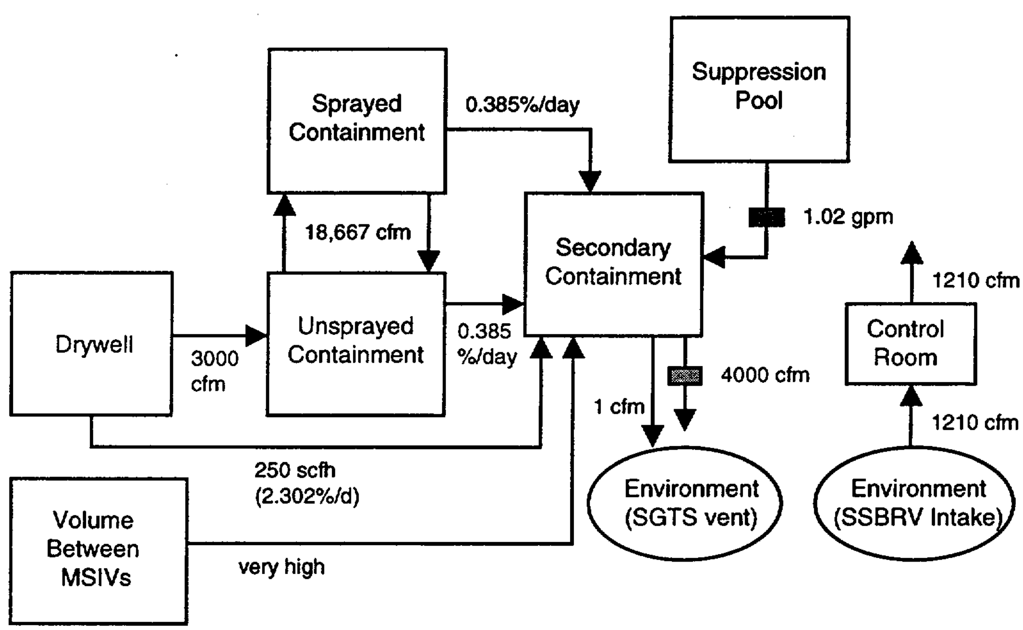


Figure 6-4a GGNS LOCA Model



LOCA Model (8 - 18 minutes)



LOCA Model (18 - 30 minutes)

Figure 6-4b GGNS LOCA Model

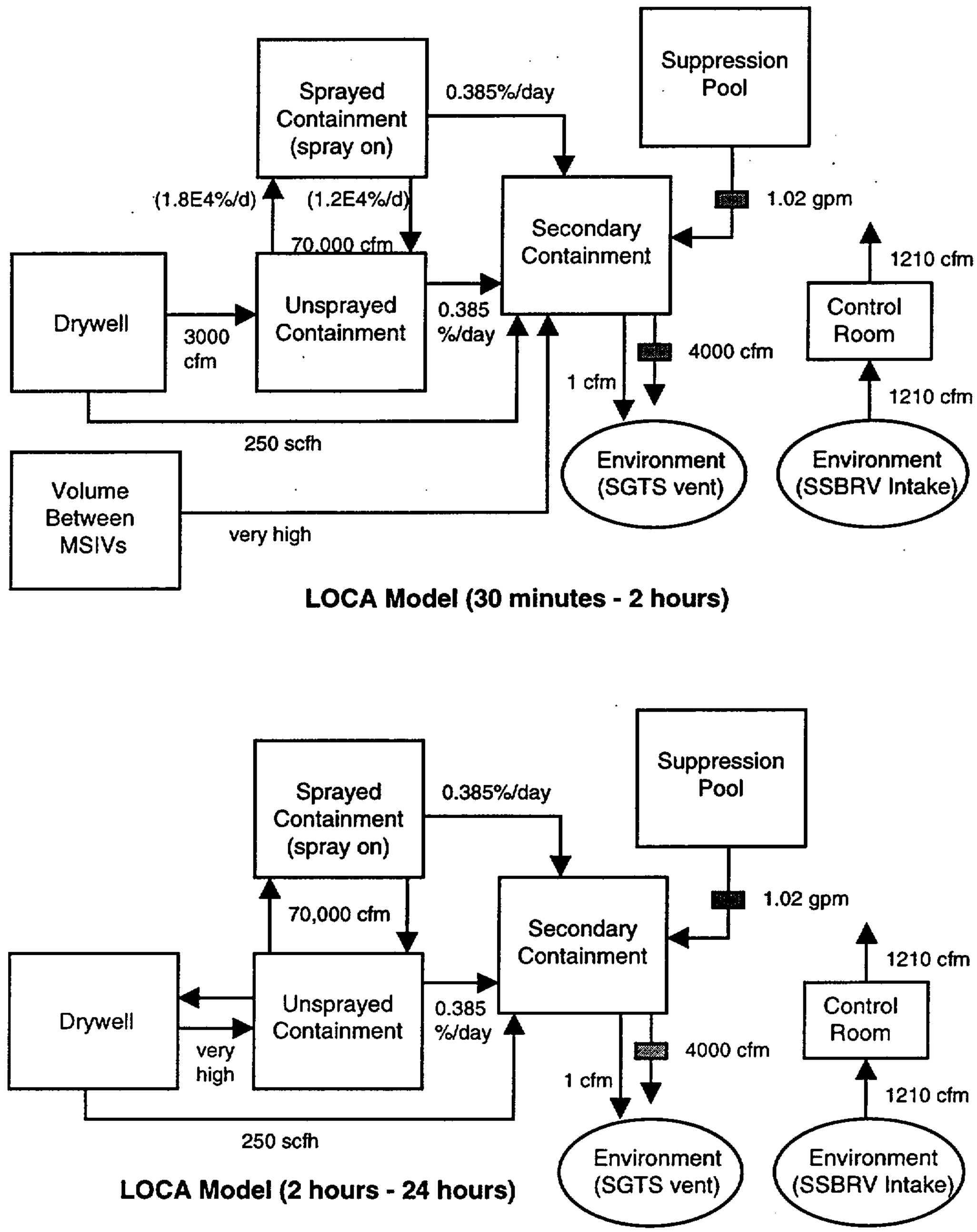
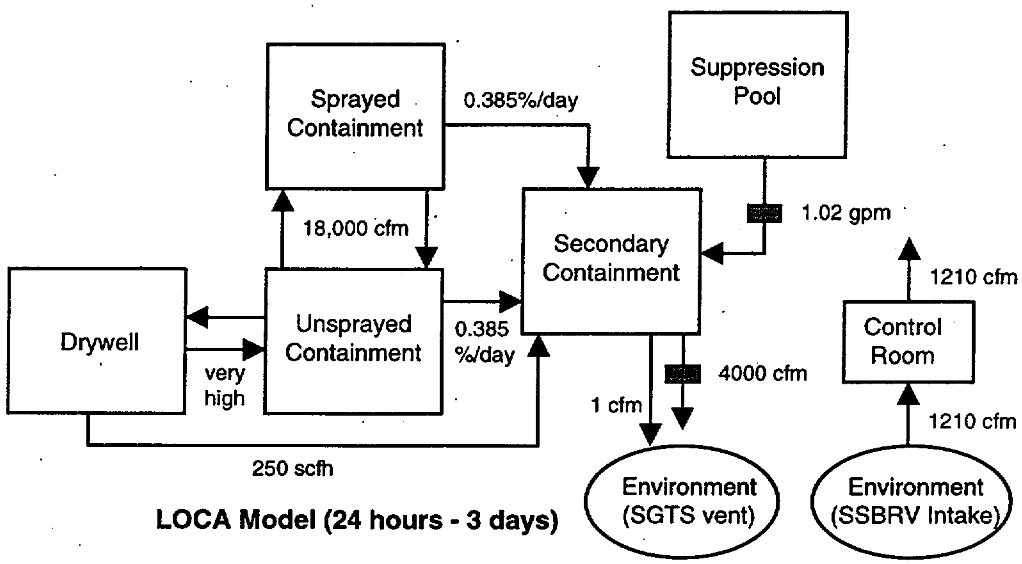
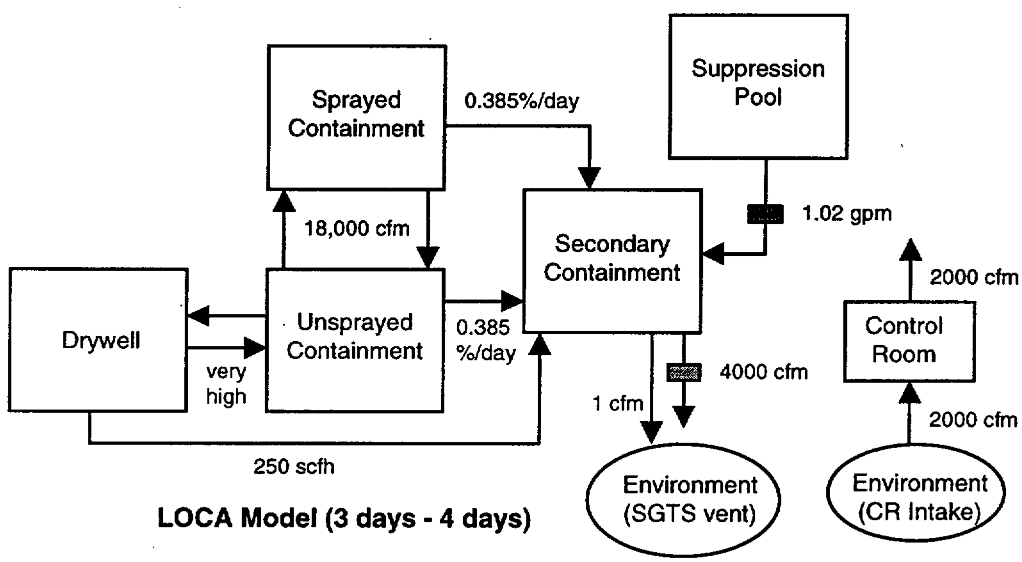


Figure 6-4c GGNS LOCA Model



LOCA Model (24 hours - 3 days)



LOCA Model (3 days - 4 days)

Figure 6-4d GGNS LOCA Model

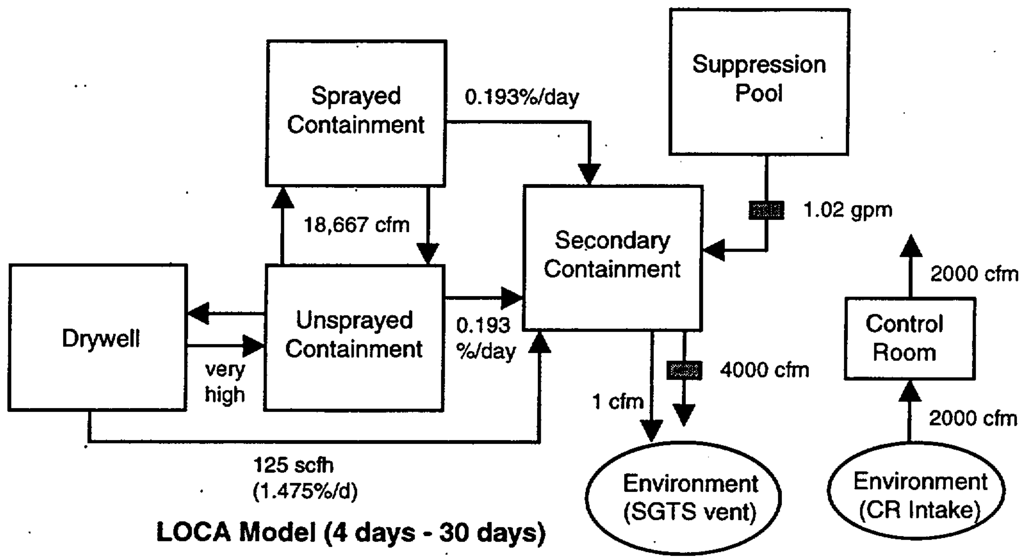


Figure 6-4e GGNS LOCA Model

6.3.7 Results

The radiological doses for the containment airborne pathway are reported in the pertinent parts of the TRANSACT output file listed in Attachment 4. As discussed in Section 6.3.4, the elemental iodine removal is neglected after a DF of 200 is reached. This DF was determined to have been reached at 3.1 hours after the gap release begins. Also, the particulate spray lambda is reduced by a factor of 10 when the aerosol activity is reduced by a DF of 50. This DF was determined to have been reached at 3.2 hours after the gap release begins. In both cases, the total activity in the drywell, and containment is considered since, if only the activity in the sprayed region of the containment was considered, a longer period of the higher lambdas would be applicable. The following table reports the elemental and particulate halogen inventory in the drywell, sprayed and unsprayed containment volumes at 2, 3.1 and 3.2 hours.

Table 6-4 Halogen Activities at 2, 3.1 and 3.2 Hours

	Drywell	Sprayed Containment	Unsprayed Containment	Total Activity
2 Hours				
Elemental	3.160E+06	8.343E+04	2.877E+05	3.53E+06
Particulate	8.569E+07	5.441E+06	1.078E+07	1.02E+08
3.1 Hours				
Elemental	4.628E+03	3.449E+03	9.600E+03	1.77E+04
3.2 Hours				
Particulate	5.657E+05	7.701E+05	1.173E+06	2.51E+06

6.4 Control Room

Although the current configuration of the GGNS control room HVAC system would automatically isolate the control room intakes on a LOCA signal (high drywell pressure or low-low water level), this analysis assumes that the control room intakes are manually isolated at 20 minutes after the initiation of the LOCA. The normal intake rate of 2000 cfm [30] is assumed to be drawn from the intake duct on the roof of the Control Building for this 20-minute period.

Once the intakes are isolated, the control room atmosphere is recirculated through the control room air conditioning units while 4000 cfm of this flow is normally drawn into the Control Room Fresh Air Supply (CRFAS) system and is passed through a charcoal/filter bed before being discharged back into the HVAC system and returned to the control room. However, the CRFAS system is not credited in this analysis. An inleakage rate of 1210 cfm is assumed during this isolation period as discussed in Section 4.2. The activity concentration of this inleakage is based on the dispersion factor to the Safeguard Switchgear and Battery Room Ventilation (SSBRV) system intakes on El. 134' of the west face of the control building. This system provides the primary flow of outside air into the Control Building during an accident (21,000 cfm) and would transport the source terms to the areas outside the isolated control room envelope, from which they can leak into the control room. These intakes are slightly farther from the SGTS release point than the normal control room intakes on the control building roof and result in a slightly lower dispersion factor (*i.e.,* 6.41E-4 versus 7.78E-4 s/m^3) per Table 3-1. Dilution with the control building volume, decay and natural removal mechanisms in the control building outside the control room envelope are conservatively neglected such that the activity concentration at these intakes is assumed to be identical to that concentration leaking into the control room.

SAR Section 9.4.1.5 reports that, in this isolated mode, fresh air makeup would not be needed for at least 72 hours. Consequently, after 3 days, the control room HVAC is assumed to be re-aligned to draw fresh air from the normal control room intake on the roof of the control building at the normal flow of 2000 cfm.[5] This configuration is assumed for the remainder of the accident duration.

The control room free volume is 2.53E5 ft^3 based on Reference 31. Although this volume considers the entire airtight boundary including the control cabinet area above the control room, the primary control room on El. 166' represents over 85% of this volume. Consequently, a Murphy-Campe Geometry Factor generated from this total volume is conservative and leads to an underestimate of this geometry factor.

The GGNS control room is separated from the Auxiliary Building atmosphere by 5 feet of concrete (3 feet for the control building wall [46] and 3 feet for the Auxiliary Building wall [47]). The side walls and roof of the control room are 2 feet thick concrete [46,48]. Considering this shielding, the contribution to the control room dose due to shine from the Aux Bldg atmosphere and release plume is neglected.

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5 Sensitivity analyses have been performed to show that a slightly larger control room dose occurs if the control room HVAC is assumed to be initiated drawing 2000 cfm from the control room intakes on the roof of the Control Building compared to CRFAS (without the charcoal filter train) drawing 4000 cfm from the SSBRV intakes at a slightly lower dispersion factor.

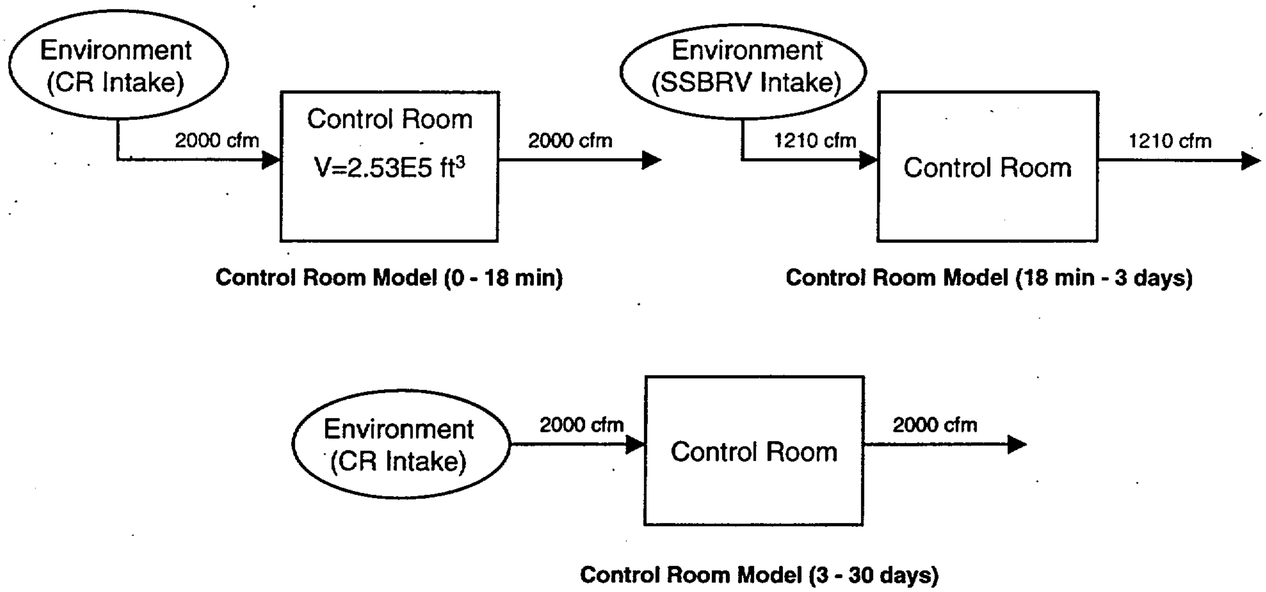

Figure 6-5 Control Room Model

7.0 RESULTS

The radiological doses for the three release pathways have been determined in Attachments 2, 3, and 4. The total offsite and control room doses would be the sum of these three calculated doses. A sliding two-hour EAB TEDE dose is evaluated in Attachment 5. The total GGNS LOCA doses are summarized in Table 7-1. These results meet the NRC proposed acceptance criteria of 25 rem TEDE offsite and 5 rem TEDE in the control room [32].

To benchmark the GGNS LOCA results, the containment leakage case was benchmarked against RADTRAD Version 2.20. A model was developed similar to the GGNS model in Section 6.3. The Control Room isolation at 20 minutes was not modeled since RADTRAD will only accept a single control room inleakage rate and a control room inleakage for the duration of the event was modeled as 2000 cfm. The RADTRAD output file is reported in Attachment 6.

The differences between the RADTRAD and GGNS results are likely due to (i) the higher GGNS core source term multipliers, (ii) the conservative Tellurium dose conversion factors in TRANSACT, and (iii) the more conservative release modeling (see Appendix A) applied in TRANSACT.

Table 7-1 Summary of TRANSACT Results

		TEDE (Rem)	RADTRAD BENCHMARK
EAB	**TOTAL**	**1.958E+01**	
LPZ	ESF Liq. Leakage	9.618E-02	
	MSIV Leakage (0-18 min)	8.525E-01	
	Containment Leakage	1.207E+01	8.488
	TOTAL	**1.302E+01**	
Control Room	ESF Liq. Leakage	3.029E-01	
	MSIV Leakage (0-18 min)	1.143E-01	
	Containment Leakage	4.503E+00	3.850
	TOTAL	**4.920E+00**	

The 2-hour GGNS EAB dose was found to peak at approximately 3.5 hours (representing a sliding 2-hour window from 1.5 to 3.5 hours). These results are illustrated in Figure 7-1 below. Table 11 of the NRC's rebaselining study in SECY-98-154 reported a worst-case GGNS TEDE dose starting at 2.2 hours. The difference is likely due to the lower drywell bypass flow applied in this calculation, leading to the higher drywell source term concentrations, and larger, earlier releases from the higher MSIV leakage. It is interesting to note that the large initial unfiltered release of MSIV leakage from the steamline with one un-isolated MSIV (prior to MSIV LCS initiation) does not even contribute to the reported EAB dose due to this sliding window.

ENTERGY	CALCULATION SHEET	Sheet 30 Cont On 31
Calculation No. XC-Q1111-98017		Rev. 0
Prepared By S.E.B. Date 8/19/99	Checked By MAM	Date 8/19/99

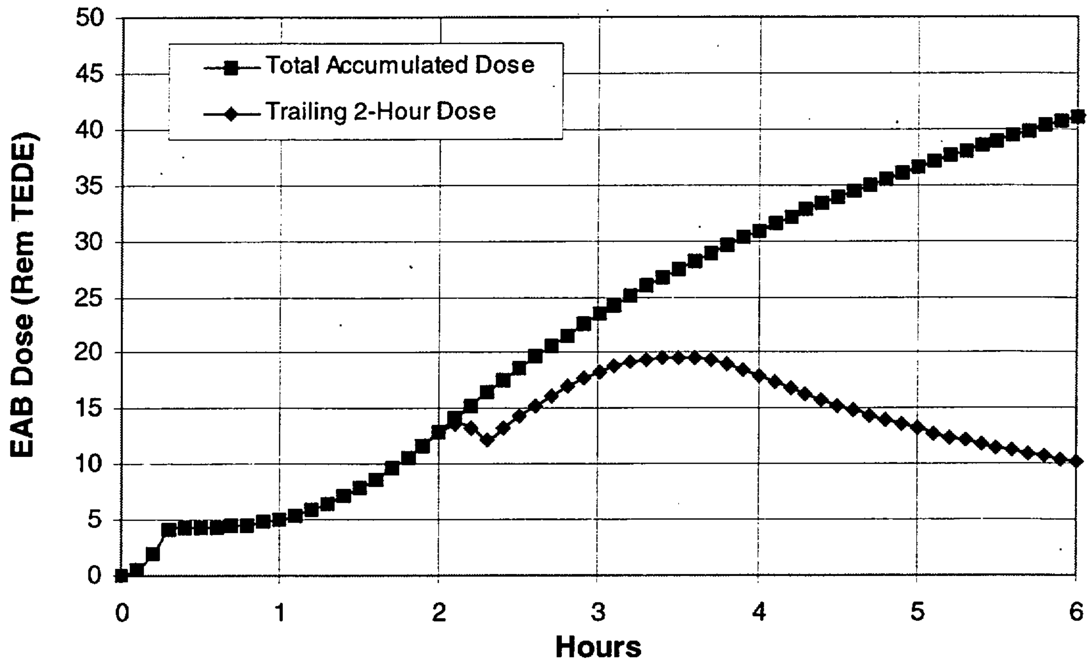

Figure 7-1 EAB TEDE Dose Characteristics

8.0 REFERENCES

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47. Drawing C-1316, Rev. 11, Unit 1 Aux Bldg Area 8 Reinforced Concrete Floor Plan – El. 166'-0"
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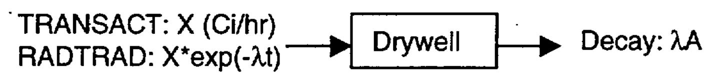
APPENDIX A
TRANSACT/RADTRAD RELEASE COMPARISON

The TRANSACT code will only model a constant release rate from the core, denoted in terms of Curies per hour. These source terms are decayed only after release when they enter the corresponding node. However, RADTRAD models this release more explicitly by considering decay in the core during the release period. These two approaches are illustrated below.



Based on an activity balance, the governing equations become:

$$\text{RADTRAD}: \frac{dA}{dt} = Xe^{-\lambda t} - \lambda A \Rightarrow A(t) = X \cdot t \cdot e^{-\lambda t} + A_0 e^{-\lambda t}$$

$$\text{TRANSACT}: \frac{dA}{dt} = X - \lambda A \Rightarrow A(t) = \frac{X}{\lambda} \cdot \left(1 - e^{-\lambda t}\right) + A_0 e^{-\lambda t}$$

The TRANSACT assumption of a constant release rate is relatively accurate for isotopes with half-lives significantly longer than the release period; however, the drywell activity of isotopes with very short half-lives will be over-estimated. In one of the two examples presented below the TRANSACT approach overestimates the source term inventory by ~25%.

Reactor Power (MW)= 3910

	I-131	I-132	
RADTRAD Production (Ci/MW)	2.581E+04	3.792E+04	per NUREG/CR-6604, Table 1.4.3.2-3
Core Inventory	1.01E+08	1.48E+08	
RADTRAD Half-Life (s)	6.94656E+05	8.28000E+03	per NUREG/CR-6604, Table 1.4.3.2-3
Decay Constant (1/hr)	3.59E-03	3.01E-01	
GAP RELEASE			
Release Fraction	5%	5%	
Release Duration (Hrs)	0.5	0.5	
Release Rate, X (Ci/hr)	1.01E+07	1.48E+07	
Node Activity at 30 min (Ci)			
with RADTRAD method	5.0368E+06	6.3764E+06	
with TRANSACT method	5.0413E+06	6.8819E+06	
IN-VESSEL RELEASE			
Release Fraction	25%	25%	
Release Duration (Hrs)	1.5	1.5	
Release Rate, X (Ci/hr)	1.68E+07	2.13E+07	
Node Activity at 2 hrs (Ci)			~25% difference
with RADTRAD method	3.0058E+07	2.4345E+07	
with TRANSACT method	3.0131E+07	3.0028E+07	

As a result, the 1.5-hour in-vessel release phase will be re-initialized after each 30 minutes to more accurately model decay of the core inventory.

APPENDIX B
VOLUME/AREA CALCULATIONS

Drywell

Volume

The GGNS drywell volume of 270,000 ft^3 is applied in this calculation per ABD-4 [21] consistent with the GGNS containment thermal-hydraulic analysis.

Wall Surface Area

Considering the 36'6"-radius [34] of the drywell cylinder and the 63-foot height above the suppression pool [34], the area of the outer drywell wall is calculated to be 14,448 ft^2.

Sprayed Volume

Volume

Although in some parts of the containment, the containment spray would fall directly to the suppression pool, the refueling floor (grating) at El. 208'10" would affect a large fraction of the containment spray. As such, the only containment volume credited with spray removal is that area above the refueling floor. The total volume of this area considers the cylindrical volume below the containment spring line at El. 237'9" [34] and the hemispherical dome with a 62-ft radius [34]. This volume is calculated below to be 8.484E5 ft^3.

$$V = \text{Hemisphere} + \text{Cylinder} = \frac{\frac{4}{3}\pi r^3}{2} + H\pi r^2$$

$$= \frac{\frac{4}{3}\pi(62\text{ ft})^3}{2} + (237'9" - 208'10")\pi(62\text{ ft})^2 = 8.4836\text{E}5\text{ ft}^3$$

If 1% of the relatively open volume is taken up by equipment, the net volume is 8.399E5 ft^3 which is consistent with the 8.394E5 ft^3 value applied on Page 24 of Bechtel Calculation 5.3.25 [35]. A sprayed volume of **8.4E5 ft^3** will be applied in this calculation. This value differs from the Bechtel volume of 9.927E5 ft^3, which was previously applied in the GGNS LOCA dose analysis, since it does not include volumes below the refueling floor that may be directly exposed to containment spray.

Wall Surface Area

The surface area is taken as the containment wall area above the refueling floor. The area below the containment spring line is calculated below as 11,265 ft^2.

$$A = 2\pi r H \quad = 2\pi(62\text{ ft})(237'9" - 208'10") = 11{,}265\text{ ft}^2$$

The half-sphere above the spring line is calculated as 24,153 ft^2.

$$A = 2\pi r^2 \quad = 2\pi(62\text{ ft})^2 = 24{,}153\text{ ft}^2$$

The total area available for plateout is therefore 35,418 ft^2.

Unsprayed Containment Volume

Volume

The volume of the unsprayed containment volume is the total containment volume (1.4E6 ft^3) per ABD-4 [21] less the sprayed containment volume (8.4E5 ft^3) and is calculated to be 5.60E5 ft^3.

Wall Surface Area

Considering the 62'-radius [34] of the containment cylinder and the 97-foot [34] height above the suppression pool (208'10"-111'10"), the area of the outer containment wall is calculated to be 37,787 ft^2.

Enclosure Building Volume

A majority of the enclosure building volume is at the top of the building, surrounding the dome of containment. The enclosure building is illustrated below based on References 34, 43, and 44.

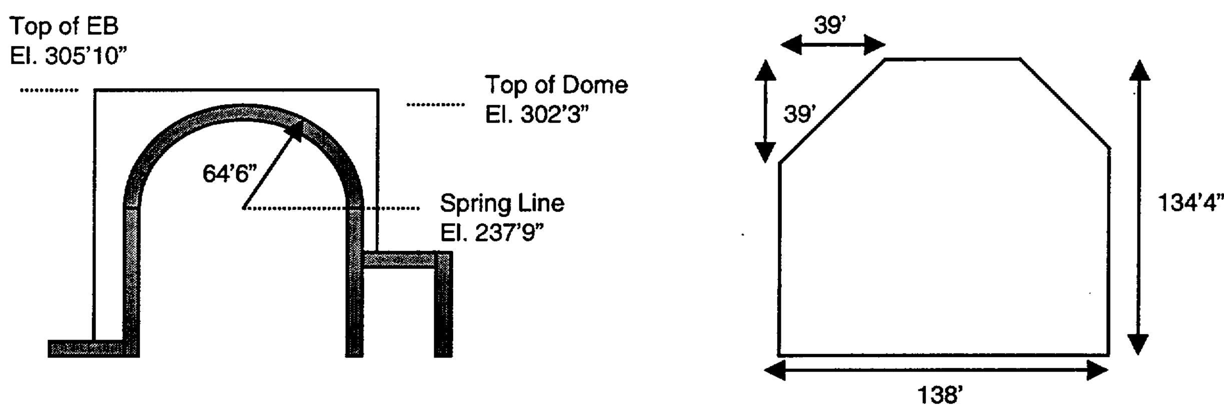


Figure B-1 Enclosure Building Volume

This part of the enclosure building volume is calculated below to be 596,571 ft^3. Considering the very small fraction of the building volume that the structural supports would accommodate and the remaining parts of the building, a net volume of **600,000 ft^3** will be applied in the calculation.

$$V = \left[(138') * (134'4") - 2 * \frac{(39') * (39')}{2} \right] (305'10" - 237'9") - \frac{\frac{4}{3}\pi(64.5')^3}{2} = 596,572 \text{ ft}^3$$

APPENDIX C
SPRAY REMOVAL COEFFICIENTS

The GGNS LOCA dose analysis credits spray removal of the particulates and the elemental iodine in the sprayed region of the GGNS containment. This appendix develops the spray removal factor (lambdas) that are applied in this calculation

Particulate Removal

This section calculates the first-order removal constant, λ_p, for aerosols with the methodology in SRP 6.5.2 [57] and then checks this value with that calculated with the methodology in NUREG/CR-5966 [36]. SRP 6.5.2 reports the following formula for the first-order removal constant, λ_p, for aerosols.

$$\lambda_p = \frac{3hF}{2V} \cdot \frac{E}{D}$$

where:

h = the fall height of the spray drops,
V = the containment building net free volume,
F = the spray flow, and
(E/D)= the ratio of a dimensionless collection efficiency E to the average-spray drop diameter D.

<u>Spray Fall Height</u>

The average droplet fall height is dependent on the available train of containment spray. As shown below, the headers for the "B" Train are located above the headers for the "A" Train per M-1348G and H [38,39].

Table C-1 GGNS Containment Spray Heights

RHR Train	Header Designation	Header Elevation	Height (ft)	Number of Nozzles	N_i*H_i
B	A	294'	85.17	50	4258.33
	C	282'-10"	74.00	115	8510.00
	E	264'	55.17	185	10205.83
				350	22974.17
A	B	292'-6"	83.67	50	4183.33
	D	279'-10"	71.00	115	8165.00
	F	261'	52.17	185	9650.83
				350	21999.17

If the flowrate through all nozzles is assumed to be equal, the average drop height can be calculated by the nozzle-weighted average of the drop heights.

$$\overline{H} = \frac{\sum N_i H_i}{\sum N_i}$$

where:

N_i is the number of nozzles on header i

H_i is the height of header i above the operating floor (ft)

The average fall height is therefore 65.64 ft for the "B" Train and 62.85 feet for the "A" Train. The average value of the two trains is calculated to be 64.245 ft (1958 cm) and will be applied in this analysis. This fall height is also within the database in NUREG/CR-5966.

Spray Flow

With a containment spray flow rate of 5650 gpm [37] and the containment radius of 62 ft [34], the water flux can be calculated to be 3.177E-2 cm^3/cm^2-s. This water flux is within the database in NUREG/CR-5966.

$$Q = \frac{5650\frac{\text{gal}}{\text{min}} \cdot \frac{\text{min}}{60\text{ sec}} \cdot 3785.4\frac{\text{cm}^3}{\text{gal}}}{\pi \cdot \left(62\text{ ft} \cdot 30.48\frac{\text{cm}}{\text{ft}}\right)^2} = 3.177\text{E}-2\frac{\text{cm}^3}{\text{cm}^2 - \text{s}}$$

Containment Volume

The free volume of the containment building is 1.04E6 ft^3 per Appendix B.

SRP Lambda Calculation

The first-order removal constant, λ_p, for aerosols can then be calculated to be 9.51 hr^{-1}.

$$\lambda_p = \frac{3hF}{2V} \cdot \frac{E}{D} = \frac{3 \cdot 64.245\text{ ft} \cdot 5650\frac{\text{gal}}{\text{min}} \cdot \frac{60\text{ min}}{\text{hr}} \frac{0.13368\text{ ft}^3}{\text{gal}}}{2 \cdot 1.4E6\text{ ft}^3} \cdot 10\text{ m}^{-1} \cdot \frac{\text{m}}{3.28\text{ ft}} = 9.51\text{ hr}^{-1}$$

As discussed in SRP 6.5.2, since the removal of particulate material depends markedly upon the relative sizes of the particles and the spray drops, the spray removal lambda is assumed to decrease by a factor of 10 after the aerosol mass has been depleted by a factor of 50.

NUREG/CR-5966 Check

As a check on this SRP result, this section calculates the first-order removal constant, λ_p, for aerosols with the methodology in NUREG/CR-5966 [36]. This NUREG develops simplified models of the spray removal process by correlating the first-order removal constant with water flux, fall distance, and mass fraction of aerosol remaining. For the continuing source expected to result from the phased release postulated in NUREG-1465, Section 6 of NUREG/CR-5966 reports that a lambda based on a 90% mass fraction is appropriate. Per M-1348 [38], GGNS uses the Spraco Model 1713A spray nozzles on which the data in this NUREG is based.

The median 10% percentile value of lambda for a case with 90% mass fraction remaining is given by the following formula.

$$\begin{aligned}\ln \lambda(m_f = 0.9) = 5.5750 + 0.94362 \cdot \ln(Q) - 7.327\text{E}-7 \cdot Q \cdot H^2 \\ - 6.9821\text{E}-3 \cdot Q^2 \cdot H + 3.555\text{E}-6 \cdot Q^2 \cdot H^2\end{aligned}$$

where:

Q = water flux (cm^3/cm^2-s), and

H = fall height (cm).

With the water flux of 3.177E-2 cm^3/cm^2-s and the 1958-cm fall height, the spray lambda at the 10% confidence factor can be calculated to be 9.31 hr^{-1} and corresponds well with the 9.51 hr^{-1} value generated with the SRP 6.5.2 methodology.

$$\ln \lambda(m_f = 0.9) = 5.5750 + 0.94362 \cdot \ln(3.177E-2) - 7.327E-7 \cdot 3.177E-2 \cdot (1958)^2$$
$$- 6.9821E-3 \cdot (3.177E-2)^2 \cdot 1958 + 3.555E-6 \cdot (3.177E-2)^2 \cdot (1958)^2 = 2.23$$
$$\lambda(m_f = 0.9) = 9.31$$

Elemental Iodine

SRP 6.5.2 provides guidance on calculating the spray lambda for removal of elemental iodine. The following formula is valid for lambdas greater than 10 per hour with a maximum of 20 per hour to prevent extrapolation beyond the existing data.

$$\lambda_s = \frac{6 \cdot k_g \cdot T \cdot F}{V \cdot D}$$

where:

λ_s = first-order removal coefficient by spray,
k_g = the gas-phase mass-transfer coefficient,
T = the time of fall of the drops, which may be estimated by the ratio of the average fall height to the terminal velocity of the mass-mean drop,
F = volume flow rate of the spray pump,
V = containment building net free volume, and
D = mass-mean diameter of the spray drops.

Gas Phase Mass Transfer Coefficient

A calculation of the gas-phase mass-transfer coefficient has been prepared for the GGNS configuration in Calculation XC-Q1E12-98002 [29] and concluded that a value of 11.95 cm/s is appropriate. As a check, the gas-phase mass-transfer coefficient for a solved case with slightly different temperature assumptions was back-calculated. Specifically, on Page 106 of NUREG/CR-0009, the lambda for a PWR case with a 1713 spray nozzle with the following parameters was evaluated with the stagnant film model.

- λ_s=14.2 hr^{-1}
- F=1500 gpm
- V=1.75E6 ft^3
- Height=90 ft
- Temp=250 °F

Applying the terminal velocity and mass-weighted average drop size for the 1713 nozzles calculated in the following sections, an estimate of the gas-phase mass-transfer coefficient can be calculated to be 6 cm/s. Since this value is lower than the 11.95 cm/s calculated previously, this value will be applied in this analysis.

$$k_g = \frac{\lambda_s \cdot V \cdot D}{6 \cdot T \cdot F} = \frac{\frac{14.2}{hr} \cdot \frac{hr}{60\,min} \cdot 1.75E6\,ft^3 \cdot 1200E-6\,m \cdot 100\frac{cm}{m}}{6 \cdot \frac{90\,ft}{400\frac{cm}{s}} \cdot 30.48\frac{cm}{ft} \cdot 1500\frac{gal}{min} \cdot 0.1337\frac{ft^3}{gal}} = 6\frac{cm}{s}$$

Spray Flow Rate
A single RHR pump can supply containment spray at a flow rate of 5650 gpm.

Drop Diameter
Section 4.7 of the ECCS System Design Criteria [45] reports the spray nozzles are designed to produce spray droplets with an average diameter of 400 microns and a maximum diameter of 1600 microns. More recent tests with the Spraco 1713A nozzles in Figure 4 of NUREG/CR-5966 have confirmed this distribution. The mass-weighted average drop size, however, will be larger than 400 microns since the larger drops have exponentially more mass. This distribution is reported in Figure 7 of NUREG/CR-5966 which illustrates an average of the volume-weighted distribution to be approximately 1200 microns. A value of 1200 microns will be applied in this calculation.

Containment Volume
The total containment volume of 1.4E6 ft^3 is applied in this calculation to produce a conservatively low spray lambda even though only a portion of the building is affected by the spray as calculated in Appendix B.

Drop Time
The fall height of the spray drops is reported above as 64.245 ft (1958 cm). The terminal velocity of 1200 μm drops can be found to be approximately 400 cm/s from Figure 16 of NUREG/CR-5966. The drop time is calculated to be 4.9 seconds.

Calculation
From the SRP equation above, the GGNS spray lambda for elemental iodine can be calculated to be 47.59 hr^{-1}.

$$\lambda_s = \frac{6 \cdot k_g \cdot T \cdot F}{V \cdot D} = \frac{6 \cdot 6\frac{cm}{s} \cdot 4.9\,s \cdot 5650\frac{gal}{min} \cdot 0.1337\frac{ft^3}{gal} \cdot 60\frac{min}{hr}}{1.4E6\,ft^3 \cdot 1200E-6\,m \cdot 100\frac{cm}{m}} = 47.59\,hr^{-1}$$

This result is reasonable considering the 14.2 hr^{-1} value calculated for the PWR case described in NUREG/CR-0009 and the much higher spray flow rate at GGNS. Since the SRP allows a maximum lambda of 20 hr^{-1}, this calculation will apply a spray removal lambda of 20 hr^{-1} for elemental iodine.

As discussed in SRP 6.5.2, the maximum decontamination factor is 200 for elemental iodine. The effectiveness of the spray in removing elemental iodine shall be presumed to end at that time, post-LOCA, when the maximum elemental iodine DF is reached.

APPENDIX D
CONTAINMENT MIXING FLOW DURING SPRAY OPERATION

The mixing flows in containment during operation of the containment spray system can be calculated by assuming that, as the spray condenses water vapor in the containment atmosphere, the movement of this condensation results in a corresponding movement of air.

Figure 16 of ABD-4 [21] illustrates the suppression pool temperature profile in the event of a recirculation line break. The pool temperature, T_p, ranges from approximately 150 °F to 120 °F between 30 minutes and 24 hours after the accident. With a spray flow rate, $\dot{m}_s$, of 5650 gpm and a standby service water temperature, T_{SW}, of 90 °F, the spray temperature at the nozzles, T_s, can be calculated to be 110.619 °F with a pool temperature, T_p, of 140 °F based on the formulas provided is SAR Section 6.2.1.1.5.5.

$$T_s = T_p - \frac{KHX}{\dot{m}_s}\frac{(T_p - T_{sw})}{C_p} = 140\ °F - \frac{454\frac{Btu}{s\text{-}°F}\cdot 60\frac{s}{min}}{5650\frac{gal}{min}\cdot 0.13368\frac{ft^3}{gal}\cdot 61.376\frac{lb}{ft^3}}\cdot\frac{(140\ °F - 90\ °F)}{1\frac{Btu}{lb\text{-}°F}} = 110.619\ °F$$

where:

C_p = the heat capacity of water (Btu/lb-°F) and
KHX = heat exchanger capacity (454 Btu/s-°F).

If the containment atmosphere is saturated with water vapor at the same temperature as the suppression pool, the condensation capability of the sprays, $\dot{m}_c$, can be calculated to be 805.92 lbs/min.

$$\dot{m}_c = \dot{m}_s\cdot\frac{V_s}{V_{free}}\frac{(T_p - T_s)}{h_{fg}}\cdot C_p = 5650\frac{gal}{min}\cdot 0.13368\frac{ft^3}{gal}\cdot 61.376\frac{lb}{ft^3}\cdot\frac{8.4E5\ ft^3}{1.40E6\ ft^3}\cdot\frac{(140\ °F - 110.619\ °F)}{1014\frac{Btu}{lb}}\cdot 1\frac{Btu}{lb\text{-}°F} = 805.92\frac{lb}{min}$$

where:

V_s = sprayed volume (8.4E5 ft^3),
V_{free} = containment free volume(1.4E6 ft^3), and
h_{fg} = latent heat of vaporization.

If the surrounding air of this condensed water vapor is dragged to the suppression pool with this condensate, the volumetric flow of dry air associated with this condensation rate can be calculated as 79,381 ft^3 per minute.

$$\dot{m}_{air} = \frac{\dot{m}_c}{HR}\cdot v_{air} = \frac{805.92\frac{lb}{min}}{0.153405\frac{lb\ water\ vapor}{lb\ dry\ air}}\cdot 15.11\frac{ft^3}{lb\ dry\ air} = 79{,}381\frac{ft^3\ dry\ air}{min}$$

This calculation is repeated for the range of suppression pool temperatures that may exist for the first 24 hours to generate the following table.

Table C-1 Range of Containment Mixing Flows during Spray Operation

Pool Temp., T_p (°F)	Water Density (lb/ft^3) [53]	Heat of Vaporization, h_{fg} (Btu/lb) [56]	Humidity Ratio, HR (lbs water vapor per lb dry air) [55]	Specific Volume (cu.ft per lb dry air) [54]	Spray Temp, T_s, (°F)	Condens. Capability (lbs water vapor/sec)	Dry Air Flow Rate (cfm)
120	61.7132	1025.6	0.081507	14.6	102.468	7.97	85,637
130	61.550	1019.8	0.111652	14.86	106.562	10.68	85,321
140	61.376	1014.0	0.153405	15.11	110.619	13.43	79,381
150	61.188	1008.2	0.212512	15.36	114.635	16.21	70,302

Based on the lowest mixing rate predicted above, a conservatively low flow of 70,000 cfm will be assumed between the sprayed and unsprayed containment regions. This will minimize the transport of source terms into the sprayed region where they are removed. This value is consistent with that applied in the Perry analysis per Table 3 of the Perry SER [33].

APPENDIX E
DRYWELL/CONTAINMENT PRESSURE CONSIDERATIONS

This calculation utilizes the GGNS drywell and containment pressure profile for calculating the MSIV leakage rate in Section 6.2.3 and for the decrease in drywell and containment leakage (due to pressure decay) some time after the accident. These profiles should consider the proposed radiological scenario of a LOCA that is unmitigated for 2 hours. However, the GGNS containment analysis is based on a design basis accident in which there is a very short core uncovery and oxidation of only 5% of the active clad. The radiological scenario would be different in that more hydrogen is produced due to additional metal-water reaction and some hydrogen ignition would occur in the drywell and containment. This appendix describes the adjustments made to the GGNS design-basis pressure profiles due to the additional hydrogen introduced into the drywell and containment and the additional heat load associated with increased metal-water reaction and hydrogen ignition.

Hydrogen Production Term

The GGNS hydrogen analysis predicts that 2585 lbs of hydrogen [51] will be produced over a 2.2-hour period [Table D-2 of Reference 52] in a degraded core accident which represents a metal-water reaction of 75% [Section D.4 of Reference 52] of the active cladding.

Residual Hydrogen Pressure

Considering nominal drywell and containment temperatures of 115 °F and 85 °F, respectively, the air mass in the containment and drywell can be calculated as 120,717 lbs at atmospheric pressure.

$$\text{Drywell at 115 °F:} \quad 0.0691\frac{\text{lbs}}{\text{ft}^3} * 2.7E5\ \text{ft}^3 = 18{,}657\ \text{lbs}$$

$$\text{Containment at 85 °F:} \quad 0.0729\frac{\text{lbs}}{\text{ft}^3} * 1.4E6\ \text{ft}^3 = 102{,}060\ \text{lbs}$$

$$\text{Total:}\ 18{,}657\ \text{lbs} + 102{,}060\ \text{lbs} = 120{,}717\ \text{lbs}$$

Assuming a mixture of 21 volume percent (v/o) oxygen and 79 v/o nitrogen, the total lbmols of gas in the containment (assuming no hydrogen ignition) is calculated below to be 5478.2 lbmols with 4185.7 lbmols from the original containment air.

Table E-1 Initial Inventories

Element	Pounds	Atomic Weight	Lbmols
Hydrogen	2585.0	2	1292.5
Oxygen	28128.3	32	879.0
Nitrogen	92588.7	28	3306.7
Total			5478.2

This hydrogen pressure at a conservatively high 24-hour containment temperature of 150 °F, would be 5 psi.

$$p = \frac{R^{\cdot}T}{V} = \frac{1292.5\ \text{lbmol} * 0.7302\frac{\text{atm - ft}^3}{\text{lbmol-°R}} * (459.67 + 150)°\text{R}}{1.67E6\ \text{ft}^3} = 0.34\ \text{atm} = 5\ \text{psi}$$

The hydrogen volume percent is calculated to be 23.6 v/o which is well above the 10 v/o combustible level [Table D-4 of Reference 52]. The oxygen concentration is 16 v/o which is also well above the 5.2 v/o level required for hydrogen combustion [Section 5 of Reference 51]. Consequently, some hydrogen would be ignited in this scenario. From the inventories above, it can be calculated that the combustion of 876 lbmols of hydrogen with 438 lbmols of oxygen would result in a hydrogen concentration of 10 v/o with an oxygen concentration of 10.6% such that the reaction is not oxygen limited. The resulting inventories are reported below. The product of hydrogen combustion, water vapor, would be swept into the suppression pool by the containment spray since this combustion would be occurring during the first 24 hours.

Table E-2 Post-Burn Inventories

Element	Lbmols
Hydrogen	416.5
Oxygen	441
Nitrogen	3306.7
Total	4164.2

Considering the 438-lbmol reduction in oxygen, the post-burn containment gas content is actually less than before the addition of hydrogen (4164.2 versus 4185.7 lbmols) and consequently, the containment pressure would be slightly lower than the design basis case. This result corresponds with the conclusions in Reference 51 that predicts a negative pressure transient if <u>all</u> the hydrogen were ignited. Consequently, the pressure impact of residual hydrogen concentrations below the combustible limit in the containment and drywell can be neglected.

The impact on MSIV leakage rates due to local pressure pulses associated with hydrogen ignition in the drywell can also be neglected since the hydrogen igniters are located outside the reactor vessel and the MSIV leakage is controlled by the differential pressure across the MSIVs.

<u>Additional Heat Loads</u>

The heat load due to metal-water reaction assumed in the design basis containment analysis is 288 Btu/s for the first 1800 seconds [53] or 518,400 Btu. Since this design case represents a reaction of 5% of the active cladding [21], the reaction of 75% of the active cladding is predicted to generate 7.78 MBtu of heat. The combustion of the hydrogen will also generate an additional heat load. Section 7 of Reference 51 predicts an additional heat load of 180E6 kcal (714.3 MBtu at 2.52E5 kcal/MBtu) due to the combustion of all 2585 lbs of hydrogen and condensation of the associated steam production.

An additional heat load of 722 MBtu would be added to the containment due to hydrogen generation if all the hydrogen were conservatively assumed to be ignited. If this heat were generated in the first 2.4 hours of the accident, the additional heat load due to hydrogen generation and ignition would be 300.8 MBtu/hr. This heat load is substantial and is on the order that the core decay heat load. Consequently, this heat load would increase the suppression pool temperature; however, since the RHR heat rejection is based on the temperature differential between the suppression pool and the service water system, the heat rejection rate would increase, and the pool temperature would be approximately the same as the design basis case after 24 hours.

To quantify the impact of this additional heat load, a simplified pool model was developed. This model does not consider the short-term containment thermal-hydraulics of reactor blowdown, steam condensation, RHR timing, and other heat loads and sinks, but is merely based on a long-term heat balance on the suppression pool. The only heat inputs applied in this model are the core decay heat load and the additional 300.8 MBtu/hr heat load (calculated above) associated with hydrogen generation and ignition for the first 2.4 hours. The only heat sink is conservatively a single RHR heat exchanger in the containment spray configuration. This model can then provide an indication of the impact of the hydrogen heat load on long-term suppression pool temperature relative to the design basis case without hydrogen ignition.

$$\rho V C p \frac{dT}{dt} = Be^{-Ct} + D - NhA(T - T_{SW}) \qquad \text{(E-1)}$$

where:

ρ	=	density of the pool water (61.5 lb/ft^3 in the pool temperature range)
V	=	pool volume (1.709E5 ft^3 from Section 6.1.2)
Cp	=	heat capacity of water (1E-6 MBtu/lb-°F)
T	=	suppression pool temperature (°F)
t	=	hours after the LOCA
Be^{-Ct}	=	curve fit for core decay heat load (MBtu/hr)
D	=	heat load associated with hydrogen generation and ignition (300.8 MBtu/hr for first 2.4 hours)
N	=	number of RHR heat exchangers in pool cooling mode (1)
hA	=	heat transfer performance of each RHR heat exchanger (1.6308 MBtu/hr-°F [21])
A	=	heat transfer area of RHR heat exchanger (21,250 ft^2 per unit [21])
T_{sw}	=	service water temperature (90 °F [21])

The differential equation above is solved below.

$$\rho V C p \frac{dT}{dt} = Be^{-Ct} + D - NhA(T - T_{SW})$$

$$\frac{dT}{dt} + \frac{NhA}{\rho VCp} T = \frac{D + NhAT_{SW}}{\rho VCp} + \frac{B}{\rho VCp} e^{-Ct}$$

$$T(t) = \frac{T_o e^{\frac{NhA}{\rho VCp} t_o} + \frac{D + NhAT_{SW}}{hA}\left(e^{\frac{NhA}{\rho VCp} t} - e^{\frac{NhA}{\rho VCp} t_o}\right) + \frac{B}{NhA - C \cdot \rho VCp}\left[e^{\left(\frac{NhA}{\rho VCp} - C\right)t} - e^{\left(\frac{NhA}{\rho VCp} - C\right)t_o}\right]}{e^{\frac{NhA}{\rho VCp} t}} \qquad \text{(E-2)}$$

The core decay heat load is fit from the heat load data generated with ASB 9-2 in Calculation XC-Q1J11-97006 [28] with the equation $1133.9e^{-0.8115t}$ for the first 2.4 hours and $153.4501e^{-0.0299t}$ for the remainder of the 24-hour period.

Table E-3 Core Decay Heat Curve Fit

Hours	Core Decay Heat (MBtu/hr)	Predicted Decay Heat (MBtu/hr)
0	1133.9	1133.9
2.4	161.7	161.7/142.8
4.8	135.5	132.9
7.2	119.3	123.7
9.6	108.1	115.2
12	100.1	107.2
14.4	94.2	99.8
16.8	89.7	92.9
19.2	86.3	86.4
21.6	83.4	80.4
24	81.1	74.9

Based on an initial suppression pool temperature of 95 °F [21], the model described above concludes that the 24-hour suppression pool temperature with release and combustion of all released hydrogen is only 2 °F above the reference case (148.3 °F versus 146.3 °F). The additional containment pressurization associated with this slightly higher temperature is negligible.

Conclusions

The impact of the hydrogen associated with this core damage scenario has been reviewed and determined to have no impact on the containment pressure after 24 hours. The drywell pressure not be significantly above the containment pressure due to the potential 2000-cfm flow of the combustible gas compressors (per Technical Specification 3.6.3.3 requiring 1000-cfm per train). The core will be covered by the available ECCS complement minimizing steam generation and rejecting decay heat to the pool via sensible energy in the ECCS flow out the break.

The calculated design-basis containment pressure at 24 hours with maximum ECCS (Case A) is approximately 18 psia (3.3 psig) per Figure 15 of ABD-4. Considering that the containment and MSIV leak rates are based on the containment P_a of 11.5 psig, a 50% reduction in the containment and MSIV leak rates is warranted at 24 hours with maximum ECCS. With minimum ECCS, the containment pressure reduces at a slower rate due to the reduced heat rejection capability and reaches 19 psig only after 4 days. Consequently, this 50% reduction in MSIV and containment leak rates are taken after 4 days.

INITIAL DOSE CONVERSION FACTORS

	Half-Life	Decay Constant (1/s)	FGR-12 Air Immersion DCF (Sv-m^3/Bq-s)	FGR-11 Thyroid DCF (Sv/Bq)	FGR-11 Inhalation DCF (Sv/Bq)	Air Immersion (Rem-m^3/Ci-s)	Thyroid (Rem/Ci)	Inhalation (Rem/Ci)	Air Immersion (Rem-m^3/s-atom)	Thyroid (Rem/atom)	Inhalation (Rem/atom)
I-129	1.60E+07 years	1.37278E-15	3.80E-16	1.56E-06	4.69E-08	1.40600E-03	5.77200E+06	1.73530E+05	5.21657E-29	2.14154E-19	6.43835E-21
I-131	8.04 days	9.97828E-07	1.82E-14	2.92E-07	8.89E-09	6.73400E-02	1.08040E+06	3.28930E+04	1.81605E-18	2.91366E-11	8.87069E-13
I-132	2.28 hours	8.44478E-05	1.12E-13	1.74E-09	1.03E-10	4.14400E-01	6.43800E+03	3.81100E+02	9.45815E-16	1.46939E-11	8.69812E-13
I-133	20.8 hours	9.25677E-06	2.94E-14	4.86E-08	1.58E-09	1.08780E-01	1.79820E+05	5.84600E+03	2.72149E-17	4.49879E-11	1.46257E-12
I-134	52.5 min	2.20047E-04	1.30E-13	2.88E-10	3.55E-11	4.81000E-01	1.06560E+03	1.31350E+02	2.86061E-15	6.33735E-12	7.81166E-13
Te-129	69.5 min	1.66222E-04	2.75E-15	5.09E-13	2.09E-11	1.01750E-02	1.88330E+00	7.73300E+01	4.57111E-17	8.46072E-15	3.47405E-13
Te-129m	33.4 days	2.40196E-07	1.55E-15	1.56E-10	6.47E-09	5.73500E-03	5.77200E+02	2.39390E+04	3.72303E-20	3.74705E-15	1.55407E-13
Te-131	25 min	4.62098E-04	2.04E-14	2.66E-09	1.24E-10	7.54800E-02	9.84200E+03	4.58800E+02	9.42680E-16	1.22918E-10	5.73002E-12
Te-131m	32.4 hours	5.94262E-06	7.01E-14	3.61E-08	1.73E-09	2.59370E-01	1.33570E+05	6.40100E+03	4.16578E-17	2.14529E-11	1.02807E-12
Te-132	78.2 hours	2.46216E-06	1.03E-14	6.28E-08	2.55E-09	3.81100E-02	2.32360E+05	9.43500E+03	2.53602E-18	1.54624E-11	6.27851E-13
Te-133	12.5 min	9.24196E-04	4.60E-14	5.91E-10	2.39E-11	1.70200E-01	2.18670E+03	8.84300E+01	4.25130E-15	5.46200E-11	2.20883E-12
Te-133m	55.4 min	2.08528E-04	1.14E-13	2.63E-09	1.10E-10	4.21800E-01	9.73100E+03	4.07000E+02	2.37722E-15	5.48429E-11	2.29381E-12
Te-134	42 min	2.75058E-04	4.24E-14	5.56E-10	3.23E-11	1.56880E-01	2.05720E+03	1.19510E+02	1.16625E-15	1.52932E-11	8.88439E-13

DCFS ADJUSTED FOR DECAY PRODUCTS

	Air Immersion (Rem-m^3/s-atom)	Thyroid (Rem/atom)	Inhalation (Rem/atom)	Air Immersion (Rem-m^3/Ci-s)	Thyroid (Rem/Ci)	Inhalation (Rem/Ci)
Te-129	4.57111E-17	8.46093E-15	3.47405E-13	1.01750E-02	1.88335E+00	7.73300E+01
Te-129m	2.97495E-17	9.24673E-15	3.81220E-13	4.58264E+00	1.42438E+03	5.87235E+04
Te-131m	2.50863E-16	7.76314E-11	3.17575E-12	1.56193E+00	4.83350E+05	1.97729E+04
Te-132	9.48351E-16	3.01563E-11	1.49766E-12	1.42513E+01	4.53172E+05	2.25061E+04
Te-133m	2.95710E-15	1.06931E-10	4.04353E-12	5.24691E-01	1.89733E+04	7.17460E+02
Te-134	4.02686E-15	2.16306E-11	1.66960E-12	5.41680E-01	2.90968E+03	2.24590E+02

1

TRANSACT Version 2.0, Revision 0
Based on TACT V
SEP 87 PC VERSION
REVISED TO VERSION 2 - JANUARY 1999
BY GGNS SAFETY ANALYSIS

MODIFIED FALL 1992 FOR GGNS
BY OMEGA TECHNICAL SERVICES, INC.

NUCLEAR REGULATORY COMMISSION
ACCIDENT EVALUATION BRANCH
DATE 8/17/99 TIME 20:38:50

MODEL SUMMARY FOR CASE 1

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
ESF Liquid Leakage Dose Calculation
Input File: ESF.TXT Output File: ESF.OUT
No CR Fresh Air system, No CR auto isolation, CR Inleakage = 1200 cfm

TIME INDEPENDENT INPUT
CASE NUMBER 1

NODES	NSTEP
2	69

OUTPUT CONTROL PARAMETER

I	1	2	3	4	5
IPRINT(I)	0	0	0	1	0

NUMBER OF DOSE EVALUATION POINTS - 3

POWER (MWT)	REACTOR SHUTDOWN TIME (HRS)
3.910E+03	3.361E-02

FRACTION OF ACTIVITY RELEASED FROM CORE TO CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PLATEOUT FACTOR FOR ACTIVITY RELEASED FROM
CORE TO CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

FRACTION OF CORE INVENTORY AIRBORNE IN THE CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

ISOTOPIC SPLIT BY GROUP

	ELEM.	ORG.	PART.
NOBLES	0.000E+00	0.000E+00	0.000E+00
HALOGENS	1.000E+00	0.000E+00	0.000E+00
ALKMETAL	0.000E+00	0.000E+00	0.000E+00
TELLURM	0.000E+00	0.000E+00	0.000E+00
BARSTRNT	0.000E+00	0.000E+00	0.000E+00
NOBMETAL	0.000E+00	0.000E+00	0.000E+00
LANTHANM	0.000E+00	0.000E+00	0.000E+00
CERIUM	0.000E+00	0.000E+00	0.000E+00

VOLUME OF NODES (CU FT)

SuppPool	Sec_Cont
1.709E+05	3.000E+05

CONTROL ROOM VOLUME (CU FT)

2.530E+05

DATA FROM NUCLIDE FILE rstfgr1.dat

ISOTOPE NAME	SPLIT	GROUP	SOURCE (CI/MWT)	DECAY CONST (1/HR)	DOSE CONVERSION FACTORS WHOLEBDY	THYROID	INHALATN
BR 82	ELEM.	HALOGENS	1.95000E+02	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 83	ELEM.	HALOGENS	3.52200E+03	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 84	ELEM.	HALOGENS	6.19900E+03	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
I 131	ELEM.	HALOGENS	2.75700E+04	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 132	ELEM.	HALOGENS	3.97700E+04	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 133	ELEM.	HALOGENS	5.51400E+04	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 134	ELEM.	HALOGENS	6.07400E+04	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02
I 135	ELEM.	HALOGENS	5.15300E+04	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03

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                              TIME DEPENDENT INPUT
                                CASE NUMBER   1

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 TIME INTERVAL          0    0    0    0    2   1.00000E-01    1.33330E-01
 TIME INTERVAL          0    0    0    0    2   1.33330E-01    2.00000E-01
 TRANSFER CFM           0    0    0    1    3   0.00000E+00    0.00000E+00
  1.36400E-01
 FILTER EFF             2    1    0    1    3   0.00000E+00    0.00000E+00
  9.00000E+01
 TRANSFER CFM           0    0    0    2    1   4.00100E+03
 FILTER EFF             2    1    0    2    1   9.89750E+01
 CONTROL ROOM           0    0    0    0    5   0.00000E+00    2.00000E+03
  2.00000E+03   0.00000E+00   1.00000E+00
 DOSE PARAMS            0    0    0    0    7   9.56000E-04    3.47000E-04
  1.94000E-04   3.47000E-04   7.78000E-04   3.47000E-04   0.00000E+00
 TIME INTERVAL          0    0    0    0    2   2.00000E-01    3.00000E-01
 TIME INTERVAL          0    0    0    0    2   3.00000E-01    4.00000E-01
 CONTROL ROOM           0    0    0    0    5   1.21000E+03    0.00000E+00
  1.21000E+03   0.00000E+00   1.00000E+00
 DOSE PARAMS            0    0    0    0    7   9.56000E-04    3.47000E-04
  1.94000E-04   3.47000E-04   6.41000E-04   3.47000E-04   0.00000E+00
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 TIME INTERVAL          0    0    0    0    2   5.00000E-01    6.00000E-01
 RELEASE FRACTION       2    0    0    0    1   1.66700E-01
 TIME INTERVAL          0    0    0    0    2   6.00000E-01    7.00000E-01
 TIME INTERVAL          0    0    0    0    2   7.00000E-01    8.00000E-01
 TIME INTERVAL          0    0    0    0    2   8.00000E-01    9.00000E-01
 TIME INTERVAL          0    0    0    0    2   9.00000E-01    1.00000E+00
 TIME INTERVAL          0    0    0    0    2   1.00000E+00    1.10000E+00
 TIME INTERVAL          0    0    0    0    2   1.10000E+00    1.20000E+00
 TIME INTERVAL          0    0    0    0    2   1.20000E+00    1.30000E+00
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 TIME INTERVAL          0    0    0    0    2   1.40000E+00    1.50000E+00
 TIME INTERVAL          0    0    0    0    2   1.50000E+00    1.60000E+00
 TIME INTERVAL          0    0    0    0    2   1.60000E+00    1.70000E+00
 TIME INTERVAL          0    0    0    0    2   1.70000E+00    1.80000E+00
 TIME INTERVAL          0    0    0    0    2   1.80000E+00    1.90000E+00
 TIME INTERVAL          0    0    0    0    2   1.90000E+00    2.00000E+00
 TIME INTERVAL          0    0    0    0    2   2.00000E+00    2.10000E+00
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 DOSE PARAMS            0    0    0    0    7   9.56000E-04    3.47000E-04
  1.06000E-04   3.47000E-04   4.44000E-04   3.47000E-04   0.00000E+00
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 TIME INTERVAL          0    0    0    0    2   2.30000E+00    2.40000E+00
 TIME INTERVAL          0    0    0    0    2   2.40000E+00    2.50000E+00
 TIME INTERVAL          0    0    0    0    2   2.50000E+00    2.60000E+00
 TIME INTERVAL          0    0    0    0    2   2.60000E+00    2.70000E+00
 TIME INTERVAL          0    0    0    0    2   2.70000E+00    2.80000E+00
 TIME INTERVAL          0    0    0    0    2   2.80000E+00    2.90000E+00
 TIME INTERVAL          0    0    0    0    2   2.90000E+00    3.00000E+00
 TIME INTERVAL          0    0    0    0    2   3.00000E+00    3.10000E+00
 TIME INTERVAL          0    0    0    0    2   3.10000E+00    3.20000E+00
 TIME INTERVAL          0    0    0    0    2   3.20000E+00    3.30000E+00
 TIME INTERVAL          0    0    0    0    2   3.30000E+00    3.40000E+00
 TIME INTERVAL          0    0    0    0    2   3.40000E+00    3.50000E+00
 TIME INTERVAL          0    0    0    0    2   3.50000E+00    3.60000E+00

                              TIME DEPENDENT INPUT
                                CASE NUMBER   1

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 TIME INTERVAL          0    0    0    0    2   3.80000E+00    3.90000E+00
 TIME INTERVAL          0    0    0    0    2   3.90000E+00    4.00000E+00
 TIME INTERVAL          0    0    0    0    2   4.00000E+00    4.10000E+00
```

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TIME INTERVAL         0    0    0    0    2   4.30000E+00   4.40000E+00
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TIME INTERVAL         0    0    0    0    2   4.50000E+00   4.60000E+00
TIME INTERVAL         0    0    0    0    2   4.60000E+00   4.70000E+00
TIME INTERVAL         0    0    0    0    2   4.70000E+00   4.80000E+00
TIME INTERVAL         0    0    0    0    2   4.80000E+00   4.90000E+00
TIME INTERVAL         0    0    0    0    2   4.90000E+00   5.00000E+00
TIME INTERVAL         0    0    0    0    2   5.00000E+00   5.10000E+00
TIME INTERVAL         0    0    0    0    2   5.10000E+00   5.20000E+00
TIME INTERVAL         0    0    0    0    2   5.20000E+00   5.30000E+00
TIME INTERVAL         0    0    0    0    2   5.30000E+00   5.40000E+00
TIME INTERVAL         0    0    0    0    2   5.40000E+00   5.50000E+00
TIME INTERVAL         0    0    0    0    2   5.50000E+00   5.60000E+00
TIME INTERVAL         0    0    0    0    2   5.60000E+00   5.70000E+00
TIME INTERVAL         0    0    0    0    2   5.70000E+00   5.80000E+00
TIME INTERVAL         0    0    0    0    2   5.80000E+00   5.90000E+00
TIME INTERVAL         0    0    0    0    2   5.90000E+00   6.00000E+00
TIME INTERVAL         0    0    0    0    2   6.00000E+00   8.00000E+00
TIME INTERVAL         0    0    0    0    2   8.00000E+00   8.33000E+00
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 7.86000E-05   1.75000E-04   1.30000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL         0    0    0    0    2   8.33000E+00   1.20000E+01
TIME INTERVAL         0    0    0    0    2   1.20000E+01   1.94000E+01
TIME INTERVAL         0    0    0    0    2   1.94000E+01   2.40000E+01
TIME INTERVAL         0    0    0    0    2   2.40000E+01   7.20000E+01
CONTROL ROOM          0    0    0    0    5   1.21000E+03   0.00000E+00
 1.21000E+03   0.00000E+00   6.00000E-01
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 4.09000E-05   2.32000E-04   1.10000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL         0    0    0    0    2   7.20000E+01   9.60000E+01
CONTROL ROOM          0    0    0    0    5   0.00000E+00   2.00000E+03
 2.00000E+03   0.00000E+00   6.00000E-01
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 4.09000E-05   2.32000E-04   1.31000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL         0    0    0    0    2   9.60000E+01   7.20000E+02
CONTROL ROOM          0    0    0    0    5   0.00000E+00   2.00000E+03
 2.00000E+03   0.00000E+00   4.00000E-01
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 1.60000E-05   2.32000E-04   1.04000E-04   3.47000E-04   0.00000E+00
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SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR WHOLEBDY DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START	EXCLUSION RADIUS		LOW POPULATION ZONE		CONTROL ROOM	
TIME (HRS)	EACH STEP	ACCUM.	EACH STEP	ACCUM.	EACH STEP	ACCUM.
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.000E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.333E-01	3.393E-07	3.393E-07	6.885E-08	6.885E-08	2.445E-10	2.445E-10
2.000E-01	2.122E-06	2.461E-06	4.306E-07	4.995E-07	2.965E-09	3.210E-09
3.000E-01	4.640E-06	7.102E-06	9.417E-07	1.441E-06	7.450E-09	1.066E-08
4.000E-01	7.714E-06	1.482E-05	1.565E-06	3.007E-06	1.352E-08	2.418E-08
5.000E-01	1.131E-05	2.612E-05	2.295E-06	5.301E-06	2.273E-08	4.690E-08
6.000E-01	1.556E-05	4.169E-05	3.158E-06	8.459E-06	3.551E-08	8.241E-08
7.000E-01	2.043E-05	6.212E-05	4.146E-06	1.261E-05	5.233E-08	1.347E-07
8.000E-01	2.582E-05	8.794E-05	5.239E-06	1.784E-05	7.356E-08	2.083E-07
9.000E-01	3.165E-05	1.196E-04	6.422E-06	2.427E-05	9.946E-08	3.078E-07
1.000E+00	3.784E-05	1.574E-04	7.679E-06	3.195E-05	1.302E-07	4.380E-07
1.100E+00	4.434E-05	2.018E-04	8.998E-06	4.094E-05	1.659E-07	6.039E-07
1.200E+00	5.109E-05	2.529E-04	1.037E-05	5.131E-05	2.066E-07	8.105E-07
1.300E+00	5.805E-05	3.109E-04	1.178E-05	6.309E-05	2.523E-07	1.063E-06
1.400E+00	6.518E-05	3.761E-04	1.323E-05	7.632E-05	3.030E-07	1.366E-06
1.500E+00	7.244E-05	4.485E-04	1.470E-05	9.102E-05	3.586E-07	1.724E-06
1.600E+00	7.980E-05	5.283E-04	1.619E-05	1.072E-04	4.190E-07	2.143E-06
1.700E+00	8.724E-05	6.156E-04	1.770E-05	1.249E-04	4.840E-07	2.627E-06
1.800E+00	9.473E-05	7.103E-04	1.922E-05	1.441E-04	5.537E-07	3.181E-06
1.900E+00	1.023E-04	8.125E-04	2.075E-05	1.649E-04	6.277E-07	3.809E-06
2.000E+00	1.096E-04	9.221E-04	1.215E-05	1.770E-04	6.878E-07	4.497E-06
2.100E+00	1.159E-04	1.038E-03	1.285E-05	1.899E-04	7.333E-07	5.230E-06
2.200E+00	1.210E-04	1.159E-03	1.342E-05	2.033E-04	7.810E-07	6.011E-06
2.300E+00	1.252E-04	1.284E-03	1.388E-05	2.172E-04	8.301E-07	6.841E-06
2.400E+00	1.286E-04	1.413E-03	1.425E-05	2.314E-04	8.798E-07	7.721E-06
2.500E+00	1.312E-04	1.544E-03	1.455E-05	2.460E-04	9.296E-07	8.650E-06
2.600E+00	1.333E-04	1.677E-03	1.478E-05	2.608E-04	9.790E-07	9.629E-06
2.700E+00	1.348E-04	1.812E-03	1.495E-05	2.757E-04	1.028E-06	1.066E-05
2.800E+00	1.359E-04	1.948E-03	1.506E-05	2.908E-04	1.075E-06	1.173E-05
2.900E+00	1.366E-04	2.084E-03	1.514E-05	3.059E-04	1.122E-06	1.285E-05
3.000E+00	1.369E-04	2.221E-03	1.518E-05	3.211E-04	1.167E-06	1.402E-05
3.100E+00	1.370E-04	2.358E-03	1.519E-05	3.363E-04	1.211E-06	1.523E-05
3.200E+00	1.368E-04	2.495E-03	1.517E-05	3.515E-04	1.253E-06	1.649E-05
3.300E+00	1.365E-04	2.632E-03	1.513E-05	3.666E-04	1.293E-06	1.778E-05
3.400E+00	1.359E-04	2.768E-03	1.507E-05	3.817E-04	1.332E-06	1.911E-05
3.500E+00	1.352E-04	2.903E-03	1.500E-05	3.967E-04	1.369E-06	2.048E-05
3.600E+00	1.344E-04	3.037E-03	1.491E-05	4.116E-04	1.405E-06	2.189E-05
3.700E+00	1.335E-04	3.171E-03	1.481E-05	4.264E-04	1.438E-06	2.332E-05
3.800E+00	1.325E-04	3.303E-03	1.470E-05	4.411E-04	1.470E-06	2.479E-05
3.900E+00	1.315E-04	3.435E-03	1.458E-05	4.556E-04	1.501E-06	2.630E-05
4.000E+00	1.303E-04	3.565E-03	1.445E-05	4.701E-04	1.530E-06	2.782E-05
4.100E+00	1.292E-04	3.694E-03	1.432E-05	4.844E-04	1.557E-06	2.938E-05
4.200E+00	1.280E-04	3.822E-03	1.419E-05	4.986E-04	1.583E-06	3.096E-05
4.300E+00	1.267E-04	3.949E-03	1.405E-05	5.127E-04	1.607E-06	3.257E-05
4.400E+00	1.255E-04	4.074E-03	1.391E-05	5.266E-04	1.629E-06	3.420E-05
4.500E+00	1.242E-04	4.199E-03	1.377E-05	5.403E-04	1.651E-06	3.585E-05
4.600E+00	1.229E-04	4.322E-03	1.363E-05	5.540E-04	1.671E-06	3.752E-05
4.700E+00	1.216E-04	4.443E-03	1.349E-05	5.675E-04	1.689E-06	3.921E-05
4.800E+00	1.204E-04	4.564E-03	1.334E-05	5.808E-04	1.707E-06	4.092E-05
4.900E+00	1.191E-04	4.683E-03	1.320E-05	5.940E-04	1.723E-06	4.264E-05
5.000E+00	1.178E-04	4.800E-03	1.306E-05	6.071E-04	1.738E-06	4.438E-05
5.100E+00	1.165E-04	4.917E-03	1.292E-05	6.200E-04	1.752E-06	4.613E-05
5.200E+00	1.153E-04	5.032E-03	1.278E-05	6.328E-04	1.764E-06	4.789E-05
5.300E+00	1.140E-04	5.146E-03	1.264E-05	6.454E-04	1.776E-06	4.967E-05
5.400E+00	1.128E-04	5.259E-03	1.250E-05	6.579E-04	1.787E-06	5.146E-05
5.500E+00	1.115E-04	5.371E-03	1.237E-05	6.703E-04	1.797E-06	5.325E-05
5.600E+00	1.103E-04	5.481E-03	1.223E-05	6.825E-04	1.805E-06	5.506E-05
5.700E+00	1.091E-04	5.590E-03	1.210E-05	6.946E-04	1.813E-06	5.687E-05
5.800E+00	1.080E-04	5.698E-03	1.197E-05	7.066E-04	1.820E-06	5.869E-05
5.900E+00	1.068E-04	5.805E-03	1.184E-05	7.184E-04	1.827E-06	6.052E-05
6.000E+00	1.918E-03	7.723E-03	2.127E-04	9.311E-04	3.657E-05	9.709E-05

8.000E+00	2.816E-04	8.004E-03	2.316E-05	9.542E-04	5.805E-06	1.029E-04
8.330E+00	2.650E-03	1.065E-02	2.178E-04	1.172E-03	4.072E-05	1.436E-04
1.200E+01	3.680E-03	1.433E-02	3.025E-04	1.475E-03	3.486E-05	1.785E-04
1.940E+01	1.657E-03	1.599E-02	1.363E-04	1.611E-03	1.373E-05	1.922E-04
2.400E+01	8.577E-03	2.457E-02	3.669E-04	1.978E-03	3.154E-05	2.237E-04
7.200E+01	2.345E-03	2.691E-02	1.003E-04	2.078E-03	1.086E-05	2.346E-04
9.600E+01	1.825E-02	4.516E-02	3.054E-04	2.384E-03	4.498E-05	2.796E-04
	TOTAL	4.516E-02	TOTAL	2.384E-03	TOTAL	2.796E-04

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR THYROID DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.000E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.333E-01	7.194E-05	7.194E-05	1.460E-05	1.460E-05	9.157E-07	9.157E-07
2.000E-01	4.608E-04	5.327E-04	9.351E-05	1.081E-04	1.142E-05	1.233E-05
3.000E-01	1.035E-03	1.568E-03	2.101E-04	3.182E-04	2.952E-05	4.185E-05
4.000E-01	1.767E-03	3.335E-03	3.586E-04	6.768E-04	5.522E-05	9.707E-05
5.000E-01	2.666E-03	6.001E-03	5.410E-04	1.218E-03	9.562E-05	1.927E-04
6.000E-01	3.807E-03	9.808E-03	7.726E-04	1.990E-03	1.541E-04	3.468E-04
7.000E-01	5.193E-03	1.500E-02	1.054E-03	3.044E-03	2.349E-04	5.817E-04
8.000E-01	6.804E-03	2.181E-02	1.381E-03	4.425E-03	3.416E-04	9.233E-04
9.000E-01	8.621E-03	3.043E-02	1.749E-03	6.174E-03	4.777E-04	1.401E-03
1.000E+00	1.063E-02	4.105E-02	2.157E-03	8.331E-03	6.459E-04	2.047E-03
1.100E+00	1.281E-02	5.386E-02	2.600E-03	1.093E-02	8.488E-04	2.896E-03
1.200E+00	1.515E-02	6.902E-02	3.075E-03	1.401E-02	1.089E-03	3.984E-03
1.300E+00	1.764E-02	8.666E-02	3.580E-03	1.759E-02	1.367E-03	5.351E-03
1.400E+00	2.027E-02	1.069E-01	4.113E-03	2.170E-02	1.686E-03	7.037E-03
1.500E+00	2.302E-02	1.299E-01	4.671E-03	2.637E-02	2.046E-03	9.082E-03
1.600E+00	2.588E-02	1.558E-01	5.252E-03	3.162E-02	2.448E-03	1.153E-02
1.700E+00	2.885E-02	1.847E-01	5.854E-03	3.748E-02	2.894E-03	1.442E-02
1.800E+00	3.191E-02	2.166E-01	6.476E-03	4.395E-02	3.384E-03	1.781E-02
1.900E+00	3.506E-02	2.516E-01	7.116E-03	5.107E-02	3.918E-03	2.173E-02
2.000E+00	3.824E-02	2.899E-01	4.240E-03	5.531E-02	4.384E-03	2.611E-02
2.100E+00	4.121E-02	3.311E-01	4.570E-03	5.988E-02	4.775E-03	3.088E-02
2.200E+00	4.394E-02	3.750E-01	4.872E-03	6.475E-02	5.192E-03	3.608E-02
2.300E+00	4.645E-02	4.215E-01	5.151E-03	6.990E-02	5.631E-03	4.171E-02
2.400E+00	4.876E-02	4.703E-01	5.406E-03	7.531E-02	6.088E-03	4.780E-02
2.500E+00	5.087E-02	5.211E-01	5.640E-03	8.095E-02	6.561E-03	5.436E-02
2.600E+00	5.281E-02	5.739E-01	5.855E-03	8.680E-02	7.047E-03	6.140E-02
2.700E+00	5.459E-02	6.285E-01	6.053E-03	9.285E-02	7.542E-03	6.895E-02
2.800E+00	5.622E-02	6.847E-01	6.234E-03	9.909E-02	8.046E-03	7.699E-02
2.900E+00	5.772E-02	7.425E-01	6.399E-03	1.055E-01	8.555E-03	8.555E-02
3.000E+00	5.909E-02	8.015E-01	6.551E-03	1.120E-01	9.067E-03	9.461E-02
3.100E+00	6.034E-02	8.619E-01	6.691E-03	1.187E-01	9.582E-03	1.042E-01
3.200E+00	6.149E-02	9.234E-01	6.818E-03	1.255E-01	1.010E-02	1.143E-01
3.300E+00	6.254E-02	9.859E-01	6.934E-03	1.325E-01	1.061E-02	1.249E-01
3.400E+00	6.350E-02	1.049E+00	7.041E-03	1.395E-01	1.112E-02	1.360E-01
3.500E+00	6.438E-02	1.114E+00	7.138E-03	1.467E-01	1.163E-02	1.477E-01
3.600E+00	6.518E-02	1.179E+00	7.227E-03	1.539E-01	1.214E-02	1.598E-01
3.700E+00	6.591E-02	1.245E+00	7.308E-03	1.612E-01	1.264E-02	1.724E-01
3.800E+00	6.657E-02	1.311E+00	7.382E-03	1.686E-01	1.313E-02	1.856E-01
3.900E+00	6.718E-02	1.379E+00	7.449E-03	1.760E-01	1.362E-02	1.992E-01
4.000E+00	6.773E-02	1.446E+00	7.510E-03	1.835E-01	1.411E-02	2.133E-01
4.100E+00	6.823E-02	1.515E+00	7.565E-03	1.911E-01	1.458E-02	2.279E-01
4.200E+00	6.868E-02	1.583E+00	7.615E-03	1.987E-01	1.505E-02	2.429E-01
4.300E+00	6.909E-02	1.652E+00	7.661E-03	2.064E-01	1.551E-02	2.584E-01
4.400E+00	6.946E-02	1.722E+00	7.702E-03	2.141E-01	1.596E-02	2.744E-01
4.500E+00	6.980E-02	1.792E+00	7.739E-03	2.218E-01	1.640E-02	2.908E-01
4.600E+00	7.010E-02	1.862E+00	7.772E-03	2.296E-01	1.683E-02	3.076E-01
4.700E+00	7.037E-02	1.932E+00	7.802E-03	2.374E-01	1.725E-02	3.249E-01
4.800E+00	7.061E-02	2.003E+00	7.829E-03	2.452E-01	1.767E-02	3.425E-01
4.900E+00	7.082E-02	2.074E+00	7.853E-03	2.531E-01	1.807E-02	3.606E-01
5.000E+00	7.101E-02	2.145E+00	7.874E-03	2.609E-01	1.847E-02	3.791E-01
5.100E+00	7.118E-02	2.216E+00	7.892E-03	2.688E-01	1.886E-02	3.979E-01
5.200E+00	7.133E-02	2.287E+00	7.909E-03	2.767E-01	1.924E-02	4.172E-01
5.300E+00	7.146E-02	2.358E+00	7.923E-03	2.847E-01	1.960E-02	4.368E-01
5.400E+00	7.157E-02	2.430E+00	7.936E-03	2.926E-01	1.996E-02	4.568E-01
5.500E+00	7.167E-02	2.502E+00	7.946E-03	3.006E-01	2.031E-02	4.771E-01
5.600E+00	7.175E-02	2.573E+00	7.955E-03	3.085E-01	2.066E-02	4.977E-01
5.700E+00	7.182E-02	2.645E+00	7.963E-03	3.165E-01	2.099E-02	5.187E-01
5.800E+00	7.187E-02	2.717E+00	7.969E-03	3.244E-01	2.131E-02	5.400E-01
5.900E+00	7.192E-02	2.789E+00	7.974E-03	3.324E-01	2.163E-02	5.616E-01
6.000E+00	1.436E+00	4.225E+00	1.593E-01	4.917E-01	4.861E-01	1.048E+00

8.000E+00	2.353E-01	4.461E+00	9.755E-03	5.014E-01	8.435E-02	1.132E+00
8.330E+00	2.564E+00	7.025E+00	1.063E-01	6.078E-01	6.838E-01	1.816E+00
1.200E+01	4.886E+00	1.191E+01	2.026E-01	8.103E-01	8.110E-01	2.627E+00
1.940E+01	2.873E+00	1.478E+01	1.191E-01	9.294E-01	4.062E-01	3.033E+00
2.400E+01	2.512E+01	3.991E+01	7.187E-01	1.648E+00	1.705E+00	4.738E+00
7.200E+01	1.038E+01	5.028E+01	2.968E-01	1.945E+00	8.452E-01	5.583E+00
9.600E+01	9.933E+01	1.496E+02	1.111E+00	3.056E+00	4.289E+00	9.872E+00
	TOTAL	1.496E+02	TOTAL	3.056E+00	TOTAL	9.872E+00

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR INHALATN DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START	EXCLUSION RADIUS		LOW POPULATION ZONE		CONTROL ROOM	
TIME (HRS)	EACH STEP	ACCUM.	EACH STEP	ACCUM.	EACH STEP	ACCUM.
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.000E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.333E-01	2.274E-06	2.274E-06	4.614E-07	4.614E-07	2.893E-08	2.893E-08
2.000E-01	1.456E-05	1.683E-05	2.954E-06	3.415E-06	3.605E-07	3.895E-07
3.000E-01	3.269E-05	4.952E-05	6.634E-06	1.005E-05	9.319E-07	1.321E-06
4.000E-01	5.578E-05	1.053E-04	1.132E-05	2.137E-05	1.743E-06	3.064E-06
5.000E-01	8.412E-05	1.894E-04	1.707E-05	3.844E-05	3.016E-06	6.080E-06
6.000E-01	1.201E-04	3.095E-04	2.436E-05	6.280E-05	4.860E-06	1.094E-05
7.000E-01	1.637E-04	4.732E-04	3.322E-05	9.602E-05	7.403E-06	1.834E-05
8.000E-01	2.143E-04	6.875E-04	4.350E-05	1.395E-04	1.076E-05	2.910E-05
9.000E-01	2.715E-04	9.590E-04	5.509E-05	1.946E-04	1.504E-05	4.414E-05
1.000E+00	3.346E-04	1.294E-03	6.789E-05	2.625E-04	2.033E-05	6.447E-05
1.100E+00	4.031E-04	1.697E-03	8.180E-05	3.443E-04	2.670E-05	9.118E-05
1.200E+00	4.766E-04	2.173E-03	9.672E-05	4.410E-04	3.423E-05	1.254E-04
1.300E+00	5.548E-04	2.728E-03	1.126E-04	5.536E-04	4.298E-05	1.684E-04
1.400E+00	6.371E-04	3.365E-03	1.293E-04	6.829E-04	5.297E-05	2.214E-04
1.500E+00	7.234E-04	4.089E-03	1.468E-04	8.297E-04	6.427E-05	2.856E-04
1.600E+00	8.132E-04	4.902E-03	1.650E-04	9.947E-04	7.689E-05	3.625E-04
1.700E+00	9.062E-04	5.808E-03	1.839E-04	1.179E-03	9.087E-05	4.534E-04
1.800E+00	1.002E-03	6.810E-03	2.034E-04	1.382E-03	1.062E-04	5.596E-04
1.900E+00	1.101E-03	7.911E-03	2.234E-04	1.605E-03	1.230E-04	6.826E-04
2.000E+00	1.200E-03	9.112E-03	1.331E-04	1.738E-03	1.376E-04	8.201E-04
2.100E+00	1.293E-03	1.040E-02	1.434E-04	1.882E-03	1.498E-04	9.699E-04
2.200E+00	1.379E-03	1.178E-02	1.529E-04	2.035E-03	1.628E-04	1.133E-03
2.300E+00	1.457E-03	1.324E-02	1.616E-04	2.196E-03	1.765E-04	1.309E-03
2.400E+00	1.529E-03	1.477E-02	1.695E-04	2.366E-03	1.908E-04	1.500E-03
2.500E+00	1.595E-03	1.636E-02	1.768E-04	2.543E-03	2.056E-04	1.706E-03
2.600E+00	1.655E-03	1.802E-02	1.835E-04	2.726E-03	2.208E-04	1.927E-03
2.700E+00	1.711E-03	1.973E-02	1.897E-04	2.916E-03	2.363E-04	2.163E-03
2.800E+00	1.761E-03	2.149E-02	1.953E-04	3.111E-03	2.520E-04	2.415E-03
2.900E+00	1.808E-03	2.330E-02	2.004E-04	3.312E-03	2.679E-04	2.683E-03
3.000E+00	1.850E-03	2.515E-02	2.051E-04	3.517E-03	2.838E-04	2.966E-03
3.100E+00	1.889E-03	2.704E-02	2.095E-04	3.726E-03	2.999E-04	3.266E-03
3.200E+00	1.925E-03	2.896E-02	2.134E-04	3.940E-03	3.160E-04	3.582E-03
3.300E+00	1.957E-03	3.092E-02	2.170E-04	4.157E-03	3.320E-04	3.914E-03
3.400E+00	1.987E-03	3.291E-02	2.203E-04	4.377E-03	3.479E-04	4.262E-03
3.500E+00	2.014E-03	3.492E-02	2.233E-04	4.600E-03	3.638E-04	4.626E-03
3.600E+00	2.038E-03	3.696E-02	2.260E-04	4.826E-03	3.795E-04	5.006E-03
3.700E+00	2.061E-03	3.902E-02	2.285E-04	5.055E-03	3.951E-04	5.401E-03
3.800E+00	2.081E-03	4.110E-02	2.307E-04	5.285E-03	4.105E-04	5.811E-03
3.900E+00	2.100E-03	4.320E-02	2.328E-04	5.518E-03	4.257E-04	6.237E-03
4.000E+00	2.116E-03	4.532E-02	2.347E-04	5.753E-03	4.407E-04	6.678E-03
4.100E+00	2.132E-03	4.745E-02	2.363E-04	5.989E-03	4.554E-04	7.133E-03
4.200E+00	2.145E-03	4.959E-02	2.379E-04	6.227E-03	4.699E-04	7.603E-03
4.300E+00	2.158E-03	5.175E-02	2.392E-04	6.466E-03	4.842E-04	8.087E-03
4.400E+00	2.169E-03	5.392E-02	2.405E-04	6.707E-03	4.981E-04	8.585E-03
4.500E+00	2.179E-03	5.610E-02	2.416E-04	6.948E-03	5.118E-04	9.097E-03
4.600E+00	2.188E-03	5.829E-02	2.426E-04	7.191E-03	5.253E-04	9.622E-03
4.700E+00	2.196E-03	6.048E-02	2.435E-04	7.435E-03	5.384E-04	1.016E-02
4.800E+00	2.203E-03	6.269E-02	2.443E-04	7.679E-03	5.513E-04	1.071E-02
4.900E+00	2.210E-03	6.490E-02	2.450E-04	7.924E-03	5.638E-04	1.128E-02
5.000E+00	2.215E-03	6.711E-02	2.456E-04	8.169E-03	5.761E-04	1.185E-02
5.100E+00	2.220E-03	6.933E-02	2.462E-04	8.416E-03	5.881E-04	1.244E-02
5.200E+00	2.224E-03	7.156E-02	2.466E-04	8.662E-03	5.998E-04	1.304E-02
5.300E+00	2.228E-03	7.378E-02	2.470E-04	8.909E-03	6.112E-04	1.365E-02
5.400E+00	2.231E-03	7.601E-02	2.474E-04	9.157E-03	6.223E-04	1.427E-02
5.500E+00	2.234E-03	7.825E-02	2.477E-04	9.404E-03	6.331E-04	1.491E-02
5.600E+00	2.236E-03	8.048E-02	2.479E-04	9.652E-03	6.437E-04	1.555E-02
5.700E+00	2.238E-03	8.272E-02	2.481E-04	9.900E-03	6.540E-04	1.620E-02
5.800E+00	2.239E-03	8.496E-02	2.483E-04	1.015E-02	6.639E-04	1.687E-02
5.900E+00	2.240E-03	8.720E-02	2.484E-04	1.040E-02	6.736E-04	1.754E-02
6.000E+00	4.469E-02	1.319E-01	4.955E-03	1.535E-02	1.512E-02	3.266E-02

8.000E+00	7.310E-03	1.392E-01	3.031E-04	1.566E-02	2.621E-03	3.528E-02
8.330E+00	7.953E-02	2.187E-01	3.298E-03	1.895E-02	2.121E-02	5.649E-02
1.200E+01	1.510E-01	3.697E-01	6.260E-03	2.521E-02	2.506E-02	8.155E-02
1.940E+01	8.850E-02	4.582E-01	3.670E-03	2.888E-02	1.252E-02	9.407E-02
2.400E+01	7.696E-01	1.228E+00	2.201E-02	5.089E-02	5.220E-02	1.463E-01
7.200E+01	3.165E-01	1.544E+00	9.054E-03	5.995E-02	2.578E-02	1.720E-01
9.600E+01	3.025E+00	4.569E+00	3.384E-02	9.379E-02	1.306E-01	3.026E-01
	TOTAL	4.569E+00	TOTAL	9.379E-02	TOTAL	3.026E-01

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR TEDE DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.000E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1.333E-01	2.613E-06	2.613E-06	5.302E-07	5.302E-07	2.918E-08	2.918E-08
2.000E-01	1.668E-05	1.929E-05	3.385E-06	3.915E-06	3.635E-07	3.927E-07
3.000E-01	3.733E-05	5.662E-05	7.576E-06	1.149E-05	9.393E-07	1.332E-06
4.000E-01	6.349E-05	1.201E-04	1.288E-05	2.437E-05	1.756E-06	3.088E-06
5.000E-01	9.543E-05	2.155E-04	1.936E-05	4.374E-05	3.039E-06	6.127E-06
6.000E-01	1.356E-04	3.512E-04	2.752E-05	7.126E-05	4.896E-06	1.102E-05
7.000E-01	1.841E-04	5.353E-04	3.736E-05	1.086E-04	7.455E-06	1.848E-05
8.000E-01	2.402E-04	7.754E-04	4.874E-05	1.574E-04	1.083E-05	2.931E-05
9.000E-01	3.031E-04	1.079E-03	6.151E-05	2.189E-04	1.514E-05	4.445E-05
1.000E+00	3.724E-04	1.451E-03	7.557E-05	2.944E-04	2.046E-05	6.491E-05
1.100E+00	4.474E-04	1.898E-03	9.080E-05	3.852E-04	2.687E-05	9.178E-05
1.200E+00	5.277E-04	2.426E-03	1.071E-04	4.923E-04	3.444E-05	1.262E-04
1.300E+00	6.128E-04	3.039E-03	1.244E-04	6.167E-04	4.323E-05	1.695E-04
1.400E+00	7.023E-04	3.741E-03	1.425E-04	7.592E-04	5.328E-05	2.227E-04
1.500E+00	7.958E-04	4.537E-03	1.615E-04	9.207E-04	6.463E-05	2.874E-04
1.600E+00	8.930E-04	5.430E-03	1.812E-04	1.102E-03	7.731E-05	3.647E-04
1.700E+00	9.934E-04	6.423E-03	2.016E-04	1.304E-03	9.135E-05	4.560E-04
1.800E+00	1.097E-03	7.520E-03	2.226E-04	1.526E-03	1.068E-04	5.628E-04
1.900E+00	1.203E-03	8.724E-03	2.442E-04	1.770E-03	1.236E-04	6.864E-04
2.000E+00	1.310E-03	1.003E-02	1.453E-04	1.916E-03	1.382E-04	8.246E-04
2.100E+00	1.409E-03	1.144E-02	1.563E-04	2.072E-03	1.505E-04	9.751E-04
2.200E+00	1.500E-03	1.294E-02	1.663E-04	2.238E-03	1.636E-04	1.139E-03
2.300E+00	1.582E-03	1.453E-02	1.754E-04	2.414E-03	1.774E-04	1.316E-03
2.400E+00	1.658E-03	1.618E-02	1.838E-04	2.597E-03	1.917E-04	1.508E-03
2.500E+00	1.726E-03	1.791E-02	1.914E-04	2.789E-03	2.066E-04	1.714E-03
2.600E+00	1.789E-03	1.970E-02	1.983E-04	2.987E-03	2.218E-04	1.936E-03
2.700E+00	1.845E-03	2.154E-02	2.046E-04	3.192E-03	2.373E-04	2.173E-03
2.800E+00	1.897E-03	2.344E-02	2.104E-04	3.402E-03	2.530E-04	2.426E-03
2.900E+00	1.944E-03	2.538E-02	2.156E-04	3.618E-03	2.690E-04	2.695E-03
3.000E+00	1.987E-03	2.737E-02	2.203E-04	3.838E-03	2.850E-04	2.980E-03
3.100E+00	2.026E-03	2.940E-02	2.246E-04	4.063E-03	3.011E-04	3.282E-03
3.200E+00	2.061E-03	3.146E-02	2.286E-04	4.291E-03	3.172E-04	3.599E-03
3.300E+00	2.093E-03	3.355E-02	2.321E-04	4.523E-03	3.333E-04	3.932E-03
3.400E+00	2.123E-03	3.567E-02	2.353E-04	4.759E-03	3.493E-04	4.281E-03
3.500E+00	2.149E-03	3.782E-02	2.383E-04	4.997E-03	3.652E-04	4.647E-03
3.600E+00	2.173E-03	4.000E-02	2.409E-04	5.238E-03	3.809E-04	5.027E-03
3.700E+00	2.194E-03	4.219E-02	2.433E-04	5.481E-03	3.965E-04	5.424E-03
3.800E+00	2.214E-03	4.440E-02	2.454E-04	5.726E-03	4.120E-04	5.836E-03
3.900E+00	2.231E-03	4.664E-02	2.474E-04	5.974E-03	4.272E-04	6.263E-03
4.000E+00	2.247E-03	4.888E-02	2.491E-04	6.223E-03	4.422E-04	6.705E-03
4.100E+00	2.261E-03	5.114E-02	2.507E-04	6.474E-03	4.570E-04	7.162E-03
4.200E+00	2.273E-03	5.342E-02	2.521E-04	6.726E-03	4.715E-04	7.634E-03
4.300E+00	2.284E-03	5.570E-02	2.533E-04	6.979E-03	4.858E-04	8.120E-03
4.400E+00	2.294E-03	5.799E-02	2.544E-04	7.233E-03	4.998E-04	8.619E-03
4.500E+00	2.303E-03	6.030E-02	2.554E-04	7.489E-03	5.135E-04	9.133E-03
4.600E+00	2.311E-03	6.261E-02	2.562E-04	7.745E-03	5.269E-04	9.660E-03
4.700E+00	2.318E-03	6.493E-02	2.570E-04	8.002E-03	5.401E-04	1.020E-02
4.800E+00	2.324E-03	6.725E-02	2.576E-04	8.260E-03	5.530E-04	1.075E-02
4.900E+00	2.329E-03	6.958E-02	2.582E-04	8.518E-03	5.656E-04	1.132E-02
5.000E+00	2.333E-03	7.191E-02	2.587E-04	8.776E-03	5.779E-04	1.190E-02
5.100E+00	2.337E-03	7.425E-02	2.591E-04	9.036E-03	5.899E-04	1.249E-02
5.200E+00	2.340E-03	7.659E-02	2.594E-04	9.295E-03	6.016E-04	1.309E-02
5.300E+00	2.342E-03	7.893E-02	2.597E-04	9.555E-03	6.130E-04	1.370E-02
5.400E+00	2.344E-03	8.127E-02	2.599E-04	9.815E-03	6.241E-04	1.432E-02
5.500E+00	2.345E-03	8.362E-02	2.601E-04	1.007E-02	6.349E-04	1.496E-02
5.600E+00	2.346E-03	8.597E-02	2.602E-04	1.033E-02	6.455E-04	1.561E-02
5.700E+00	2.347E-03	8.831E-02	2.602E-04	1.059E-02	6.558E-04	1.626E-02
5.800E+00	2.347E-03	9.066E-02	2.603E-04	1.086E-02	6.658E-04	1.693E-02
5.900E+00	2.347E-03	9.301E-02	2.602E-04	1.112E-02	6.755E-04	1.760E-02
6.000E+00	4.661E-02	1.396E-01	5.168E-03	1.628E-02	1.516E-02	3.276E-02

8.000E+00	7.592E-03	1.472E-01	3.263E-04	1.661E-02	2.627E-03	3.539E-02
8.330E+00	8.218E-02	2.294E-01	3.515E-03	2.012E-02	2.125E-02	5.664E-02
1.200E+01	1.547E-01	3.840E-01	6.563E-03	2.669E-02	2.509E-02	8.173E-02
1.940E+01	9.016E-02	4.742E-01	3.806E-03	3.049E-02	1.253E-02	9.426E-02
2.400E+01	7.781E-01	1.252E+00	2.238E-02	5.287E-02	5.223E-02	1.465E-01
7.200E+01	3.189E-01	1.571E+00	9.154E-03	6.203E-02	2.579E-02	1.723E-01
9.600E+01	3.043E+00	4.614E+00	3.415E-02	9.618E-02	1.306E-01	3.029E-01
	TOTAL	4.614E+00	TOTAL	9.618E-02	TOTAL	3.029E-01

1 NO MORE CASES

END OF EXECUTION

1

TRANSACT Version 2.0, Revision 0
Based on TACT V
SEP 87 PC VERSION
REVISED TO VERSION 2 - JANUARY 1999
BY GGNS SAFETY ANALYSIS

MODIFIED FALL 1992 FOR GGNS
BY OMEGA TECHNICAL SERVICES, INC.

NUCLEAR REGULATORY COMMISSION
ACCIDENT EVALUATION BRANCH
DATE 8/19/99 TIME 13:16:37

MODEL SUMMARY FOR CASE 1

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
MSIV Leakage Dose Calculation
Input File: MSIV.TXT Output File: MSIV.OUT
No CR Fresh Air system, No CR auto isolation, CR Inleakage = 1200 cfm
MSIV Leakage 100 scfh max line, 250 scfh total

TIME INDEPENDENT INPUT
CASE NUMBER 1

NODES	NSTEP
3	4

OUTPUT CONTROL PARAMETER

I	1	2	3	4	5
IPRINT(I)	0	0	0	1	0

NUMBER OF DOSE EVALUATION POINTS - 3

POWER (MWT)	REACTOR SHUTDOWN TIME (HRS)
3.910E+03	3.361E-02

FRACTION OF ACTIVITY RELEASED FROM CORE TO CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PLATEOUT FACTOR FOR ACTIVITY RELEASED FROM
CORE TO CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

FRACTION OF CORE INVENTORY AIRBORNE IN THE CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

ISOTOPIC SPLIT BY GROUP

	ELEM.	ORG.	PART.
NOBLES	1.000E+00	0.000E+00	0.000E+00
HALOGENS	4.850E-02	1.500E-03	9.500E-01
ALKMETAL	0.000E+00	0.000E+00	1.000E+00
TELLURM	0.000E+00	0.000E+00	0.000E+00
BARSTRNT	0.000E+00	0.000E+00	0.000E+00
NOBMETAL	0.000E+00	0.000E+00	0.000E+00
LANTHANM	0.000E+00	0.000E+00	0.000E+00
CERIUM	0.000E+00	0.000E+00	0.000E+00

VOLUME OF NODES (CU FT)

Drywell	Contmnt	MSIV_Vol
2.700E+05	1.400E+06	4.337E+02

CONTROL ROOM VOLUME (CU FT)
2.530E+05

DATA FROM NUCLIDE FILE rstfgr1.dat

ISOTOPE NAME	SPLIT	GROUP	SOURCE (CI/MWT)	DECAY CONST (1/HR)	DOSE CONVERSION FACTORS WHOLEBDY	THYROID	INHALATN
BR 82	ELEM.	HALOGENS	9.45750E+00	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 82	ORG.	HALOGENS	2.92500E-01	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 82	PART.	HALOGENS	1.85250E+02	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 83	ELEM.	HALOGENS	1.70817E+02	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 83	ORG.	HALOGENS	5.28300E+00	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 83	PART.	HALOGENS	3.34590E+03	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 84	ELEM.	HALOGENS	3.00652E+02	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
BR 84	ORG.	HALOGENS	9.29850E+00	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
BR 84	PART.	HALOGENS	5.88905E+03	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
KR 85	ELEM.	NOBLES	3.88000E+02	7.37614E-06	4.40300E-04	0.00000E+00	0.00000E+00
KR 85M	ELEM.	NOBLES	9.11000E+03	1.54720E-01	2.76760E-02	0.00000E+00	0.00000E+00
KR 87	ELEM.	NOBLES	1.65700E+04	5.45070E-01	1.52440E-01	0.00000E+00	0.00000E+00
KR 88	ELEM.	NOBLES	2.23600E+04	2.44066E-01	3.77400E-01	0.00000E+00	0.00000E+00
RB 86	PART.	ALKMETAL	7.37600E+01	1.54776E-03	1.77970E-02	4.92100E+03	6.62300E+03
I 131	ELEM.	HALOGENS	1.33715E+03	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 131	ORG.	HALOGENS	4.13550E+01	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 131	PART.	HALOGENS	2.61915E+04	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 132	ELEM.	HALOGENS	1.92885E+03	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 132	ORG.	HALOGENS	5.96550E+01	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 132	PART.	HALOGENS	3.77815E+04	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 133	ELEM.	HALOGENS	2.67429E+03	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 133	ORG.	HALOGENS	8.27100E+01	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 133	PART.	HALOGENS	5.23830E+04	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 134	ELEM.	HALOGENS	2.94589E+03	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02
I 134	ORG.	HALOGENS	9.11100E+01	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02
I 134	PART.	HALOGENS	5.77030E+04	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02
I 135	ELEM.	HALOGENS	2.49921E+03	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03
I 135	ORG.	HALOGENS	7.72950E+01	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03
I 135	PART.	HALOGENS	4.89535E+04	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03
XE 133	ELEM.	NOBLES	5.42500E+04	5.50641E-03	5.77200E-03	0.00000E+00	0.00000E+00
XE 135	ELEM.	NOBLES	2.15400E+04	7.62538E-02	4.40300E-02	0.00000E+00	0.00000E+00
CS 134	PART.	ALKMETAL	8.19400E+03	3.83473E-05	2.80090E-01	4.10700E+04	4.62500E+04
CS 136	PART.	ALKMETAL	2.40400E+03	2.20467E-03	3.92200E-01	6.40100E+03	7.32600E+03
CS 137	PART.	ALKMETAL	4.19700E+03	2.63574E-06	1.00825E-01	2.93410E+04	3.19310E+04
CS 138	PART.	ALKMETAL	5.10200E+04	1.29132E+00	4.47700E-01	1.32090E+01	1.01380E+02

TIME DEPENDENT INPUT
CASE NUMBER 1

```
TIME INTERVAL        0   0   0   0   2   0.00000E+00   1.00000E-01
RELEASE FRACTION     1   0   0   0   1   1.00000E-01
RELEASE FRACTION     2   0   0   0   1   1.00000E-01
RELEASE FRACTION     3   0   0   0   1   1.00000E-01
TRANSFER PERCENT     0   0   0   1   4   9.20900E-01   0.00000E+00
 1.60000E+03   1.38100E+00
TRANSFER PERCENT     0   0   0   3   1   2.00000E-04
REMOVAL RATE         2   1   0   0   1   8.66000E-01
REMOVAL RATE         2   3   0   0   1   7.47400E-01
REMOVAL RATE         3   3   0   0   1   7.47400E-01
CONTROL ROOM         0   0   0   0   5   2.00000E+03   0.00000E+00
 2.00000E+03   0.00000E+00   1.00000E+00
DOSE PARAMS          0   0   0   0   7   9.56000E-04   3.47000E-04
 1.94000E-04   3.47000E-04   6.05000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL        0   0   0   0   2   1.00000E-01   2.00000E-01
TIME INTERVAL        0   0   0   0   2   2.00000E-01   3.00000E-01
TIME INTERVAL        0   0   0   0   2   3.00000E-01   7.20000E+02
TRANSFER PERCENT     0   0   0   1   4   0.00000E+00   0.00000E+00
 0.00000E+00   0.00000E+00
TRANSFER PERCENT     0   0   0   3   1   0.00000E+00
```

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR WHOLEBDY DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	7.378E-02	7.378E-02	1.497E-02	1.497E-02	6.111E-05	6.111E-05
1.000E-01	2.040E-01	2.778E-01	4.141E-02	5.638E-02	2.831E-04	3.443E-04
2.000E-01	3.120E-01	5.898E-01	6.331E-02	1.197E-01	6.773E-04	1.022E-03
3.000E-01	0.000E+00	5.898E-01	0.000E+00	1.197E-01	0.000E+00	1.022E-03
	TOTAL	5.898E-01	TOTAL	1.197E-01	TOTAL	1.022E-03

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR THYROID DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START	EXCLUSION RADIUS		LOW POPULATION ZONE		CONTROL ROOM	
TIME (HRS)	EACH STEP	ACCUM.	EACH STEP	ACCUM.	EACH STEP	ACCUM.
0.000E+00	9.992E+00	9.992E+00	2.028E+00	2.028E+00	1.475E-01	1.475E-01
1.000E-01	2.817E+01	3.816E+01	5.717E+00	7.745E+00	7.016E-01	8.491E-01
2.000E-01	4.392E+01	8.208E+01	8.913E+00	1.666E+01	1.726E+00	2.575E+00
3.000E-01	0.000E+00	8.208E+01	0.000E+00	1.666E+01	0.000E+00	2.575E+00
	TOTAL	8.208E+01	TOTAL	1.666E+01	TOTAL	2.575E+00

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR INHALATN DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	4.396E-01	4.396E-01	8.921E-02	8.921E-02	6.491E-03	6.491E-03
1.000E-01	1.239E+00	1.679E+00	2.515E-01	3.407E-01	3.086E-02	3.735E-02
2.000E-01	1.932E+00	3.611E+00	3.921E-01	7.328E-01	7.590E-02	1.132E-01
3.000E-01	0.000E+00	3.611E+00	0.000E+00	7.328E-01	0.000E+00	1.132E-01
	TOTAL	3.611E+00	TOTAL	7.328E-01	TOTAL	1.132E-01

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR TEDE DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	5.134E-01	5.134E-01	1.042E-01	1.042E-01	6.552E-03	6.552E-03
1.000E-01	1.443E+00	1.957E+00	2.929E-01	3.971E-01	3.114E-02	3.770E-02
2.000E-01	2.244E+00	4.201E+00	4.554E-01	8.525E-01	7.658E-02	1.143E-01
3.000E-01	0.000E+00	4.201E+00	0.000E+00	8.525E-01	0.000E+00	1.143E-01
	TOTAL	4.201E+00	TOTAL	8.525E-01	TOTAL	1.143E-01

1 NO MORE CASES

END OF EXECUTION

1

TRANSACT Version 2.0, Revision 0
Based on TACT V
SEP 87 PC VERSION
REVISED TO VERSION 2 - JANUARY 1999
BY GGNS SAFETY ANALYSIS

MODIFIED FALL 1992 FOR GGNS
BY OMEGA TECHNICAL SERVICES, INC.

NUCLEAR REGULATORY COMMISSION
ACCIDENT EVALUATION BRANCH
DATE 8/17/99 TIME 20:29:42

MODEL SUMMARY FOR CASE 1

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
Airborne Case: Input File: RSTLOCA.TXT Output File: RSTLOCA.OUT
No CR Fresh Air system; No CR auto isolation; CR Inleakage = 1210 cfm
MSIV Leakage 100 scfh max line, 250 scfh total; Cont Int Leak = 0.385%/day
Containment Spray Credit at 30 minutes
Single Failure: MSIV open and outboard MSIV LCS electrical division

TIME INDEPENDENT INPUT
CASE NUMBER 1

NODES	NSTEP
5	69

OUTPUT CONTROL PARAMETER

I	1	2	3	4	5
IPRINT(I)	1	0	0	1	0

NUMBER OF DOSE EVALUATION POINTS - 3

POWER (MWT)	REACTOR SHUTDOWN TIME (HRS)
3.910E+03	3.361E-02

FRACTION OF ACTIVITY RELEASED FROM CORE TO CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PLATEOUT FACTOR FOR ACTIVITY RELEASED FROM
CORE TO CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

FRACTION OF CORE INVENTORY AIRBORNE IN THE CONTAINMENT BY ISOTOPIC GROUP

NOBLES	HALOGENS	ALKMETAL	TELLURM	BARSTRNT	NOBMETAL	LANTHANM	CERIUM
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

ISOTOPIC SPLIT BY GROUP

	ELEM.	ORG.	PART.
NOBLES	1.000E+00	0.000E+00	0.000E+00
HALOGENS	4.850E-02	1.500E-03	9.500E-01
ALKMETAL	0.000E+00	0.000E+00	1.000E+00
TELLURM	0.000E+00	0.000E+00	1.000E+00
BARSTRNT	0.000E+00	0.000E+00	1.000E+00
NOBMETAL	0.000E+00	0.000E+00	1.000E+00
LANTHANM	0.000E+00	0.000E+00	1.000E+00
CERIUM	0.000E+00	0.000E+00	1.000E+00

VOLUME OF NODES (CU FT)

Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
2.700E+05	8.400E+05	5.600E+05	3.000E+05	4.337E+02

CONTROL ROOM VOLUME (CU FT)
2.530E+05

DATA FROM NUCLIDE FILE rstfgr1.dat

ISOTOPE NAME	SPLIT	GROUP	SOURCE (CI/MWT)	DECAY CONST (1/HR)	DOSE CONVERSION FACTORS WHOLEBDY	THYROID	INHALATN
CO 58	PART.	NOBMETAL	1.52900E+02	4.07926E-04	1.76120E-01	3.22640E+03	1.08780E+04
CO 60	PART.	NOBMETAL	1.83000E+02	1.50014E-05	4.66200E-01	5.99400E+04	2.18670E+05
BR 82	ELEM.	HALOGENS	9.45750E+00	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 82	ORG.	HALOGENS	2.92500E-01	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 82	PART.	HALOGENS	1.85250E+02	1.96416E-02	4.81000E-01	7.62200E+02	1.52810E+03
BR 83	ELEM.	HALOGENS	1.70817E+02	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 83	ORG.	HALOGENS	5.28300E+00	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 83	PART.	HALOGENS	3.34590E+03	2.88756E-01	1.41340E-03	4.21800E+00	8.91700E+01
BR 84	ELEM.	HALOGENS	3.00652E+02	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
BR 84	ORG.	HALOGENS	9.29850E+00	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
BR 84	PART.	HALOGENS	5.88905E+03	1.31256E+00	3.48170E-01	5.29100E+00	8.39900E+01
KR 85	ELEM.	NOBLES	3.88000E+02	7.37614E-06	4.40300E-04	0.00000E+00	0.00000E+00
KR 85M	ELEM.	NOBLES	9.11000E+03	1.54720E-01	2.76760E-02	0.00000E+00	0.00000E+00
KR 87	ELEM.	NOBLES	1.65700E+04	5.45070E-01	1.52440E-01	0.00000E+00	0.00000E+00
KR 88	ELEM.	NOBLES	2.23600E+04	2.44066E-01	3.77400E-01	0.00000E+00	0.00000E+00
RB 86	PART.	ALKMETAL	7.37600E+01	1.54776E-03	1.77970E-02	4.92100E+03	6.62300E+03
SR 89	PART.	BARSTRNT	2.79500E+04	5.71904E-04	2.86010E-04	2.94520E+01	4.14400E+04
SR 90	PART.	BARSTRNT	3.15100E+03	2.71539E-06	2.78610E-05	9.95300E+02	1.29870E+06
SR 91	PART.	BARSTRNT	3.60400E+04	7.29629E-02	1.82188E-01	3.67410E+01	1.68239E+03
SR 92	PART.	BARSTRNT	3.76500E+04	2.55774E-01	2.51230E-01	1.45040E+01	8.06600E+02
Y 90	PART.	LANTHANM	3.25100E+03	1.08304E-02	7.03000E-04	1.91290E+00	8.43600E+03
Y 91	PART.	LANTHANM	3.56000E+04	4.93610E-04	9.62000E-04	3.14500E+01	4.88400E+04
Y 92	PART.	LANTHANM	3.78000E+04	1.95804E-01	4.81000E-02	3.88500E+00	7.80700E+02
Y 93	PART.	LANTHANM	4.29800E+04	6.86284E-02	1.77600E-02	3.42620E+00	2.15340E+03
ZR 95	PART.	LANTHANM	4.66000E+04	4.51409E-04	1.33200E-01	5.32800E+03	2.36430E+04
ZR 97	PART.	LANTHANM	4.58700E+04	4.10146E-02	1.63984E-01	8.56550E+01	4.33270E+03
NB 95	PART.	LANTHANM	4.67500E+04	8.21654E-04	1.38380E-01	1.32460E+03	5.80900E+03
MO 99	PART.	NOBMETAL	5.13800E+04	1.05022E-02	2.69360E-02	5.62400E+01	3.95900E+03
TC 99M	PART.	NOBMETAL	4.49900E+04	1.15141E-01	2.17930E-02	1.85370E+02	3.25600E+01
RU 103	PART.	NOBMETAL	4.51900E+04	7.35263E-04	8.32870E-02	9.50900E+02	8.95770E+03
RU 105	PART.	NOBMETAL	3.30400E+04	1.56114E-01	1.40970E-01	1.53550E+01	4.55100E+02
RU 106	PART.	NOBMETAL	1.96800E+04	7.84387E-05	3.84800E-02	6.36400E+03	4.77300E+05
RH 105	PART.	NOBMETAL	3.08700E+04	1.96026E-02	1.37640E-02	1.06560E+01	9.54600E+02
SB 125	PART.	TELLURM	5.55500E+02	3.29688E-05	7.47400E-02	1.19880E+03	1.22100E+04
SB 127	PART.	TELLURM	2.23400E+04	7.50159E-03	1.23210E-01	2.27550E+02	6.03100E+03
SB 129	PART.	TELLURM	9.30900E+03	1.60451E-01	2.64180E-01	3.59640E+01	6.43800E+02
TE 127	PART.	TELLURM	3.22000E+03	7.41334E-02	8.95400E-04	6.80800E+00	3.18200E+02
TE 127M	PART.	TELLURM	4.29700E+02	2.64965E-04	5.43900E-04	3.57420E+02	2.14970E+04
TE 129	PART.	TELLURM	9.16100E+03	5.97541E-01	1.01750E-02	1.88335E+00	7.73300E+01
TE 129M	PART.	TELLURM	1.99000E+03	8.59558E-04	4.58264E+00	1.42438E+03	5.87235E+04
TE 131M	PART.	TELLURM	4.07900E+03	2.31049E-02	1.56193E+00	4.83350E+05	1.97729E+04
TE 132	PART.	TELLURM	3.90800E+04	8.86378E-03	1.42513E+01	4.53172E+05	2.25061E+04
TE 133M	PART.	TELLURM	2.06800E+04	8.31600E-01	5.24691E-01	1.89733E+04	7.17460E+02
TE 134	PART.	TELLURM	4.68800E+04	9.90000E-01	5.41680E-01	2.90968E+03	2.24590E+02
I 131	ELEM.	HALOGENS	1.33715E+03	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 131	ORG.	HALOGENS	4.13550E+01	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 131	PART.	HALOGENS	2.61915E+04	3.59218E-03	6.73400E-02	1.08040E+06	3.28930E+04
I 132	ELEM.	HALOGENS	1.92885E+03	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 132	ORG.	HALOGENS	5.96550E+01	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 132	PART.	HALOGENS	3.77815E+04	3.01368E-01	4.14400E-01	6.43800E+03	3.81100E+02
I 133	ELEM.	HALOGENS	2.67429E+03	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 133	ORG.	HALOGENS	8.27100E+01	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 133	PART.	HALOGENS	5.23830E+04	3.33244E-02	1.08780E-01	1.79820E+05	5.84600E+03
I 134	ELEM.	HALOGENS	2.94589E+03	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02
I 134	ORG.	HALOGENS	9.11100E+01	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02
I 134	PART.	HALOGENS	5.77030E+04	7.90662E-01	4.81000E-01	1.06560E+03	1.31350E+02

DATA FROM NUCLIDE FILE rstfgr1.dat

ISOTOPE NAME	SPLIT	GROUP	SOURCE (CI/MWT)	DECAY CONST (1/HR)	DOSE CONVERSION FACTORS WHOLEBDY	THYROID	INHALATN
I 135	ELEM.	HALOGENS	2.49921E+03	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03
I 135	ORG.	HALOGENS	7.72950E+01	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03
I 135	PART.	HALOGENS	4.89535E+04	1.04863E-01	3.06878E-01	3.13020E+04	1.22840E+03
XE 133	ELEM.	NOBLES	5.42500E+04	5.50641E-03	5.77200E-03	0.00000E+00	0.00000E+00
XE 135	ELEM.	NOBLES	2.15400E+04	7.62538E-02	4.40300E-02	0.00000E+00	0.00000E+00
CS 134	PART.	ALKMETAL	8.19400E+03	3.83473E-05	2.80090E-01	4.10700E+04	4.62500E+04
CS 136	PART.	ALKMETAL	2.40400E+03	2.20467E-03	3.92200E-01	6.40100E+03	7.32600E+03
CS 137	PART.	ALKMETAL	4.19700E+03	2.63574E-06	1.00825E-01	2.93410E+04	3.19310E+04
CS 138	PART.	ALKMETAL	5.10200E+04	1.29132E+00	4.47700E-01	1.32090E+01	1.01380E+02

BA 139	PART.	BARSTRNT	4.99400E+04	5.02888E-01	8.02900E-03	8.88000E+00	1.71680E+02
BA 140	PART.	BARSTRNT	4.92700E+04	2.26696E-03	3.17460E-02	9.47200E+02	3.73700E+03
LA 140	PART.	LANTHANM	5.06900E+04	1.72116E-02	4.32900E-01	2.54190E+02	4.84700E+03
LA 141	PART.	LANTHANM	4.64200E+04	1.76373E-01	8.84300E-03	3.47800E+01	5.80900E+02
LA 142	PART.	LANTHANM	4.46600E+04	4.49609E-01	5.32800E-01	3.23380E+01	2.53080E+02
CE 141	PART.	CERIUM	4.56800E+04	8.88623E-04	1.26910E-02	9.43500E+01	8.95400E+03
CE 143	PART.	CERIUM	4.35500E+04	2.10045E-02	4.77300E-02	2.30510E+01	3.38920E+03
CE 144	PART.	CERIUM	3.57500E+04	1.01587E-04	1.02601E-02	1.08040E+03	3.73700E+05
PR 143	PART.	LANTHANM	4.26300E+04	2.12988E-03	7.77000E-05	6.21600E-06	8.10300E+03
ND 147	PART.	LANTHANM	1.90500E+04	2.63034E-03	2.29030E-02	6.73400E+01	6.84500E+03
NP 238	PART.	CERIUM	1.58000E+04	1.37484E-02	1.00640E-01	9.06500E+01	3.70000E+04
NP 239	PART.	CERIUM	6.57000E+05	1.22637E-02	2.84530E-02	2.81940E+01	2.50860E+03
PU 238	PART.	CERIUM	1.89500E+02	9.01211E-07	1.80560E-05	1.42820E+03	2.88230E+08
PU 239	PART.	CERIUM	1.36600E+01	3.28578E-09	1.56880E-05	1.38750E+03	3.08210E+08
PU 240	PART.	CERIUM	2.06900E+01	1.20961E-08	1.75750E-05	1.39120E+03	3.08210E+08
PU 241	PART.	CERIUM	5.55000E+03	5.49113E-06	2.68250E-07	3.38550E+01	4.95800E+06
AM 241	PART.	LANTHANM	7.13000E+00	1.82953E-07	3.02660E-03	5.92000E+03	4.44000E+08
CM 242	PART.	LANTHANM	2.16900E+03	1.77403E-04	2.10530E-05	3.48170E+03	1.72790E+07
CM 244	PART.	LANTHANM	4.57800E+02	4.36622E-06	1.81670E-05	3.73700E+03	2.47900E+08

```
                              TIME DEPENDENT INPUT
                                CASE NUMBER   1

TIME INTERVAL           0    0    0    0    2   0.00000E+00   1.66700E-02
RELEASE FRACTION        1    0    0    0    1   1.00000E-01
RELEASE FRACTION        2    0    0    0    1   1.00000E-01
RELEASE FRACTION        3    0    0    0    1   1.00000E-01
TRANSFER PERCENT        0    0    0    1    6   0.00000E+00   0.00000E+00
 0.00000E+00   1.60000E+03   0.00000E+00   1.38100E+00
TRANSFER PERCENT        0    0    0    2    5   3.85000E-01   0.00000E+00
 0.00000E+00   3.20000E+03   0.00000E+00
TRANSFER PERCENT        0    0    0    3    5   3.85000E-01   0.00000E+00
 4.80000E+03   0.00000E+00   0.00000E+00
TRANSFER CFM            0    0    0    1    1   1.72700E+00
FILTER EFF              1    1    0    1    1   1.00000E+02
FILTER EFF              2    1    0    1    1   1.00000E+02
FILTER EFF              2    2    0    1    1   1.00000E+02
FILTER EFF              2    3    0    1    1   1.00000E+02
FILTER EFF              3    3    0    1    1   1.00000E+02
REMOVAL RATE            2    1    0    0    3   8.66000E-01   6.82300E-01
 1.09200E+00
REMOVAL RATE            2    3    0    0    1   7.47400E-01
REMOVAL RATE            3    3    0    0    1   7.47400E-01
REMOVAL RATE            4    3    0    0    1   7.47400E-01
REMOVAL RATE            5    3    0    0    1   7.47400E-01
REMOVAL RATE            6    3    0    0    1   7.47400E-01
REMOVAL RATE            7    3    0    0    1   7.47400E-01
REMOVAL RATE            8    3    0    0    1   7.47400E-01
TRANSFER CFM            0    0    0    4    1   1.00000E-03
CONTROL ROOM            0    0    0    0    5   0.00000E+00   2.00000E+03
 2.00000E+03   0.00000E+00   1.00000E+00
DOSE PARAMS             0    0    0    0    7   9.56000E-04   3.47000E-04
 1.94000E-04   3.47000E-04   7.71000E-03   3.47000E-04   0.00000E+00
TIME INTERVAL           0    0    0    0    2   1.66700E-02   1.00000E-01
TRANSFER PERCENT        0    0    0    2    5   0.00000E+00   0.00000E+00
 0.00000E+00   3.20000E+03   3.85000E-01
TRANSFER PERCENT        0    0    0    3    5   0.00000E+00   0.00000E+00
 4.80000E+03   0.00000E+00   3.85000E-01
TRANSFER CFM            0    0    0    4    1   4.00100E+03
FILTER EFF              2    1    0    4    1   9.89750E+01
FILTER EFF              2    2    0    4    1   9.89750E+01
FILTER EFF              2    3    0    4    1   9.89750E+01
FILTER EFF              3    3    0    4    1   9.89750E+01
FILTER EFF              4    3    0    4    1   9.89750E+01
FILTER EFF              5    3    0    4    1   9.89750E+01
FILTER EFF              6    3    0    4    1   9.89750E+01
FILTER EFF              7    3    0    4    1   9.89750E+01
FILTER EFF              8    3    0    4    1   9.89750E+01
DOSE PARAMS             0    0    0    0    7   9.56000E-04   3.47000E-04
 1.94000E-04   3.47000E-04   7.78000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL           0    0    0    0    2   1.00000E-01   2.00000E-01
TIME INTERVAL           0    0    0    0    2   2.00000E-01   3.00000E-01
TIME INTERVAL           0    0    0    0    2   3.00000E-01   4.00000E-01
TRANSFER PERCENT        0    0    0    1    6   0.00000E+00   0.00000E+00
 0.00000E+00   1.60000E+03   2.30200E+00   0.00000E+00
TRANSFER PERCENT        0    0    0    5    5   0.00000E+00   0.00000E+00
 0.00000E+00   0.00000E+00   1.00000E+06
TRANSFER CFM            0    0    0    1    1   0.00000E+00
CONTROL ROOM            0    0    0    0    5   1.21000E+03   0.00000E+00

                              TIME DEPENDENT INPUT
                                CASE NUMBER   1

 1.21000E+03   0.00000E+00   1.00000E+00
DOSE PARAMS             0    0    0    0    7   9.56000E-04   3.47000E-04
 1.94000E-04   3.47000E-04   6.41000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL           0    0    0    0    2   4.00000E-01   5.00000E-01
TIME INTERVAL           0    0    0    0    2   5.00000E-01   6.00000E-01
```

```
RELEASE FRACTION      1    0    0    0    1    6.33300E-01
RELEASE FRACTION      2    0    0    0    1    1.66700E-01
RELEASE FRACTION      3    0    0    0    1    1.33300E-01
RELEASE FRACTION      4    0    0    0    1    3.33300E-02
RELEASE FRACTION      5    0    0    0    1    1.33300E-02
RELEASE FRACTION      6    0    0    0    1    1.66700E-03
RELEASE FRACTION      7    0    0    0    1    1.33300E-04
RELEASE FRACTION      8    0    0    0    1    3.33300E-04
REMOVAL RATE          2    1    0    0    3    8.66000E-01    2.06800E+01
 1.09200E+00
REMOVAL RATE          2    3    0    0    2    2.98300E-01    9.51000E+00
REMOVAL RATE          3    3    0    0    2    2.98300E-01    9.51000E+00
REMOVAL RATE          4    3    0    0    2    2.98300E-01    9.51000E+00
REMOVAL RATE          5    3    0    0    2    2.98300E-01    9.51000E+00
REMOVAL RATE          6    3    0    0    2    2.98300E-01    9.51000E+00
REMOVAL RATE          7    3    0    0    2    2.98300E-01    9.51000E+00
REMOVAL RATE          8    3    0    0    2    2.98300E-01    9.51000E+00
TRANSFER PERCENT      0    0    0    2    5    0.00000E+00    0.00000E+00
 0.00000E+00   1.20000E+04   3.85000E-01
TRANSFER PERCENT      0    0    0    3    5    0.00000E+00    0.00000E+00
 1.80000E+04   0.00000E+00   3.85000E-01
TIME INTERVAL         0    0    0    0    2    6.00000E-01    7.00000E-01
TIME INTERVAL         0    0    0    0    2    7.00000E-01    8.00000E-01
TIME INTERVAL         0    0    0    0    2    8.00000E-01    9.00000E-01
TIME INTERVAL         0    0    0    0    2    9.00000E-01    1.00000E+00
TIME INTERVAL         0    0    0    0    2    1.00000E+00    1.10000E+00
RELEASE FRACTION      1    0    0    0    1    6.33300E-01
RELEASE FRACTION      2    0    0    0    1    1.66700E-01
RELEASE FRACTION      3    0    0    0    1    1.33300E-01
RELEASE FRACTION      4    0    0    0    1    3.33300E-02
RELEASE FRACTION      5    0    0    0    1    1.33300E-02
RELEASE FRACTION      6    0    0    0    1    1.66700E-03
RELEASE FRACTION      7    0    0    0    1    1.33300E-04
RELEASE FRACTION      8    0    0    0    1    3.33300E-04
TIME INTERVAL         0    0    0    0    2    1.10000E+00    1.20000E+00
TIME INTERVAL         0    0    0    0    2    1.20000E+00    1.30000E+00
TIME INTERVAL         0    0    0    0    2    1.30000E+00    1.40000E+00
TIME INTERVAL         0    0    0    0    2    1.40000E+00    1.50000E+00
TIME INTERVAL         0    0    0    0    2    1.50000E+00    1.60000E+00
RELEASE FRACTION      1    0    0    0    1    6.33300E-01
RELEASE FRACTION      2    0    0    0    1    1.66700E-01
RELEASE FRACTION      3    0    0    0    1    1.33300E-01
RELEASE FRACTION      4    0    0    0    1    3.33300E-02
RELEASE FRACTION      5    0    0    0    1    1.33300E-02
RELEASE FRACTION      6    0    0    0    1    1.66700E-03
RELEASE FRACTION      7    0    0    0    1    1.33300E-04
RELEASE FRACTION      8    0    0    0    1    3.33300E-04
TIME INTERVAL         0    0    0    0    2    1.60000E+00    1.70000E+00
TIME INTERVAL         0    0    0    0    2    1.70000E+00    1.80000E+00
TIME INTERVAL         0    0    0    0    2    1.80000E+00    1.90000E+00
TIME INTERVAL         0    0    0    0    2    1.90000E+00    2.00000E+00


                          TIME DEPENDENT INPUT
                            CASE NUMBER   1


TIME INTERVAL         0    0    0    0    2    2.00000E+00    2.10000E+00
RELEASE FRACTION      1    0    0    0    1    0.00000E+00
RELEASE FRACTION      2    0    0    0    1    0.00000E+00
RELEASE FRACTION      3    0    0    0    1    0.00000E+00
RELEASE FRACTION      4    0    0    0    1    0.00000E+00
RELEASE FRACTION      5    0    0    0    1    0.00000E+00
RELEASE FRACTION      6    0    0    0    1    0.00000E+00
RELEASE FRACTION      7    0    0    0    1    0.00000E+00
RELEASE FRACTION      8    0    0    0    1    0.00000E+00
TRANSFER PERCENT      0    0    0    1    6    0.00000E+00    0.00000E+00
 0.00000E+00   1.00000E+10   2.30200E+00   0.00000E+00
TRANSFER PERCENT      0    0    0    3    5    0.00000E+00    4.82100E+09
 1.80000E+04   0.00000E+00   3.85000E-01
REMOVAL RATE          2    3    0    0    1    1.05500E+00
REMOVAL RATE          3    3    0    0    1    1.05500E+00
REMOVAL RATE          4    3    0    0    1    1.05500E+00
REMOVAL RATE          5    3    0    0    1    1.05500E+00
```

```
REMOVAL RATE        6    3    0    0    1    1.05500E+00
REMOVAL RATE        7    3    0    0    1    1.05500E+00
REMOVAL RATE        8    3    0    0    1    1.05500E+00
DOSE PARAMS         0    0    0    0    7    9.56000E-04    3.47000E-04
 1.06000E-04    3.47000E-04    4.44000E-04    3.47000E-04    0.00000E+00
TIME INTERVAL       0    0    0    0    2    2.10000E+00    2.20000E+00
TIME INTERVAL       0    0    0    0    2    2.20000E+00    2.30000E+00
TIME INTERVAL       0    0    0    0    2    2.30000E+00    2.40000E+00
TIME INTERVAL       0    0    0    0    2    2.40000E+00    2.50000E+00
TIME INTERVAL       0    0    0    0    2    2.50000E+00    2.60000E+00
TIME INTERVAL       0    0    0    0    2    2.60000E+00    2.70000E+00
TIME INTERVAL       0    0    0    0    2    2.70000E+00    2.80000E+00
TIME INTERVAL       0    0    0    0    2    2.80000E+00    2.90000E+00
TIME INTERVAL       0    0    0    0    2    2.90000E+00    3.00000E+00
TIME INTERVAL       0    0    0    0    2    3.00000E+00    3.10000E+00
TIME INTERVAL       0    0    0    0    2    3.10000E+00    3.20000E+00
REMOVAL RATE        2    1    0    0    3    0.00000E+00    0.00000E+00
 0.00000E+00
TIME INTERVAL       0    0    0    0    2    3.20000E+00    3.30000E+00
REMOVAL RATE        2    3    0    0    2    1.05500E+00    9.51000E-01
REMOVAL RATE        3    3    0    0    2    1.05500E+00    9.51000E-01
REMOVAL RATE        4    3    0    0    2    1.05500E+00    9.51000E-01
REMOVAL RATE        5    3    0    0    2    1.05500E+00    9.51000E-01
REMOVAL RATE        6    3    0    0    2    1.05500E+00    9.51000E-01
REMOVAL RATE        7    3    0    0    2    1.05500E+00    9.51000E-01
REMOVAL RATE        8    3    0    0    2    1.05500E+00    9.51000E-01
TIME INTERVAL       0    0    0    0    2    3.30000E+00    3.40000E+00
TIME INTERVAL       0    0    0    0    2    3.40000E+00    3.50000E+00
TIME INTERVAL       0    0    0    0    2    3.50000E+00    3.60000E+00
TIME INTERVAL       0    0    0    0    2    3.60000E+00    3.70000E+00
TIME INTERVAL       0    0    0    0    2    3.70000E+00    3.80000E+00
TIME INTERVAL       0    0    0    0    2    3.80000E+00    3.90000E+00
TIME INTERVAL       0    0    0    0    2    3.90000E+00    4.00000E+00
TIME INTERVAL       0    0    0    0    2    4.00000E+00    4.10000E+00
TIME INTERVAL       0    0    0    0    2    4.10000E+00    4.20000E+00
TIME INTERVAL       0    0    0    0    2    4.20000E+00    4.30000E+00
TIME INTERVAL       0    0    0    0    2    4.30000E+00    4.40000E+00
TIME INTERVAL       0    0    0    0    2    4.40000E+00    4.50000E+00
TIME INTERVAL       0    0    0    0    2    4.50000E+00    4.60000E+00
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TIME DEPENDENT INPUT
CASE NUMBER 1

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TIME INTERVAL       0    0    0    0    2    4.60000E+00    4.70000E+00
TIME INTERVAL       0    0    0    0    2    4.70000E+00    4.80000E+00
TIME INTERVAL       0    0    0    0    2    4.80000E+00    4.90000E+00
TIME INTERVAL       0    0    0    0    2    4.90000E+00    5.00000E+00
TIME INTERVAL       0    0    0    0    2    5.00000E+00    5.10000E+00
REMOVAL RATE        2    3    0    0    1    6.39000E-01
REMOVAL RATE        3    3    0    0    1    6.39000E-01
REMOVAL RATE        4    3    0    0    1    6.39000E-01
REMOVAL RATE        5    3    0    0    1    6.39000E-01
REMOVAL RATE        6    3    0    0    1    6.39000E-01
REMOVAL RATE        7    3    0    0    1    6.39000E-01
REMOVAL RATE        8    3    0    0    1    6.39000E-01
TIME INTERVAL       0    0    0    0    2    5.10000E+00    5.20000E+00
TIME INTERVAL       0    0    0    0    2    5.20000E+00    5.30000E+00
TIME INTERVAL       0    0    0    0    2    5.30000E+00    5.40000E+00
TIME INTERVAL       0    0    0    0    2    5.40000E+00    5.50000E+00
TIME INTERVAL       0    0    0    0    2    5.50000E+00    5.60000E+00
TIME INTERVAL       0    0    0    0    2    5.60000E+00    5.70000E+00
TIME INTERVAL       0    0    0    0    2    5.70000E+00    5.80000E+00
TIME INTERVAL       0    0    0    0    2    5.80000E+00    5.90000E+00
TIME INTERVAL       0    0    0    0    2    5.90000E+00    6.00000E+00
TIME INTERVAL       0    0    0    0    2    6.00000E+00    8.00000E+00
TIME INTERVAL       0    0    0    0    2    8.00000E+00    8.33000E+00
DOSE PARAMS         0    0    0    0    7    9.56000E-04    3.47000E-04
 7.86000E-05    1.75000E-04    1.30000E-04    3.47000E-04    0.00000E+00
TIME INTERVAL       0    0    0    0    2    8.33000E+00    1.20000E+01
REMOVAL RATE        2    3    0    0    1    5.57100E-01
REMOVAL RATE        3    3    0    0    1    5.57100E-01
REMOVAL RATE        4    3    0    0    1    5.57100E-01
```

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REMOVAL RATE          5    3    0    0    1   5.57100E-01
REMOVAL RATE          6    3    0    0    1   5.57100E-01
REMOVAL RATE          7    3    0    0    1   5.57100E-01
REMOVAL RATE          8    3    0    0    1   5.57100E-01
TIME INTERVAL         0    0    0    0    2   1.20000E+01   1.94000E+01
REMOVAL RATE          2    3    0    0    1   5.23600E-01
REMOVAL RATE          3    3    0    0    1   5.23600E-01
REMOVAL RATE          4    3    0    0    1   5.23600E-01
REMOVAL RATE          5    3    0    0    1   5.23600E-01
REMOVAL RATE          6    3    0    0    1   5.23600E-01
REMOVAL RATE          7    3    0    0    1   5.23600E-01
REMOVAL RATE          8    3    0    0    1   5.23600E-01
TIME INTERVAL         0    0    0    0    2   1.94000E+01   2.40000E+01
REMOVAL RATE          2    3    0    0    1   5.06800E-01
REMOVAL RATE          3    3    0    0    1   5.06800E-01
REMOVAL RATE          4    3    0    0    1   5.06800E-01
REMOVAL RATE          5    3    0    0    1   5.06800E-01
REMOVAL RATE          6    3    0    0    1   5.06800E-01
REMOVAL RATE          7    3    0    0    1   5.06800E-01
REMOVAL RATE          8    3    0    0    1   5.06800E-01
TIME INTERVAL         0    0    0    0    2   2.40000E+01   7.20000E+01
REMOVAL RATE          2    3    0    0    2   0.00000E+00   0.00000E+00
REMOVAL RATE          3    3    0    0    2   0.00000E+00   0.00000E+00
REMOVAL RATE          4    3    0    0    2   0.00000E+00   0.00000E+00
REMOVAL RATE          5    3    0    0    2   0.00000E+00   0.00000E+00
REMOVAL RATE          6    3    0    0    2   0.00000E+00   0.00000E+00
REMOVAL RATE          7    3    0    0    2   0.00000E+00   0.00000E+00

                         TIME DEPENDENT INPUT
                          CASE NUMBER    1

REMOVAL RATE          8    3    0    0    2   0.00000E+00   0.00000E+00
TRANSFER PERCENT      0    0    0    1    6   0.00000E+00   0.00000E+00
 0.00000E+00   1.00000E+10   2.30200E+00   0.00000E+00
TRANSFER PERCENT      0    0    0    2    5   0.00000E+00   0.00000E+00
 0.00000E+00   3.20000E+03   3.85000E-01
TRANSFER PERCENT      0    0    0    3    5   0.00000E+00   4.82100E+09
 4.80000E+03   0.00000E+00   3.85000E-01
CONTROL ROOM          0    0    0    0    5   1.21000E+03   0.00000E+00
 1.21000E+03   0.00000E+00   6.00000E-01
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 4.09000E-05   2.32000E-04   1.10000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL         0    0    0    0    2   7.20000E+01   9.60000E+01
CONTROL ROOM          0    0    0    0    5   0.00000E+00   2.00000E+03
 2.00000E+03   0.00000E+00   6.00000E-01
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 4.09000E-05   2.32000E-04   1.31000E-04   3.47000E-04   0.00000E+00
TIME INTERVAL         0    0    0    0    2   9.60000E+01   7.20000E+02
TRANSFER PERCENT      0    0    0    1    6   0.00000E+00   0.00000E+00
 0.00000E+00   1.00000E+10   1.47500E+00   0.00000E+00
TRANSFER PERCENT      0    0    0    2    5   0.00000E+00   0.00000E+00
 0.00000E+00   3.20000E+03   1.93000E-01
TRANSFER PERCENT      0    0    0    3    5   0.00000E+00   4.82100E+09
 4.80000E+03   0.00000E+00   1.93000E-01
CONTROL ROOM          0    0    0    0    5   0.00000E+00   2.00000E+03
 2.00000E+03   0.00000E+00   4.00000E-01
DOSE PARAMS           0    0    0    0    7   9.56000E-04   3.47000E-04
 1.60000E-05   2.32000E-04   1.04000E-04   3.47000E-04   0.00000E+00
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ACTIVITIES (CI) AT END OF TIME STEP 21

CASE NUMBER 1

STEP START TIME AT 1.900E+00 (HRS) STEP END TIME AT 2.000E+00 (HRS)

ACTIVITY DISTRIBUTION IN THE NODES MODELED
BY CHEMICAL/PHYSICAL FORM AND GROUP

GROUP	FORM	TOTAL BY	TOTAL BY	Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
NOBLES	ELEM.	3.939E+08	3.939E+08	2.429E+08	8.297E+07	6.786E+07	1.531E+05	5.969E-30
HALOGENS	ELEM.	1.058E+08	3.534E+06	3.160E+06	8.343E+04	2.877E+05	2.332E+03	0.000E+00
	ORG.		2.880E+05	1.670E+05	6.734E+04	5.356E+04	1.169E+02	0.000E+00
	PART.		1.020E+08	8.569E+07	5.441E+06	1.078E+07	5.894E+04	2.504E-30
ALKMETAL	PART.	1.078E+07	1.078E+07	9.057E+06	5.769E+05	1.141E+06	6.370E+03	0.000E+00
TELLURM	PART.	1.147E+07	1.147E+07	9.684E+06	5.936E+05	1.186E+06	5.866E+03	0.000E+00
BARSTRNT	PART.	7.669E+06	7.669E+06	6.473E+06	3.974E+05	7.940E+05	3.928E+03	0.000E+00
NOBMETAL	PART.	1.269E+06	1.269E+06	1.071E+06	6.590E+04	1.316E+05	6.516E+02	0.000E+00
LANTHANM	PART.	1.994E+05	1.994E+05	1.682E+05	1.035E+04	2.067E+04	1.023E+02	0.000E+00
CERIUM	PART.	9.637E+05	9.637E+05	8.131E+05	5.009E+04	1.000E+05	4.954E+02	0.000E+00

ACTIVITY CONTRIBUTION TO THE ENVIRONMENT FROM EACH NODE MODELED
FOR THE PLANT BY CHEMICAL/PHYSICAL FORM AND GROUP

GROUP	FORM	TOTAL BY	TOTAL BY	Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
NOBLES	ELEM.	1.177E+04	1.177E+04	0.000E+00	0.000E+00	0.000E+00	1.177E+04	0.000E+00
HALOGENS	ELEM.	4.914E+01	1.877E+00	0.000E+00	0.000E+00	0.000E+00	1.877E+00	0.000E+00
	ORG.		9.308E-02	0.000E+00	0.000E+00	0.000E+00	9.308E-02	0.000E+00
	PART.		4.717E+01	0.000E+00	0.000E+00	0.000E+00	4.717E+01	0.000E+00
ALKMETAL	PART.	5.153E+00	5.153E+00	0.000E+00	0.000E+00	0.000E+00	5.153E+00	0.000E+00
TELLURM	PART.	4.650E+00	4.650E+00	0.000E+00	0.000E+00	0.000E+00	4.650E+00	0.000E+00
BARSTRNT	PART.	3.106E+00	3.106E+00	0.000E+00	0.000E+00	0.000E+00	3.106E+00	0.000E+00
NOBMETAL	PART.	5.134E-01	5.134E-01	0.000E+00	0.000E+00	0.000E+00	5.134E-01	0.000E+00
LANTHANM	PART.	8.069E-02	8.069E-02	0.000E+00	0.000E+00	0.000E+00	8.069E-02	0.000E+00
CERIUM	PART.	3.897E-01	3.897E-01	0.000E+00	0.000E+00	0.000E+00	3.897E-01	0.000E+00

ACTIVITIES (CI) AT END OF TIME STEP 32

CASE NUMBER 1

STEP START TIME AT 3.000E+00 (HRS) STEP END TIME AT 3.100E+00 (HRS)

ACTIVITY DISTRIBUTION IN THE NODES MODELED
BY CHEMICAL/PHYSICAL FORM AND GROUP

GROUP	FORM	TOTAL BY	TOTAL BY	Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
NOBLES	ELEM.	3.762E+08	3.762E+08	6.105E+07	1.883E+08	1.266E+08	1.371E+05	1.334E-17
HALOGENS	ELEM.	3.764E+06	1.864E+04	4.628E+03	3.449E+03	9.600E+03	9.625E+02	2.912E-21
	ORG.		2.637E+05	4.285E+04	1.318E+05	8.888E+04	9.694E+01	6.940E-21
	PART.		3.482E+06	7.790E+05	1.060E+06	1.616E+06	2.684E+04	4.399E-19
ALKMETAL	PART.	3.413E+05	3.413E+05	7.633E+04	1.039E+05	1.583E+05	2.690E+03	1.303E-20
TELLURM	PART.	3.962E+05	3.962E+05	8.868E+04	1.208E+05	1.839E+05	2.793E+03	3.253E-20
BARSTRNT	PART.	2.661E+05	2.661E+05	5.953E+04	8.116E+04	1.235E+05	1.904E+03	1.792E-20
NOBMETAL	PART.	4.779E+04	4.779E+04	1.070E+04	1.457E+04	2.219E+04	3.384E+02	5.694E-21
LANTHANM	PART.	7.426E+03	7.426E+03	1.662E+03	2.263E+03	3.448E+03	5.234E+01	6.136E-22
CERIUM	PART.	3.809E+04	3.809E+04	8.528E+03	1.160E+04	1.769E+04	2.666E+02	1.265E-21

ACTIVITY CONTRIBUTION TO THE ENVIRONMENT FROM EACH NODE MODELED
FOR THE PLANT BY CHEMICAL/PHYSICAL FORM AND GROUP

GROUP	FORM	TOTAL BY	TOTAL BY	Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
NOBLES	ELEM.	1.102E+04	1.102E+04	0.000E+00	0.000E+00	0.000E+00	1.102E+04	0.000E+00
HALOGENS	ELEM.	2.391E+01	8.265E-01	0.000E+00	0.000E+00	0.000E+00	8.265E-01	0.000E+00
	ORG.		8.003E-02	0.000E+00	0.000E+00	0.000E+00	8.003E-02	0.000E+00
	PART.		2.301E+01	0.000E+00	0.000E+00	0.000E+00	2.301E+01	0.000E+00
ALKMETAL	PART.	2.304E+00	2.304E+00	0.000E+00	0.000E+00	0.000E+00	2.304E+00	0.000E+00
TELLURM	PART.	2.390E+00	2.390E+00	0.000E+00	0.000E+00	0.000E+00	2.390E+00	0.000E+00
BARSTRNT	PART.	1.629E+00	1.629E+00	0.000E+00	0.000E+00	0.000E+00	1.629E+00	0.000E+00
NOBMETAL	PART.	2.889E-01	2.889E-01	0.000E+00	0.000E+00	0.000E+00	2.889E-01	0.000E+00
LANTHANM	PART.	4.469E-02	4.469E-02	0.000E+00	0.000E+00	0.000E+00	4.469E-02	0.000E+00
CERIUM	PART.	2.272E-01	2.272E-01	0.000E+00	0.000E+00	0.000E+00	2.272E-01	0.000E+00

ACTIVITIES (CI) AT END OF TIME STEP 33

CASE NUMBER 1

STEP START TIME AT 3.100E+00 (HRS) STEP END TIME AT 3.200E+00 (HRS)

ACTIVITY DISTRIBUTION IN THE NODES MODELED
BY CHEMICAL/PHYSICAL FORM AND GROUP

GROUP	FORM	TOTAL BY	TOTAL BY	Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
NOBLES	ELEM.	3.749E+08	3.749E+08	6.084E+07	1.877E+08	1.262E+08	1.360E+05	1.329E-17
HALOGENS	ELEM.	2.814E+06	1.849E+04	3.500E+03	6.848E+03	7.260E+03	8.788E+02	4.413E-22
	ORG.		2.621E+05	4.259E+04	1.310E+05	8.833E+04	9.574E+01	6.793E-21
	PART.		2.534E+06	5.657E+05	7.701E+05	1.173E+06	2.459E+04	3.162E-19
ALKMETAL	PART.	2.487E+05	2.487E+05	5.551E+04	7.557E+04	1.151E+05	2.469E+03	8.956E-21
TELLURM	PART.	2.891E+05	2.891E+05	6.460E+04	8.797E+04	1.340E+05	2.568E+03	2.371E-20
BARSTRNT	PART.	1.937E+05	1.937E+05	4.326E+04	5.898E+04	8.973E+04	1.749E+03	1.295E-20
NOBMETAL	PART.	3.501E+04	3.501E+04	7.822E+03	1.065E+04	1.622E+04	3.125E+02	4.138E-21
LANTHANM	PART.	5.437E+03	5.437E+03	1.215E+03	1.654E+03	2.520E+03	4.827E+01	4.457E-22
CERIUM	PART.	2.802E+04	2.802E+04	6.262E+03	8.521E+03	1.299E+04	2.469E+02	9.291E-22

ACTIVITY CONTRIBUTION TO THE ENVIRONMENT FROM EACH NODE MODELED
FOR THE PLANT BY CHEMICAL/PHYSICAL FORM AND GROUP

GROUP	FORM	TOTAL BY	TOTAL BY	Drywell	Sprayed	Unsprayd	Sec_Cont	MSIV_Vol
NOBLES	ELEM.	1.093E+04	1.093E+04	0.000E+00	0.000E+00	0.000E+00	1.093E+04	0.000E+00
HALOGENS	ELEM.	2.192E+01	7.546E-01	0.000E+00	0.000E+00	0.000E+00	7.546E-01	0.000E+00
	ORG.		7.901E-02	0.000E+00	0.000E+00	0.000E+00	7.901E-02	0.000E+00
	PART.		2.108E+01	0.000E+00	0.000E+00	0.000E+00	2.108E+01	0.000E+00
ALKMETAL	PART.	2.114E+00	2.114E+00	0.000E+00	0.000E+00	0.000E+00	2.114E+00	0.000E+00
TELLURM	PART.	2.198E+00	2.198E+00	0.000E+00	0.000E+00	0.000E+00	2.198E+00	0.000E+00
BARSTRNT	PART.	1.497E+00	1.497E+00	0.000E+00	0.000E+00	0.000E+00	1.497E+00	0.000E+00
NOBMETAL	PART.	2.668E-01	2.668E-01	0.000E+00	0.000E+00	0.000E+00	2.668E-01	0.000E+00
LANTHANM	PART.	4.124E-02	4.124E-02	0.000E+00	0.000E+00	0.000E+00	4.124E-02	0.000E+00
CERIUM	PART.	2.105E-01	2.105E-01	0.000E+00	0.000E+00	0.000E+00	2.105E-01	0.000E+00

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR WHOLEBDY DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	3.378E-06	3.378E-06	6.854E-07	6.854E-07	6.117E-09	6.117E-09
1.667E-02	1.684E-06	5.062E-06	3.417E-07	1.027E-06	5.988E-08	6.599E-08
1.000E-01	2.436E-05	2.942E-05	4.943E-06	5.970E-06	9.328E-08	1.593E-07
2.000E-01	9.985E-05	1.293E-04	2.026E-05	2.623E-05	2.177E-07	3.770E-07
3.000E-01	1.400E-02	1.413E-02	2.840E-03	2.866E-03	7.854E-06	8.231E-06
4.000E-01	2.505E-02	3.918E-02	5.083E-03	7.950E-03	2.832E-05	3.655E-05
5.000E-01	3.989E-02	7.906E-02	8.094E-03	1.604E-02	6.147E-05	9.802E-05
6.000E-01	6.807E-02	1.471E-01	1.381E-02	2.986E-02	1.158E-04	2.139E-04
7.000E-01	1.095E-01	2.566E-01	2.222E-02	5.208E-02	2.045E-04	4.184E-04
8.000E-01	1.616E-01	4.182E-01	3.279E-02	8.487E-02	3.384E-04	7.568E-04
9.000E-01	2.221E-01	6.404E-01	4.508E-02	1.299E-01	5.254E-04	1.282E-03
1.000E+00	2.889E-01	9.292E-01	5.862E-02	1.886E-01	7.705E-04	2.053E-03
1.100E+00	3.587E-01	1.288E+00	7.279E-02	2.614E-01	1.076E-03	3.128E-03
1.200E+00	4.303E-01	1.718E+00	8.731E-02	3.487E-01	1.440E-03	4.569E-03
1.300E+00	5.028E-01	2.221E+00	1.020E-01	4.507E-01	1.863E-03	6.432E-03
1.400E+00	5.757E-01	2.797E+00	1.168E-01	5.675E-01	2.341E-03	8.773E-03
1.500E+00	6.480E-01	3.445E+00	1.315E-01	6.990E-01	2.873E-03	1.165E-02
1.600E+00	7.182E-01	4.163E+00	1.457E-01	8.448E-01	3.453E-03	1.510E-02
1.700E+00	7.858E-01	4.949E+00	1.595E-01	1.004E+00	4.077E-03	1.918E-02
1.800E+00	8.508E-01	5.799E+00	1.727E-01	1.177E+00	4.741E-03	2.392E-02
1.900E+00	9.134E-01	6.713E+00	1.853E-01	1.362E+00	5.439E-03	2.936E-02
2.000E+00	9.361E-01	7.649E+00	1.038E-01	1.466E+00	5.991E-03	3.535E-02
2.100E+00	9.149E-01	8.564E+00	1.014E-01	1.567E+00	6.368E-03	4.172E-02
2.200E+00	8.898E-01	9.454E+00	9.866E-02	1.666E+00	6.710E-03	4.842E-02
2.300E+00	8.643E-01	1.032E+01	9.583E-02	1.762E+00	7.016E-03	5.544E-02
2.400E+00	8.393E-01	1.116E+01	9.306E-02	1.855E+00	7.289E-03	6.273E-02
2.500E+00	8.153E-01	1.197E+01	9.040E-02	1.945E+00	7.532E-03	7.026E-02
2.600E+00	7.924E-01	1.276E+01	8.786E-02	2.033E+00	7.745E-03	7.801E-02
2.700E+00	7.705E-01	1.354E+01	8.543E-02	2.119E+00	7.933E-03	8.594E-02
2.800E+00	7.497E-01	1.429E+01	8.313E-02	2.202E+00	8.096E-03	9.404E-02
2.900E+00	7.299E-01	1.501E+01	8.093E-02	2.283E+00	8.238E-03	1.023E-01
3.000E+00	7.110E-01	1.573E+01	7.884E-02	2.362E+00	8.359E-03	1.106E-01
3.100E+00	6.931E-01	1.642E+01	7.685E-02	2.438E+00	8.461E-03	1.191E-01
3.200E+00	6.759E-01	1.709E+01	7.494E-02	2.513E+00	8.547E-03	1.276E-01
3.300E+00	6.595E-01	1.775E+01	7.313E-02	2.587E+00	8.617E-03	1.363E-01
3.400E+00	6.439E-01	1.840E+01	7.139E-02	2.658E+00	8.673E-03	1.449E-01
3.500E+00	6.289E-01	1.903E+01	6.973E-02	2.728E+00	8.716E-03	1.536E-01
3.600E+00	6.146E-01	1.964E+01	6.814E-02	2.796E+00	8.747E-03	1.624E-01
3.700E+00	6.008E-01	2.024E+01	6.662E-02	2.862E+00	8.767E-03	1.712E-01
3.800E+00	5.877E-01	2.083E+01	6.516E-02	2.928E+00	8.777E-03	1.799E-01
3.900E+00	5.750E-01	2.141E+01	6.375E-02	2.991E+00	8.779E-03	1.887E-01
4.000E+00	5.628E-01	2.197E+01	6.240E-02	3.054E+00	8.772E-03	1.975E-01
4.100E+00	5.511E-01	2.252E+01	6.110E-02	3.115E+00	8.757E-03	2.062E-01
4.200E+00	5.398E-01	2.306E+01	5.985E-02	3.175E+00	8.736E-03	2.150E-01
4.300E+00	5.289E-01	2.359E+01	5.864E-02	3.233E+00	8.709E-03	2.237E-01
4.400E+00	5.184E-01	2.411E+01	5.748E-02	3.291E+00	8.676E-03	2.324E-01
4.500E+00	5.083E-01	2.461E+01	5.635E-02	3.347E+00	8.638E-03	2.410E-01
4.600E+00	4.984E-01	2.511E+01	5.527E-02	3.402E+00	8.595E-03	2.496E-01
4.700E+00	4.890E-01	2.560E+01	5.422E-02	3.457E+00	8.549E-03	2.581E-01
4.800E+00	4.798E-01	2.608E+01	5.320E-02	3.510E+00	8.498E-03	2.666E-01
4.900E+00	4.709E-01	2.655E+01	5.221E-02	3.562E+00	8.444E-03	2.751E-01
5.000E+00	4.623E-01	2.701E+01	5.126E-02	3.613E+00	8.388E-03	2.835E-01
5.100E+00	4.539E-01	2.747E+01	5.033E-02	3.664E+00	8.328E-03	2.918E-01
5.200E+00	4.458E-01	2.791E+01	4.943E-02	3.713E+00	8.266E-03	3.001E-01
5.300E+00	4.380E-01	2.835E+01	4.856E-02	3.762E+00	8.202E-03	3.083E-01
5.400E+00	4.303E-01	2.878E+01	4.772E-02	3.809E+00	8.137E-03	3.164E-01
5.500E+00	4.229E-01	2.921E+01	4.689E-02	3.856E+00	8.069E-03	3.245E-01
5.600E+00	4.157E-01	2.962E+01	4.610E-02	3.902E+00	8.001E-03	3.325E-01
5.700E+00	4.087E-01	3.003E+01	4.532E-02	3.948E+00	7.931E-03	3.404E-01
5.800E+00	4.019E-01	3.043E+01	4.456E-02	3.992E+00	7.860E-03	3.483E-01
5.900E+00	3.953E-01	3.083E+01	4.383E-02	4.036E+00	7.788E-03	3.561E-01
6.000E+00	6.745E+00	3.757E+01	7.479E-01	4.784E+00	1.389E-01	4.950E-01

8.000E+00	9.386E-01	3.851E+01	7.717E-02	4.861E+00	1.992E-02	5.149E-01
8.330E+00	8.296E+00	4.681E+01	6.821E-01	5.543E+00	1.243E-01	6.392E-01
1.200E+01	1.094E+01	5.775E+01	8.995E-01	6.443E+00	9.183E-02	7.310E-01
1.940E+01	5.618E+00	6.337E+01	4.619E-01	6.905E+00	4.011E-02	7.712E-01
2.400E+01	4.074E+01	1.041E+02	1.743E+00	8.648E+00	1.538E-01	9.249E-01
7.200E+01	1.620E+01	1.203E+02	6.929E-01	9.341E+00	7.513E-02	1.000E+00
9.600E+01	1.104E+02	2.307E+02	1.848E+00	1.119E+01	2.714E-01	1.271E+00
	TOTAL	2.307E+02	TOTAL	1.119E+01	TOTAL	1.271E+00

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR THYROID DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	4.482E-04	4.482E-04	9.095E-05	9.095E-05	1.425E-05	1.425E-05
1.667E-02	1.875E-05	4.669E-04	3.805E-06	9.476E-05	1.397E-04	1.540E-04
1.000E-01	2.720E-04	7.390E-04	5.520E-05	1.500E-04	1.658E-04	3.197E-04
2.000E-01	1.119E-03	1.858E-03	2.270E-04	3.770E-04	1.842E-04	5.039E-04
3.000E-01	1.528E-01	1.546E-01	3.100E-02	3.138E-02	1.653E-03	2.157E-03
4.000E-01	2.715E-01	4.262E-01	5.510E-02	8.648E-02	5.630E-03	7.787E-03
5.000E-01	4.083E-01	8.344E-01	8.285E-02	1.693E-01	1.191E-02	1.970E-02
6.000E-01	5.853E-01	1.420E+00	1.188E-01	2.881E-01	2.098E-02	4.067E-02
7.000E-01	8.007E-01	2.220E+00	1.625E-01	4.506E-01	3.349E-02	7.417E-02
8.000E-01	1.047E+00	3.267E+00	2.124E-01	6.630E-01	5.001E-02	1.242E-01
9.000E-01	1.317E+00	4.584E+00	2.672E-01	9.302E-01	7.092E-02	1.951E-01
1.000E+00	1.605E+00	6.189E+00	3.257E-01	1.256E+00	9.651E-02	2.916E-01
1.100E+00	1.906E+00	8.095E+00	3.868E-01	1.643E+00	1.269E-01	4.185E-01
1.200E+00	2.215E+00	1.031E+01	4.495E-01	2.092E+00	1.622E-01	5.807E-01
1.300E+00	2.529E+00	1.284E+01	5.132E-01	2.605E+00	2.023E-01	7.830E-01
1.400E+00	2.844E+00	1.568E+01	5.772E-01	3.183E+00	2.472E-01	1.030E+00
1.500E+00	3.159E+00	1.884E+01	6.410E-01	3.824E+00	2.967E-01	1.327E+00
1.600E+00	3.470E+00	2.231E+01	7.041E-01	4.528E+00	3.507E-01	1.678E+00
1.700E+00	3.775E+00	2.609E+01	7.662E-01	5.294E+00	4.090E-01	2.087E+00
1.800E+00	4.074E+00	3.016E+01	8.268E-01	6.121E+00	4.712E-01	2.558E+00
1.900E+00	4.366E+00	3.453E+01	8.859E-01	7.007E+00	5.372E-01	3.095E+00
2.000E+00	4.468E+00	3.900E+01	4.954E-01	7.502E+00	5.918E-01	3.687E+00
2.100E+00	4.340E+00	4.334E+01	4.812E-01	7.983E+00	6.320E-01	4.319E+00
2.200E+00	4.162E+00	4.750E+01	4.615E-01	8.445E+00	6.690E-01	4.988E+00
2.300E+00	3.954E+00	5.145E+01	4.384E-01	8.883E+00	7.024E-01	5.690E+00
2.400E+00	3.731E+00	5.518E+01	4.137E-01	9.297E+00	7.320E-01	6.422E+00
2.500E+00	3.503E+00	5.869E+01	3.884E-01	9.685E+00	7.577E-01	7.180E+00
2.600E+00	3.275E+00	6.196E+01	3.632E-01	1.005E+01	7.797E-01	7.960E+00
2.700E+00	3.053E+00	6.502E+01	3.386E-01	1.039E+01	7.981E-01	8.758E+00
2.800E+00	2.840E+00	6.785E+01	3.149E-01	1.070E+01	8.131E-01	9.571E+00
2.900E+00	2.636E+00	7.049E+01	2.923E-01	1.099E+01	8.249E-01	1.040E+01
3.000E+00	2.444E+00	7.294E+01	2.710E-01	1.127E+01	8.338E-01	1.123E+01
3.100E+00	2.263E+00	7.520E+01	2.510E-01	1.152E+01	8.400E-01	1.207E+01
3.200E+00	2.094E+00	7.729E+01	2.322E-01	1.175E+01	8.437E-01	1.291E+01
3.300E+00	1.937E+00	7.923E+01	2.148E-01	1.196E+01	8.451E-01	1.376E+01
3.400E+00	1.792E+00	8.102E+01	1.987E-01	1.216E+01	8.446E-01	1.460E+01
3.500E+00	1.658E+00	8.268E+01	1.838E-01	1.235E+01	8.422E-01	1.545E+01
3.600E+00	1.534E+00	8.421E+01	1.701E-01	1.252E+01	8.382E-01	1.628E+01
3.700E+00	1.419E+00	8.563E+01	1.573E-01	1.267E+01	8.328E-01	1.712E+01
3.800E+00	1.313E+00	8.695E+01	1.456E-01	1.282E+01	8.261E-01	1.794E+01
3.900E+00	1.215E+00	8.816E+01	1.347E-01	1.295E+01	8.182E-01	1.876E+01
4.000E+00	1.125E+00	8.929E+01	1.247E-01	1.308E+01	8.094E-01	1.957E+01
4.100E+00	1.041E+00	9.033E+01	1.154E-01	1.319E+01	7.996E-01	2.037E+01
4.200E+00	9.638E-01	9.129E+01	1.069E-01	1.330E+01	7.891E-01	2.116E+01
4.300E+00	8.923E-01	9.218E+01	9.894E-02	1.340E+01	7.780E-01	2.194E+01
4.400E+00	8.263E-01	9.301E+01	9.162E-02	1.349E+01	7.663E-01	2.270E+01
4.500E+00	7.652E-01	9.377E+01	8.485E-02	1.358E+01	7.541E-01	2.346E+01
4.600E+00	7.088E-01	9.448E+01	7.859E-02	1.365E+01	7.414E-01	2.420E+01
4.700E+00	6.566E-01	9.514E+01	7.280E-02	1.373E+01	7.285E-01	2.493E+01
4.800E+00	6.083E-01	9.575E+01	6.745E-02	1.379E+01	7.153E-01	2.564E+01
4.900E+00	5.637E-01	9.631E+01	6.251E-02	1.386E+01	7.018E-01	2.634E+01
5.000E+00	5.225E-01	9.683E+01	5.793E-02	1.392E+01	6.882E-01	2.703E+01
5.100E+00	4.843E-01	9.732E+01	5.370E-02	1.397E+01	6.745E-01	2.771E+01
5.200E+00	4.491E-01	9.777E+01	4.979E-02	1.402E+01	6.608E-01	2.837E+01
5.300E+00	4.165E-01	9.818E+01	4.618E-02	1.406E+01	6.469E-01	2.901E+01
5.400E+00	3.863E-01	9.857E+01	4.283E-02	1.411E+01	6.331E-01	2.965E+01
5.500E+00	3.584E-01	9.893E+01	3.974E-02	1.415E+01	6.193E-01	3.027E+01
5.600E+00	3.326E-01	9.926E+01	3.688E-02	1.418E+01	6.056E-01	3.087E+01
5.700E+00	3.088E-01	9.957E+01	3.423E-02	1.422E+01	5.919E-01	3.146E+01
5.800E+00	2.867E-01	9.986E+01	3.179E-02	1.425E+01	5.784E-01	3.204E+01
5.900E+00	2.663E-01	1.001E+02	2.952E-02	1.428E+01	5.649E-01	3.261E+01
6.000E+00	2.734E+00	1.029E+02	3.031E-01	1.458E+01	8.705E+00	4.131E+01

8.000E+00	1.919E-01	1.030E+02	7.955E-03	1.459E+01	1.052E+00	4.236E+01
8.330E+00	9.142E-01	1.040E+02	3.791E-02	1.463E+01	6.821E+00	4.919E+01
1.200E+01	9.072E-01	1.049E+02	3.762E-02	1.467E+01	3.152E+00	5.234E+01
1.940E+01	6.592E-01	1.055E+02	2.733E-02	1.469E+01	3.661E-01	5.270E+01
2.400E+01	7.086E+00	1.126E+02	2.027E-01	1.490E+01	4.838E-01	5.319E+01
7.200E+01	3.115E+00	1.157E+02	8.911E-02	1.499E+01	2.526E-01	5.344E+01
9.600E+01	2.516E+01	1.409E+02	2.816E-01	1.527E+01	1.086E+00	5.453E+01
	TOTAL	1.409E+02	TOTAL	1.527E+01	TOTAL	5.453E+01

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR INHALATN DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START	EXCLUSION RADIUS		LOW POPULATION ZONE		CONTROL ROOM	
TIME (HRS)	EACH STEP	ACCUM.	EACH STEP	ACCUM.	EACH STEP	ACCUM.
0.000E+00	1.972E-05	1.972E-05	4.003E-06	4.003E-06	6.272E-07	6.272E-07
1.667E-02	8.252E-07	2.055E-05	1.675E-07	4.170E-06	6.147E-06	6.774E-06
1.000E-01	1.197E-05	3.252E-05	2.430E-06	6.600E-06	7.293E-06	1.407E-05
2.000E-01	4.925E-05	8.177E-05	9.993E-06	1.659E-05	8.100E-06	2.217E-05
3.000E-01	6.720E-03	6.802E-03	1.364E-03	1.380E-03	7.270E-05	9.487E-05
4.000E-01	1.194E-02	1.874E-02	2.423E-03	3.804E-03	2.476E-04	3.424E-04
5.000E-01	1.819E-02	3.693E-02	3.691E-03	7.495E-03	5.259E-04	8.684E-04
6.000E-01	2.730E-02	6.423E-02	5.540E-03	1.303E-02	9.416E-04	1.810E-03
7.000E-01	3.923E-02	1.035E-01	7.961E-03	2.100E-02	1.544E-03	3.354E-03
8.000E-01	5.346E-02	1.569E-01	1.085E-02	3.184E-02	2.377E-03	5.732E-03
9.000E-01	6.951E-02	2.264E-01	1.411E-02	4.595E-02	3.473E-03	9.204E-03
1.000E+00	8.698E-02	3.134E-01	1.765E-02	6.360E-02	4.853E-03	1.406E-02
1.100E+00	1.055E-01	4.189E-01	2.141E-02	8.501E-02	6.534E-03	2.059E-02
1.200E+00	1.248E-01	5.437E-01	2.532E-02	1.103E-01	8.524E-03	2.912E-02
1.300E+00	1.445E-01	6.882E-01	2.933E-02	1.397E-01	1.083E-02	3.994E-02
1.400E+00	1.645E-01	8.527E-01	3.339E-02	1.730E-01	1.344E-02	5.338E-02
1.500E+00	1.846E-01	1.037E+00	3.746E-02	2.105E-01	1.635E-02	6.973E-02
1.600E+00	2.046E-01	1.242E+00	4.152E-02	2.520E-01	1.956E-02	8.928E-02
1.700E+00	2.244E-01	1.466E+00	4.553E-02	2.976E-01	2.305E-02	1.123E-01
1.800E+00	2.438E-01	1.710E+00	4.948E-02	3.470E-01	2.681E-02	1.391E-01
1.900E+00	2.628E-01	1.973E+00	5.333E-02	4.004E-01	3.083E-02	1.700E-01
2.000E+00	2.701E-01	2.243E+00	2.995E-02	4.303E-01	3.418E-02	2.042E-01
2.100E+00	2.629E-01	2.506E+00	2.915E-02	4.595E-01	3.668E-02	2.408E-01
2.200E+00	2.526E-01	2.759E+00	2.801E-02	4.875E-01	3.899E-02	2.798E-01
2.300E+00	2.403E-01	2.999E+00	2.665E-02	5.141E-01	4.109E-02	3.209E-01
2.400E+00	2.271E-01	3.226E+00	2.518E-02	5.393E-01	4.295E-02	3.639E-01
2.500E+00	2.134E-01	3.439E+00	2.366E-02	5.630E-01	4.459E-02	4.085E-01
2.600E+00	1.997E-01	3.639E+00	2.214E-02	5.851E-01	4.600E-02	4.545E-01
2.700E+00	1.863E-01	3.825E+00	2.066E-02	6.058E-01	4.719E-02	5.016E-01
2.800E+00	1.734E-01	3.999E+00	1.923E-02	6.250E-01	4.817E-02	5.498E-01
2.900E+00	1.611E-01	4.160E+00	1.786E-02	6.429E-01	4.896E-02	5.988E-01
3.000E+00	1.494E-01	4.309E+00	1.657E-02	6.594E-01	4.957E-02	6.483E-01
3.100E+00	1.385E-01	4.448E+00	1.535E-02	6.748E-01	5.002E-02	6.984E-01
3.200E+00	1.282E-01	4.576E+00	1.421E-02	6.890E-01	5.031E-02	7.487E-01
3.300E+00	1.186E-01	4.695E+00	1.315E-02	7.021E-01	5.046E-02	7.991E-01
3.400E+00	1.098E-01	4.804E+00	1.217E-02	7.143E-01	5.049E-02	8.496E-01
3.500E+00	1.016E-01	4.906E+00	1.127E-02	7.256E-01	5.041E-02	9.000E-01
3.600E+00	9.405E-02	5.000E+00	1.043E-02	7.360E-01	5.022E-02	9.503E-01
3.700E+00	8.706E-02	5.087E+00	9.653E-03	7.457E-01	4.995E-02	1.000E+00
3.800E+00	8.059E-02	5.168E+00	8.936E-03	7.546E-01	4.960E-02	1.050E+00
3.900E+00	7.461E-02	5.242E+00	8.273E-03	7.629E-01	4.917E-02	1.099E+00
4.000E+00	6.908E-02	5.311E+00	7.660E-03	7.705E-01	4.868E-02	1.148E+00
4.100E+00	6.397E-02	5.375E+00	7.093E-03	7.776E-01	4.814E-02	1.196E+00
4.200E+00	5.924E-02	5.435E+00	6.568E-03	7.842E-01	4.755E-02	1.243E+00
4.300E+00	5.486E-02	5.490E+00	6.083E-03	7.903E-01	4.691E-02	1.290E+00
4.400E+00	5.082E-02	5.540E+00	5.634E-03	7.959E-01	4.624E-02	1.336E+00
4.500E+00	4.707E-02	5.587E+00	5.219E-03	8.011E-01	4.554E-02	1.382E+00
4.600E+00	4.361E-02	5.631E+00	4.835E-03	8.060E-01	4.481E-02	1.427E+00
4.700E+00	4.041E-02	5.671E+00	4.480E-03	8.105E-01	4.406E-02	1.471E+00
4.800E+00	3.744E-02	5.709E+00	4.152E-03	8.146E-01	4.329E-02	1.514E+00
4.900E+00	3.470E-02	5.744E+00	3.847E-03	8.184E-01	4.251E-02	1.557E+00
5.000E+00	3.216E-02	5.776E+00	3.566E-03	8.220E-01	4.171E-02	1.598E+00
5.100E+00	2.982E-02	5.806E+00	3.306E-03	8.253E-01	4.091E-02	1.639E+00
5.200E+00	2.764E-02	5.833E+00	3.065E-03	8.284E-01	4.010E-02	1.679E+00
5.300E+00	2.563E-02	5.859E+00	2.842E-03	8.312E-01	3.928E-02	1.719E+00
5.400E+00	2.377E-02	5.883E+00	2.636E-03	8.339E-01	3.847E-02	1.757E+00
5.500E+00	2.205E-02	5.905E+00	2.445E-03	8.363E-01	3.765E-02	1.795E+00
5.600E+00	2.046E-02	5.925E+00	2.269E-03	8.386E-01	3.684E-02	1.832E+00
5.700E+00	1.899E-02	5.944E+00	2.105E-03	8.407E-01	3.603E-02	1.868E+00
5.800E+00	1.762E-02	5.962E+00	1.954E-03	8.426E-01	3.522E-02	1.903E+00
5.900E+00	1.636E-02	5.978E+00	1.814E-03	8.445E-01	3.442E-02	1.937E+00
6.000E+00	1.661E-01	6.144E+00	1.842E-02	8.629E-01	5.328E-01	2.470E+00

8.000E+00	1.121E-02	6.155E+00	4.648E-04	8.633E-01	6.478E-02	2.535E+00
8.330E+00	4.702E-02	6.202E+00	1.950E-03	8.653E-01	4.227E-01	2.958E+00
1.200E+01	2.999E-02	6.232E+00	1.243E-03	8.665E-01	1.969E-01	3.155E+00
1.940E+01	2.039E-02	6.253E+00	8.455E-04	8.674E-01	2.128E-02	3.176E+00
2.400E+01	2.179E-01	6.471E+00	6.233E-03	8.736E-01	1.514E-02	3.191E+00
7.200E+01	9.542E-02	6.566E+00	2.729E-03	8.763E-01	7.735E-03	3.199E+00
9.600E+01	7.669E-01	7.333E+00	8.582E-03	8.849E-01	3.310E-02	3.232E+00
	TOTAL	7.333E+00	TOTAL	8.849E-01	TOTAL	3.232E+00

SUMMARY OF OFF-SITE DOSES

GGNS - LOCA Calculation using FGR 11&12 DCFs and NUREG-1465 Source Terms
CALCULATION FOR TEDE DOSE (REMS)
MULTI NODE CONTAINMENT WITH ESF

START TIME (HRS)	EXCLUSION RADIUS EACH STEP	EXCLUSION RADIUS ACCUM.	LOW POPULATION ZONE EACH STEP	LOW POPULATION ZONE ACCUM.	CONTROL ROOM EACH STEP	CONTROL ROOM ACCUM.
0.000E+00	2.310E-05	2.310E-05	4.688E-06	4.688E-06	6.333E-07	6.333E-07
1.667E-02	2.509E-06	2.561E-05	5.092E-07	5.197E-06	6.207E-06	6.840E-06
1.000E-01	3.633E-05	6.194E-05	7.372E-06	1.257E-05	7.386E-06	1.423E-05
2.000E-01	1.491E-04	2.110E-04	3.026E-05	4.282E-05	8.318E-06	2.254E-05
3.000E-01	2.072E-02	2.093E-02	4.204E-03	4.247E-03	8.056E-05	1.031E-04
4.000E-01	3.699E-02	5.792E-02	7.507E-03	1.175E-02	2.759E-04	3.790E-04
5.000E-01	5.808E-02	1.160E-01	1.179E-02	2.354E-02	5.874E-04	9.664E-04
6.000E-01	9.537E-02	2.114E-01	1.935E-02	4.289E-02	1.057E-03	2.024E-03
7.000E-01	1.487E-01	3.601E-01	3.018E-02	7.307E-02	1.749E-03	3.773E-03
8.000E-01	2.151E-01	5.751E-01	4.364E-02	1.167E-01	2.716E-03	6.488E-03
9.000E-01	2.917E-01	8.668E-01	5.919E-02	1.759E-01	3.998E-03	1.049E-02
1.000E+00	3.758E-01	1.243E+00	7.627E-02	2.522E-01	5.624E-03	1.611E-02
1.100E+00	4.642E-01	1.707E+00	9.420E-02	3.464E-01	7.610E-03	2.372E-02
1.200E+00	5.550E-01	2.262E+00	1.126E-01	4.590E-01	9.964E-03	3.368E-02
1.300E+00	6.473E-01	2.909E+00	1.314E-01	5.904E-01	1.269E-02	4.637E-02
1.400E+00	7.402E-01	3.649E+00	1.502E-01	7.406E-01	1.578E-02	6.215E-02
1.500E+00	8.327E-01	4.482E+00	1.690E-01	9.095E-01	1.922E-02	8.137E-02
1.600E+00	9.228E-01	5.405E+00	1.873E-01	1.097E+00	2.301E-02	1.044E-01
1.700E+00	1.010E+00	6.415E+00	2.050E-01	1.302E+00	2.713E-02	1.315E-01
1.800E+00	1.095E+00	7.510E+00	2.221E-01	1.524E+00	3.155E-02	1.631E-01
1.900E+00	1.176E+00	8.686E+00	2.387E-01	1.763E+00	3.627E-02	1.993E-01
2.000E+00	1.206E+00	9.892E+00	1.337E-01	1.896E+00	4.018E-02	2.395E-01
2.100E+00	1.178E+00	1.107E+01	1.306E-01	2.027E+00	4.305E-02	2.826E-01
2.200E+00	1.142E+00	1.221E+01	1.267E-01	2.154E+00	4.570E-02	3.283E-01
2.300E+00	1.105E+00	1.332E+01	1.225E-01	2.276E+00	4.810E-02	3.764E-01
2.400E+00	1.066E+00	1.438E+01	1.182E-01	2.394E+00	5.024E-02	4.266E-01
2.500E+00	1.029E+00	1.541E+01	1.141E-01	2.508E+00	5.212E-02	4.787E-01
2.600E+00	9.921E-01	1.640E+01	1.100E-01	2.618E+00	5.374E-02	5.325E-01
2.700E+00	9.568E-01	1.736E+01	1.061E-01	2.724E+00	5.512E-02	5.876E-01
2.800E+00	9.231E-01	1.828E+01	1.024E-01	2.827E+00	5.627E-02	6.439E-01
2.900E+00	8.910E-01	1.917E+01	9.880E-02	2.926E+00	5.720E-02	7.011E-01
3.000E+00	8.605E-01	2.004E+01	9.541E-02	3.021E+00	5.793E-02	7.590E-01
3.100E+00	8.315E-01	2.087E+01	9.220E-02	3.113E+00	5.848E-02	8.175E-01
3.200E+00	8.041E-01	2.167E+01	8.916E-02	3.202E+00	5.885E-02	8.763E-01
3.300E+00	7.782E-01	2.245E+01	8.628E-02	3.289E+00	5.908E-02	9.354E-01
3.400E+00	7.537E-01	2.320E+01	8.357E-02	3.372E+00	5.916E-02	9.946E-01
3.500E+00	7.305E-01	2.393E+01	8.100E-02	3.453E+00	5.912E-02	1.054E+00
3.600E+00	7.086E-01	2.464E+01	7.857E-02	3.532E+00	5.897E-02	1.113E+00
3.700E+00	6.879E-01	2.533E+01	7.627E-02	3.608E+00	5.872E-02	1.171E+00
3.800E+00	6.683E-01	2.600E+01	7.409E-02	3.682E+00	5.837E-02	1.230E+00
3.900E+00	6.496E-01	2.665E+01	7.203E-02	3.754E+00	5.795E-02	1.288E+00
4.000E+00	6.319E-01	2.728E+01	7.006E-02	3.824E+00	5.745E-02	1.345E+00
4.100E+00	6.151E-01	2.789E+01	6.820E-02	3.892E+00	5.690E-02	1.402E+00
4.200E+00	5.990E-01	2.849E+01	6.642E-02	3.959E+00	5.628E-02	1.458E+00
4.300E+00	5.838E-01	2.908E+01	6.473E-02	4.024E+00	5.562E-02	1.514E+00
4.400E+00	5.692E-01	2.965E+01	6.311E-02	4.087E+00	5.492E-02	1.569E+00
4.500E+00	5.553E-01	3.020E+01	6.157E-02	4.148E+00	5.418E-02	1.623E+00
4.600E+00	5.421E-01	3.074E+01	6.010E-02	4.208E+00	5.341E-02	1.676E+00
4.700E+00	5.294E-01	3.127E+01	5.870E-02	4.267E+00	5.261E-02	1.729E+00
4.800E+00	5.172E-01	3.179E+01	5.735E-02	4.324E+00	5.179E-02	1.781E+00
4.900E+00	5.056E-01	3.230E+01	5.606E-02	4.380E+00	5.095E-02	1.832E+00
5.000E+00	4.944E-01	3.279E+01	5.482E-02	4.435E+00	5.010E-02	1.882E+00
5.100E+00	4.837E-01	3.327E+01	5.364E-02	4.489E+00	4.924E-02	1.931E+00
5.200E+00	4.735E-01	3.375E+01	5.250E-02	4.541E+00	4.836E-02	1.980E+00
5.300E+00	4.636E-01	3.421E+01	5.140E-02	4.593E+00	4.749E-02	2.027E+00
5.400E+00	4.541E-01	3.467E+01	5.035E-02	4.643E+00	4.660E-02	2.074E+00
5.500E+00	4.450E-01	3.511E+01	4.934E-02	4.693E+00	4.572E-02	2.119E+00
5.600E+00	4.362E-01	3.555E+01	4.836E-02	4.741E+00	4.484E-02	2.164E+00
5.700E+00	4.277E-01	3.597E+01	4.742E-02	4.788E+00	4.396E-02	2.208E+00
5.800E+00	4.195E-01	3.639E+01	4.652E-02	4.835E+00	4.308E-02	2.251E+00
5.900E+00	4.116E-01	3.681E+01	4.564E-02	4.880E+00	4.221E-02	2.293E+00
6.000E+00	6.912E+00	4.372E+01	7.664E-01	5.647E+00	6.717E-01	2.965E+00

8.000E+00	9.498E-01	4.467E+01	7.764E-02	5.724E+00	8.469E-02	3.050E+00
8.330E+00	8.343E+00	5.301E+01	6.840E-01	6.409E+00	5.470E-01	3.597E+00
1.200E+01	1.097E+01	6.398E+01	9.007E-01	7.309E+00	2.887E-01	3.886E+00
1.940E+01	5.639E+00	6.962E+01	4.628E-01	7.772E+00	6.139E-02	3.947E+00
2.400E+01	4.096E+01	1.106E+02	1.749E+00	9.521E+00	1.689E-01	4.116E+00
7.200E+01	1.629E+01	1.269E+02	6.957E-01	1.022E+01	8.286E-02	4.199E+00
9.600E+01	1.112E+02	2.381E+02	1.857E+00	1.207E+01	3.045E-01	4.503E+00
	TOTAL	2.381E+02	TOTAL	1.207E+01	TOTAL	4.503E+00

1 NO MORE CASES

END OF EXECUTION

	EAB DOSE (Rem TEDE)				
Time (Hrs)	ESF Leakage	MSIV Leakage	Containment Airborne	Total	Trailing 2-Hr Dose
0.00E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
1.00E-01	0.000E+00	5.134E-01	2.310E-05	5.134E-01	
2.00E-01	2.613E-06	1.957E+00	6.194E-05	1.957E+00	
3.00E-01	1.929E-05	4.201E+00	2.110E-04	4.201E+00	
4.00E-01	5.662E-05	4.201E+00	2.093E-02	4.222E+00	
5.00E-01	1.201E-04	4.201E+00	5.792E-02	4.259E+00	
6.00E-01	2.155E-04	4.201E+00	1.160E-01	4.317E+00	
7.00E-01	3.512E-04	4.201E+00	2.114E-01	4.413E+00	
8.00E-01	5.353E-04	4.201E+00	3.601E-01	4.562E+00	
9.00E-01	7.754E-04	4.201E+00	5.751E-01	4.777E+00	
1.00E+00	1.079E-03	4.201E+00	8.668E-01	5.069E+00	
1.10E+00	1.451E-03	4.201E+00	1.243E+00	5.445E+00	
1.20E+00	1.898E-03	4.201E+00	1.707E+00	5.910E+00	
1.30E+00	2.426E-03	4.201E+00	2.262E+00	6.465E+00	
1.40E+00	3.039E-03	4.201E+00	2.909E+00	7.113E+00	
1.50E+00	3.741E-03	4.201E+00	3.649E+00	7.854E+00	
1.60E+00	4.537E-03	4.201E+00	4.482E+00	8.688E+00	
1.70E+00	5.430E-03	4.201E+00	5.405E+00	9.611E+00	
1.80E+00	6.423E-03	4.201E+00	6.415E+00	1.062E+01	
1.90E+00	7.520E-03	4.201E+00	7.510E+00	1.172E+01	
2.00E+00	8.724E-03	4.201E+00	8.686E+00	1.290E+01	1.290E+01
2.10E+00	1.003E-02	4.201E+00	9.892E+00	1.410E+01	1.359E+01
2.20E+00	1.144E-02	4.201E+00	1.107E+01	1.528E+01	1.333E+01
2.30E+00	1.294E-02	4.201E+00	1.221E+01	1.642E+01	1.222E+01
2.40E+00	1.453E-02	4.201E+00	1.332E+01	1.754E+01	1.331E+01
2.50E+00	1.618E-02	4.201E+00	1.438E+01	1.860E+01	1.434E+01
2.60E+00	1.791E-02	4.201E+00	1.541E+01	1.963E+01	1.531E+01
2.70E+00	1.970E-02	4.201E+00	1.640E+01	2.062E+01	1.621E+01
2.80E+00	2.154E-02	4.201E+00	1.736E+01	2.158E+01	1.702E+01
2.90E+00	2.344E-02	4.201E+00	1.828E+01	2.250E+01	1.773E+01
3.00E+00	2.538E-02	4.201E+00	1.917E+01	2.340E+01	1.833E+01
3.10E+00	2.737E-02	4.201E+00	2.004E+01	2.427E+01	1.882E+01
3.20E+00	2.940E-02	4.201E+00	2.087E+01	2.510E+01	1.919E+01
3.30E+00	3.146E-02	4.201E+00	2.167E+01	2.590E+01	1.944E+01
3.40E+00	3.355E-02	4.201E+00	2.245E+01	2.668E+01	1.957E+01
3.50E+00	3.567E-02	4.201E+00	2.320E+01	2.744E+01	1.958E+01
3.60E+00	3.782E-02	4.201E+00	2.393E+01	2.817E+01	1.948E+01
3.70E+00	4.000E-02	4.201E+00	2.464E+01	2.888E+01	1.927E+01
3.80E+00	4.219E-02	4.201E+00	2.533E+01	2.957E+01	1.895E+01
3.90E+00	4.440E-02	4.201E+00	2.600E+01	3.025E+01	1.853E+01
4.00E+00	4.664E-02	4.201E+00	2.665E+01	3.090E+01	1.800E+01
4.10E+00	4.888E-02	4.201E+00	2.728E+01	3.153E+01	1.743E+01
4.20E+00	5.114E-02	4.201E+00	2.789E+01	3.214E+01	1.686E+01
4.30E+00	5.342E-02	4.201E+00	2.849E+01	3.274E+01	1.632E+01

	EAB DOSE (Rem TEDE)				
Time (Hrs)	ESF Leakage	MSIV Leakage	Containment Airborne	Total	Trailing 2-Hr Dose
4.40E+00	5.570E-02	4.201E+00	2.908E+01	3.334E+01	1.580E+01
4.50E+00	5.799E-02	4.201E+00	2.965E+01	3.391E+01	1.531E+01
4.60E+00	6.030E-02	4.201E+00	3.020E+01	3.446E+01	1.483E+01
4.70E+00	6.261E-02	4.201E+00	3.074E+01	3.500E+01	1.438E+01
4.80E+00	6.493E-02	4.201E+00	3.127E+01	3.554E+01	1.395E+01
4.90E+00	6.725E-02	4.201E+00	3.179E+01	3.606E+01	1.355E+01
5.00E+00	6.958E-02	4.201E+00	3.230E+01	3.657E+01	1.317E+01
5.10E+00	7.191E-02	4.201E+00	3.279E+01	3.706E+01	1.279E+01
5.20E+00	7.425E-02	4.201E+00	3.327E+01	3.755E+01	1.244E+01
5.30E+00	7.659E-02	4.201E+00	3.375E+01	3.803E+01	1.213E+01
5.40E+00	7.893E-02	4.201E+00	3.421E+01	3.849E+01	1.181E+01
5.50E+00	8.127E-02	4.201E+00	3.467E+01	3.895E+01	1.152E+01
5.60E+00	8.362E-02	4.201E+00	3.511E+01	3.939E+01	1.123E+01
5.70E+00	8.597E-02	4.201E+00	3.555E+01	3.984E+01	1.096E+01
5.80E+00	8.831E-02	4.201E+00	3.597E+01	4.026E+01	1.069E+01
5.90E+00	9.066E-02	4.201E+00	3.639E+01	4.068E+01	1.044E+01
6.00E+00	9.301E-02	4.201E+00	3.681E+01	4.110E+01	1.021E+01
8.00E+00	1.396E-01	4.201E+00	4.372E+01	4.806E+01	
8.33E+00	1.472E-01	4.201E+00	4.467E+01	4.902E+01	
1.20E+01	2.294E-01	4.201E+00	5.301E+01	5.744E+01	
1.94E+01	3.840E-01	4.201E+00	6.398E+01	6.857E+01	
2.40E+01	4.742E-01	4.201E+00	6.962E+01	7.430E+01	
7.20E+01	1.252E+00	4.201E+00	1.106E+02	1.161E+02	
9.60E+01	1.571E+00	4.201E+00	1.269E+02	1.327E+02	
7.20E+02	4.614E+00	4.201E+00	2.381E+02	2.469E+02	

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#########################################################################
               RADTRAD Version 2.20  08/19/99 14:24:23.06
#########################################################################

#########################################################################
                    File information
#########################################################################

Plant file name            = RSTLOCA.PMF
Inventory file name        = DEFAULTS\BWR_DEF.NIF
Scenario file name         = RSTLOCA.SDF
Release file name          = DEFAULTS\BWR_DBA.RFT
Dose conversion file name = DEFAULTS\FGR60.INP

#########################################################################
                    Plant Description
#########################################################################

Number of Nuclides =  60

Inventory Power =  0.1000E+01 MWth
Plant Power Level =  0.3910E+04 MWth

Number of compartments     =   7

Compartment information

Compartment number  1  (Source term compartment)
Name: Drywell
Compartment volume =  0.2700E+06 (Cubic feet)
Removal devices within compartment:
     Deposition
Pathways into and out of compartment  1
    Pathway to compartment number   4: MSIV Leakage to Secondary Containment
    Pathway to compartment number   3: Drywell-Unsprayed Flow
    Pathway to compartment number   7: MSIV Leakage to Holdup Volume
    Pathway from compartment number 3: Unsprayed-Drywell Flow

Compartment number  2
Name: Sprayed Containment
Compartment volume =  0.8400E+06 (Cubic feet)
Removal devices within compartment:
     Deposition
Pathways into and out of compartment  2
    Pathway to compartment number   3: Sprayed-Unsprayed Flow
    Pathway to compartment number   4: Sprayed Containment Leakage
    Pathway from compartment number 3: Unsprayed-Sprayed Flow

Compartment number  3
Name: Unsprayed Containment
Compartment volume =  0.5600E+06 (Cubic feet)
Removal devices within compartment:
     Deposition
Pathways into and out of compartment  3
    Pathway to compartment number   1: Unsprayed-Drywell Flow
    Pathway to compartment number   2: Unsprayed-Sprayed Flow
    Pathway to compartment number   4: Unsprayed Containment Leakage
    Pathway from compartment number 1: Drywell-Unsprayed Flow
    Pathway from compartment number 2: Sprayed-Unsprayed Flow
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Compartment number  4
Name: Secondary Containment
Compartment volume =  0.3000E+06 (Cubic feet)
Pathways into and out of compartment  4
    Pathway to compartment number   6: SGTS Flow
    Pathway from compartment number 1: MSIV Leakage to Secondary Containment
    Pathway from compartment number 2: Sprayed Containment Leakage
    Pathway from compartment number 3: Unsprayed Containment Leakage
    Pathway from compartment number 7: MSIV LCS Release from Holdup Volume

Compartment number  5
Name: Control Room
Compartment volume =  0.2530E+06 (Cubic feet)
Pathways into and out of compartment  5
    Pathway to compartment number   6: Control Room Outleakage
    Pathway from compartment number 6: Control Room Inleakage

Compartment number  6
Name: Environment
Pathways into and out of compartment  6
    Pathway to compartment number   5: Control Room Inleakage
    Pathway from compartment number 4: SGTS Flow
    Pathway from compartment number 5: Control Room Outleakage

Compartment number  7
Name: MSIV Holdup Volume
Compartment volume =  0.4337E+03 (Cubic feet)
Pathways into and out of compartment  7
    Pathway to compartment number   4: MSIV LCS Release from Holdup Volume
    Pathway from compartment number 1: MSIV Leakage to Holdup Volume

Total number of pathways =  12


########################################################################
                    Scenario Description
########################################################################

Radioactive Decay is enabled

Iodine fractions
     Aerosol     =  0.9500E+00
     Elemental   =  0.4850E-01
     Organic     =  0.1500E-02

COMPARTMENT DATA

Compartment number   1: Drywell
Natural Deposition (Powers' model):  Aerosol data
      Reactor type:   3
      Percentile =  10 (%)

     Natural Deposition:  Elemental Removal Data
      Time (hr)          DF (hr^-1)
      0.0000E+00         0.8660E+00
      0.3100E+01         0.0000E+00

Compartment number   2: Sprayed Containment

     Natural Deposition: Aerosol data
```

Time (hr)	DF (hr^-1)
0.0000E+00	0.1000E-01
0.5000E+00	0.9510E+01
0.3200E+01	0.9510E+00
0.2400E+02	0.0000E+00

Natural Deposition: Elemental Removal Data

Time (hr)	DF (hr^-1)
0.0000E+00	0.6823E+00
0.5000E+00	0.2068E+02
0.3100E+01	0.0000E+00

Compartment number 3: Unsprayed Containment

Natural Deposition: Elemental Removal Data

Time (hr)	DF (hr^-1)
0.0000E+00	0.1092E+01
0.3100E+01	0.0000E+00

Compartment number 4: Secondary Containment

Compartment number 5: Control Room

Compartment number 6: Environment

Compartment number 7: MSIV Holdup Volume

PATHWAY DATA

Pathway number 1: MSIV Leakage to Secondary Containment

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	0.0000E+00
0.3000E+00	0.2302E+01
0.9600E+02	0.1475E+01
0.7200E+03	0.0000E+00

Pathway number 2: SGTS Flow

Pathway Filter: Removal Data

Filter flow rate = 0.4001E+04 (cfm)

Time (hr)	Filter efficiency (%)		
	Aerosol	Elemental	Organic
0.0000E+00	0.9897E+02	0.9897E+02	0.9897E+02

Pathway number 3: Drywell-Unsprayed Flow

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	0.1600E+04
0.2000E+01	0.1000E+07
0.7200E+03	0.0000E+00

Pathway number 4: Unsprayed-Drywell Flow

Convection Data

Time (hr) Flow Rate (% / day)

0.0000E+00	0.0000E+00
0.2000E+01	0.1000E+07
0.7200E+03	0.0000E+00

Pathway number 5: Unsprayed-Sprayed Flow

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	0.4800E+04
0.5000E+00	0.1800E+05
0.2400E+02	0.4800E+04
0.7200E+03	0.0000E+00

Pathway number 6: Sprayed-Unsprayed Flow

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	0.3200E+04
0.5000E+00	0.1200E+05
0.2400E+02	0.3200E+04
0.7200E+03	0.0000E+00

Pathway number 7: Sprayed Containment Leakage

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	0.3850E+00
0.9600E+02	0.1925E+00
0.7200E+03	0.0000E+00

Pathway number 8: Unsprayed Containment Leakage

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	0.3850E+00
0.9600E+02	0.1925E+00
0.7200E+03	0.0000E+00

Pathway number 9: Control Room Inleakage

Pathway Filter: Removal Data

Filter flow rate = 0.2000E+04 (cfm)

Time (hr)	Filter efficiency (%)		
	Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 10: Control Room Outleakage

Pathway Filter: Removal Data

Filter flow rate = 0.2000E+04 (cfm)

Time (hr)	Filter efficiency (%)		
	Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 11: MSIV Leakage to Holdup Volume

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     Convection Data
      Time (hr)            Flow Rate (% / day)
      0.0000E+00               0.1381E+01
      0.3000E+00               0.0000E+00

Pathway number 12: MSIV LCS Release from Holdup Volume

     Convection Data
      Time (hr)            Flow Rate (% / day)
      0.0000E+00               0.0000E+00
      0.3000E+00               0.1000E+07

LOCATION DATA
     Location Exclusion Area Boundary     is in compartment   6

     Location X/Q Data
      Time (hr)           X/Q (s * m^-3)
      0.0000E+00           0.9560E-03
      0.7200E+03           0.0000E+00

     Location Breathing Rate Data
      Time (hr)           Breathing Rate (m^3 * sec^-1)
      0.0000E+00                  0.3470E-03
      0.7200E+03                  0.0000E+00
     Location Low Population Zone     is in compartment   6

     Location X/Q Data
      Time (hr)           X/Q (s * m^-3)
      0.0000E+00           0.1940E-03
      0.2000E+01           0.1060E-03
      0.8000E+01           0.7860E-04
      0.2400E+02           0.4090E-04
      0.9600E+02           0.1600E-04

     Location Breathing Rate Data
      Time (hr)           Breathing Rate (m^3 * sec^-1)
      0.0000E+00                  0.3470E-03
      0.8000E+01                  0.1750E-03
      0.2400E+02                  0.2320E-03
     Location Control Room     is in compartment   5

     Location Breathing Rate Data
      Time (hr)           Breathing Rate (m^3 * sec^-1)
      0.0000E+00                  0.3470E-03

     Location Occupancy Factor Data
      Time (hr)           Occupancy Factor
      0.0000E+00             0.1000E+01
      0.2400E+02             0.6000E+00
      0.9600E+02             0.4000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
     0.0000E+00      0.1000E+00
     0.4800E+02      0.1000E+01

#######################################################################
                              Dose Output
#######################################################################
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Exclusion Area Boundary Doses:

Time (h) = 0.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1202E-03	0.1389E-02	0.1738E-03
Accumulated dose (rem)	0.1202E-03	0.1389E-02	0.1738E-03

Low Population Zone Doses:

Time (h) = 0.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.2439E-04	0.2818E-03	0.3527E-04
Accumulated dose (rem)	0.2439E-04	0.2818E-03	0.3527E-04

Control Room Doses:

Time (h) = 0.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1854E-06	0.3673E-04	0.1604E-05
Accumulated dose (rem)	0.1854E-06	0.3673E-04	0.1604E-05

Exclusion Area Boundary Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.3615E-01	0.3965E+00	0.5145E-01
Accumulated dose (rem)	0.3627E-01	0.3979E+00	0.5162E-01

Low Population Zone Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.7337E-02	0.8047E-01	0.1044E-01
Accumulated dose (rem)	0.7361E-02	0.8075E-01	0.1047E-01

Control Room Doses:

Time (h) = 0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.6629E-04	0.1292E-01	0.5648E-03
Accumulated dose (rem)	0.6647E-04	0.1296E-01	0.5664E-03

Exclusion Area Boundary Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.5980E+01	0.3174E+02	0.7445E+01
Accumulated dose (rem)	0.6016E+01	0.3213E+02	0.7497E+01

Low Population Zone Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1214E+01	0.6440E+01	0.1511E+01
Accumulated dose (rem)	0.1221E+01	0.6521E+01	0.1521E+01

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.4980E-01	0.5330E+01	0.2892E+00
Accumulated dose (rem)	0.4987E-01	0.5343E+01	0.2898E+00

Exclusion Area Boundary Doses:

Time (h) = 3.1000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.8805E+01	0.3858E+02	0.1066E+02
Accumulated dose (rem)	0.1482E+02	0.7072E+02	0.1816E+02

Low Population Zone Doses:

Time (h) = 3.1000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.9763E+00	0.4278E+01	0.1182E+01
Accumulated dose (rem)	0.2197E+01	0.1080E+02	0.2704E+01

Control Room Doses:

Time (h) = 3.1000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1214E+00	0.1255E+02	0.7117E+00
Accumulated dose (rem)	0.1712E+00	0.1789E+02	0.1001E+01

Exclusion Area Boundary Doses:

Time (h) = 3.2000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.7265E+00	0.2423E+01	0.8437E+00
Accumulated dose (rem)	0.1555E+02	0.7314E+02	0.1900E+02

Low Population Zone Doses:

Time (h) = 3.2000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.8055E-01	0.2686E+00	0.9355E-01
Accumulated dose (rem)	0.2278E+01	0.1107E+02	0.2797E+01

Control Room Doses:

Time (h) = 3.2000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1195E-01	0.1208E+01	0.6932E-01
Accumulated dose (rem)	0.1832E+00	0.1910E+02	0.1071E+01

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.2222E+02	0.3197E+02	0.2377E+02
Accumulated dose (rem)	0.3776E+02	0.1051E+03	0.4277E+02

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.2463E+01	0.3545E+01	0.2635E+01
Accumulated dose (rem)	0.4741E+01	0.1461E+02	0.5433E+01

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.4793E+00	0.3350E+02	0.2090E+01
Accumulated dose (rem)	0.6624E+00	0.5260E+02	0.3161E+01

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1853E+02	0.2829E+01	0.1865E+02
Accumulated dose (rem)	0.5630E+02	0.1079E+03	0.6142E+02

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.1524E+01	0.1173E+00	0.1529E+01
Accumulated dose (rem)	0.6265E+01	0.1473E+02	0.6961E+01

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Control Room Doses:

Time (h) =  24.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.2209E+00  0.5830E+01  0.5040E+00
Accumulated dose (rem)  0.8834E+00  0.5843E+02  0.3665E+01

Exclusion Area Boundary Doses:

Time (h) =  96.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.2516E+02  0.4755E+01  0.2531E+02
Accumulated dose (rem)  0.8146E+02  0.1127E+03  0.8673E+02

Low Population Zone Doses:

Time (h) =  96.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.1076E+01  0.1360E+00  0.1081E+01
Accumulated dose (rem)  0.7341E+01  0.1487E+02  0.8042E+01

Control Room Doses:

Time (h) =  96.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.1001E+00  0.3238E+00  0.1101E+00
Accumulated dose (rem)  0.9835E+00  0.5875E+02  0.3775E+01

Exclusion Area Boundary Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.2649E+02  0.7476E+01  0.2672E+02
Accumulated dose (rem)  0.1080E+03  0.1202E+03  0.1134E+03

Low Population Zone Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.4434E+00  0.8366E-01  0.4460E+00
Accumulated dose (rem)  0.7785E+01  0.1495E+02  0.8488E+01

Control Room Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.6652E-01  0.2785E+00  0.7500E-01
Accumulated dose (rem)  0.1050E+01  0.5903E+02  0.3850E+01

######################################################################
                       Cumulative Dose Summary
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	Exclusion Area Bounda		Low Population Zone		Control Room	
Time (hr)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.30	0.1389E-02	0.1738E-03	0.2818E-03	0.3527E-04	0.3673E-04	0.1604E-05
0.50	0.3979E+00	0.5162E-01	0.8075E-01	0.1047E-01	0.1296E-01	0.5664E-03
2.00	0.3213E+02	0.7497E+01	0.6521E+01	0.1521E+01	0.5343E+01	0.2898E+00
3.10	0.7072E+02	0.1816E+02	0.1080E+02	0.2704E+01	0.1789E+02	0.1001E+01
3.20	0.7314E+02	0.1900E+02	0.1107E+02	0.2797E+01	0.1910E+02	0.1071E+01
8.00	0.1051E+03	0.4277E+02	0.1461E+02	0.5433E+01	0.5260E+02	0.3161E+01
24.00	0.1079E+03	0.6142E+02	0.1473E+02	0.6961E+01	0.5843E+02	0.3665E+01
96.00	0.1127E+03	0.8673E+02	0.1487E+02	0.8042E+01	0.5875E+02	0.3775E+01
720.00	0.1202E+03	0.1134E+03	0.1495E+02	0.8488E+01	0.5903E+02	0.3850E+01

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I-131 Summary

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Time (hr)	Drywell I-131 (Curies)	Sprayed Containment I-131 (Curies)	Unsprayed Containment I-131 (Curies)
0.30	0.2355E+07	0.4439E+05	0.2244E+06
0.50	0.3429E+07	0.1597E+06	0.4942E+06
2.00	0.1403E+08	0.8966E+06	0.1776E+07
3.10	0.5185E+06	0.3289E+06	0.5161E+06
3.20	0.4123E+06	0.2654E+06	0.4103E+06
8.00	0.4072E+05	0.5812E+05	0.4071E+05
24.00	0.1410E+05	0.2115E+05	0.1410E+05
96.00	0.1058E+05	0.1587E+05	0.1058E+05
720.00	0.9722E+03	0.1458E+04	0.9722E+03

Time (hr)	Secondary Containment I-131 (Curies)	Control Room I-131 (Curies)	Environment I-131 (Curies)
0.30	0.4261E+01	0.1911E-05	0.2165E-02
0.50	0.7362E+03	0.5522E-03	0.4949E+00
2.00	0.9840E+04	0.3600E-01	0.7861E+01
3.10	0.5939E+04	0.4511E-01	0.5069E+01
3.20	0.5535E+04	0.4494E-01	0.4728E+01
8.00	0.2357E+03	0.1036E-01	0.2004E+00
24.00	0.2401E+02	0.5706E-04	0.1979E-01
96.00	0.1799E+02	0.3087E-04	0.1475E+00
720.00	0.9906E+00	0.1406E-05	0.8013E-02

Time (hr)	MSIV Holdup Volume I-131 (Curies)
0.30	0.2331E+03
0.50	0.1221E-21
2.00	0.7623-210
3.10	0.0000E+00
3.20	0.0000E+00
8.00	0.0000E+00
24.00	0.0000E+00
96.00	0.0000E+00
720.00	0.0000E+00