ATTACHMENT 2 to ENCLOSURE
(SUPERCEDES ATTACHMENT 9 to LAR)

MSLB Analysis titled, "GEN-PI-078, Main Steam Line Break (MSLB) Accident Analysis Using AST," Revision 1

277 Pages Follow

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Calculation Signature Sheet

Document Information

NSPM Calculation (Doc) No: GEN-PI-078	Revision: 1
Title: Main Steam Line Break (MSLB) Accident Analysis Using AST	
Facility: ☐ MT ☒ PI	Unit: ☒ 1 ☒ 2
Safety Class: ☒ SR ☐ Aug Q ☐ Non SR	
Special Codes: ☐ Safeguards ☐ Proprietary	
Type: **Calc** Sub-Type:	

NOTE:	Print **and** sign name in signature blocks, as required.

Major Revisions

EC Number: 13720	☐ Vendor Calc
Vendor Name or Code:	Vendor Doc No:
Description of Revision: The TDAFW pump exhaust steam release path is re-evaluated as an Unit 2 Group 1 PORV release path	
Prepared by: Gopal J. Patel	Date: 07/12/2010
Reviewed by: Thomas J. Mscisz	Date: 07/19/2010
Type of Review: ☒ Design Verification ☐ Tech Review ☐ Vendor Acceptance	
Method Used (For DV Only): ☒ Review ☐ Alternate Calc ☐ Test	
Approved by:	Date: 7/23/10

Minor Revisions

EC No:	☐ Vendor Calc:
Minor Rev. No:	
Description of Change:	
Pages Affected:	
Prepared by:	Date:
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Type of Review: ☐ Design Verification ☐ Tech Review ☐ Vendor Acceptance	
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Approved by:	Date:

(continued on next page)

Record Retention: Retain this form with the associated calculation for the life of the plant.

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Description of Change:	
Pages Affected:	
Prepared by:	Date:
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NOTE:	This reference table is used for data entry into the PassPort Controlled Documents Module, reference tables (C012 Panel). It may also be used as the reference section of the calculation. The input documents, output documents and other references should all be listed here. Add additional lines as needed.

Reference Documents (PassPort C012 Panel from C020)

#	Controlled* Doc? + Type	Document Name	Document Number	Doc Rev	Ref Type** (if known)
1		Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, July 2000	1.183	July 2000	☒Input ☐Output
2		A Simplified Model for Radionuclide Transport and Removal and Dose Estimation	NUREG/CR-6604	Dec 1997	☒Input ☐Output
3	☒ TRNS	MSLB Input Parameters	DIT No. 13720-08	0	☒Input ☐Output
4	☒ TRNS	Control Room Input Parameters	DIT No. 13720-07	0	☒Input ☐Output
5	☒ TRNS	Meteorological Input Parameters	DIT No. 13720-03	0	☒Input ☐Output
6	☒ CALC	Prairie Island Atmospheric Dispersion Factors (χ/Q) – AST Additional Releases	GEN-PI-080	1	☒Input ☐Output
7	☒ CALC	PI Control Room Atmospheric Dispersion Factors	GEN-PI-049	Add 2	☒Input ☐Output
8	☒ Tech Spec	PINGP Units 1 & 2, Definition of Rated Thermal Power	1.1	U1/U2 Amendment 158/149	☒Input ☐Output
10	☒ Tech Spec	PINGP Units 1 & 2, Definition of Dose Equivalent I-131	1.1	U1/U2 Amendment 158/149	☒Input ☐Output
11	☒ Tech Spec	PINGP Units 1 & 2, Definition of E-bar Average Disintegration Energy	1.1	U1/U2 Amendment 177/167	☒Input ☐Output
12	☒ Tech Spec	PINGP Units 1 & 2 LCO for Secondary Specific Activity	3.7.14	U1/U2 Amendment 158/149	☒Input ☐Output

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13	☒ Tech Spec	PINGP Units 1 & 2 LCO for RCS Specific Activity	3.4.17	U1/U2 Amendment 191/180	☒Input ☐Output
14	☒ Tech Spec	PINGP Units 1 & 2 LCO for Reactor Coolant Dose Equivalent I-131 Specific Activity Limit Versus Percentage Rated Thermal Power	Figure 3.4.17-1	U1/U2 Amendment 191/180	☒Input ☐Output
15	☒ Tech Spec	PINGP Units 1 & 2 LCO for RCS Operational Leakage	3.4.14	U1/U2 Amendment 158/149	☒Input ☐Output
16	☒ Tech Spec	PINGP Units 1 & 2 Specification for Ventilation Filter Testing Program (VFTP)	5.5.9	U1/U2 Amendment 186/176	☒Input ☐Output
17	☒ Tech Spec	PINGP Units 1 & 2 Bases for RCS Operational Leakage	B3.4.14	U1/U2 Amendment 158/149	☒Input ☐Output
18	☒ Tech Spec	PINGP Units 1 & 2 Bases for Control Room Special Ventilation System (CRSVS) Actuation Instrumentation	B3.3.6	U1/U2 Amendment 158/149	☒Input ☐Output
19	☒ Tech Spec	PINGP Units 1 & 2 LCO for Control Room Special Ventilation System (CRSVS) Actuation Instrumentation	3.3.6	U1/U2 Amendment 158/149	☒Input ☐Output
20	☒ Tech Spec	PINGP Units 1 & 2 LCO for Control Room Special Ventilation System (CRSVS)	3.7.10	U1/U2 Amendment 158/149	☒Input ☐Output
21		Federal Guidance Report 11	EPA-520/1-88-020		☒Input ☐Output
22		Federal Guidance Report 12	EPA-402-R-93-081		☒Input ☐Output
23	☒ LTR	Westinghouse Letter - Nuclear Management Company Prairie Island Units 1 & 2, MUR Power Uprate Program, Core Activity Inventory and Coolant Activity Concentrations	NSP-07-59 LTR-PEP-07-26	11/02/2007	☒Input ☐Output
24		Laboratory Testing of Nuclear-Grade Activated Charcoal	GL 99-02	6/3/99	☒Input ☐Output

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25		ASME Steam Tables		Sixth Edition	☒Input ☐Output
26		Accident Source Term	10 CFR 50.67		☒Input ☐Output
27	☒ DRAW	Admin Bldg, Screen House, & Control RM Flow Diagram	NF-39603-1	76	☒Input ☐Output
28	☒ SER	Prairie Island Nuclear Generating Plant, Units 1 And 2 - Issuance Of Amendments Re: Revision To Loss-Of-Coolant (LOCA) Accident And Main Steam Line Break (MSLB) Accident Radiological Dose Consequences Analyses And Affected Technical Specifications (TAC Nos. MD9140 And MD9141)	MD9140 & MD9141	06/19/2009	☒Input ☐Output
29	☒ PROC	Natural Circulation Cooldown With CRDM Fans	1ES-0.3A	14	☒Input ☐Output
30	☒ PROC	Natural Circulation Cooldown Without CRDM Fans	1ES-0.3B	11	☒Input ☐Output
31	☒ DRAW	Architectural Plant Roof Plan	NF-38513	T	☒Input ☐Output
32		NUREG-0800, Standard Review Plan, "Radiological Consequence Analyses Using Alternative Source Terms"	15.0.1	0	☒Input ☐Output
33	☒ CALC	Post-LOCA EAB, LPZ, and CR Doses - AST	GEN-PI-079	0	☒Input ☐Output
34	☒ CALC	Dose Consequences At The Site Boundary & Control Room Following a MSLB	12400604-UR(B)-005	0	☐Input ☒Output
35	☒ USAR	Dose Analysis for MSLB Outside Containment	14.5.5.6	29P	☐Input ☒Output
36	☒ USAR	Steam Generators	Section 4.3.2.1.1	29	☒Input ☐Output
37	☒ STD	Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec	TSTF-490	0	☒Input ☐Output
38	☒ LA	PINGP Amendment Nos. 166 and 156 to Operating License Nos. DPR-42 and DPR-60, respectively, Selective Implementation Of Alternate Source Term For Fuel Handling Accidents	LA # 166 & 156		☒Input ☐Output
39	☒ USAR	Letdown Orifices	Section 10.2.3.2.4.b	29	☒Input ☐Output
40	☒ USAR	Chemical and Volume control System Performance Requirements	Table 10.2-7	27	☒Input ☐Output
41	☒ PROC	PINGP Emergency Plan Implementing Procedure, Determination of Radioactive Release Concentrations	F3-20	22	☒Input ☐Output

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42	☒ TRNS	Steam Release Pathway Inputs for Main Steam Line Break (MSLB), Steam Generator Tube Rupture (SGTR), Locked Rotor Accident (LRA) and Control Rod Ejection Accident (CREA)	DIT No. 13720-16	0	☒Input ☐Output
43	☒ PROC	PINGP Operating Procedure, Unit 1 Shutdown Unit 2 Shutdown	1C1.3 2C1.3	68 67	☒Input ☐Output
44	☒ CALC	Shaw Stone & Webster Calculation - ARCON96 Atmospheric Dispersion Factors (χ/Qs) for Post-LOCA Gaseous Radiological Releases from Units 1 and 2	12400604-WM(B)-001	0	☒Input ☐Output

*Controlled Doc checkmark means the reference can be entered on the C012 panel in black. Unchecked lines will be yellow. If checked, also list the Doc Type, e.g., CALC, DRAW, VTM, PROC, etc.)
**Corresponds to these PassPort "Ref Type" codes: Inputs/Both = ICALC, Outputs = OCALC, Other/Unknown = blank)

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Calculation Signature Sheet

Other Pass Port Data

Associated System (PassPort C011, first three columns) **OR** **Equipment References** (PassPort C025, all five columns):

Facility	Unit	System	Equipment Type	Equipment Number
PI	1	MS	GEN	134-011
PI	1	MS	GEN	134-012
PI	1	MS	GEN	234-011
PI	1	MS	GEN	234-012
PI	1	MS	CV	CV-31084
PI	1	MS	CV	CV-31085
PI	1	MS	CV	CV-31086
PI	1	MS	CV	CV-31089
PI	1	MS	CV	CV-31090
PI	1	MS	CV	CV-31091
PI	2	MS	CV	CV-31102
PI	2	MS	CV	CV-31103
PI	2	MS	CV	CV-31104
PI	2	MS	CV	CV-31107
PI	2	MS	CV	CV-31108
PI	2	MS	CV	CV-31109
PI	1	MS	RFV	RS-21-1
PI	1	MS	RFV	RS-21-2
PI	1	MS	RFV	RS-21-3
PI	1	MS	RFV	RS-21-4
PI	1	MS	RFV	RS-21-5
PI	1	MS	RFV	RS-21-6
PI	1	MS	RFV	RS-21-7
PI	1	MS	RFV	RS-21-8
PI	1	MS	RFV	RS-21-9
PI	1	MS	RFV	RS-21-10
PI	2	MS	RFV	RS-21-11
PI	2	MS	RFV	RS-21-12
PI	2	MS	RFV	RS-21-13

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PI	2	MS	RFV	RS-21-14
PI	2	MS	RFV	RS-21-15
PI	2	MS	RFV	RS-21-16
PI	2	MS	RFV	RS-21-17
PI	2	MS	RFV	RS-21-18
PI	2	MS	RFV	RS-21-19
PI	2	MS	RFV	RS-21-20
PI	0	ZN	SYS	SYS 0ZN

Superseded Calculations (PassPort C019):

Facility	Calc Document Number	Title
PI	12400604-UR(B)-005	Dose Consequences at Site Boundary & Control Room Following a MSLB Accident

Description Codes - Optional (PassPort C018):

Code	Description (optional)	Code	Description (optional)

Notes (Nts) - Optional (PassPort X293 from C020):

Topic Notes	Text
☐ Calc Introduction	☒ Copy directly from the calculation Intro Paragraph **or** ☐ See write-up below

The purpose of this calculation is to determine the Exclusion Area Boundary (EAB), Low Population Zone (LPZ), and Control Room (CR) doses due to a Main Steam Line Break (MSLB) accident using the Alternative Source Term (AST) methodology, the total effective dose equivalent (TEDE) dose criteria, and the plant-specific bounding design information applicable to the PINGP Units 1 & 2 steam generators. The dose consequences are analyzed using the maximum allowed accident induced primary-to-secondary (P-T-S) leak rate. The dose consequences are representative of a MSLB occurring in either Unit 1 or Unit 2. The following post-MSLB cases are analyzed:
Pre-accident Iodine Spike
Concurrent Accident Iodine Spike

☐ (Specify)	

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Design Review Comment Form

Sheet ___ of ___

DOCUMENT NUMBER/ TITLE:	GEN-PI-078/ Main Steam Line Break (MSLB) Accident Analysis Using AST

REVISION: 0 DATE: _____

ITEM #	REVIEWER'S COMMENTS	PREPARER'S RESOLUTION	REVIEWER'S DISPOSITION
1	Design Input Parameter 5.3.1. There are two power levels listed. Do these include the 2% uncertainty? Either way, it should be indicated.	Incorporated.	Accepted
2	Design Input Parameter 5.3.3. The units for DEI are listed as uCi/gm and uCi/g. They should be consistent throughout the calc.	Incorporated.	Accepted
3	Design Input Parameter 5.3.4. Should the RTP be 102%?	Incorporated.	Accepted
4	Design Input Parameter 5.3.14. Two SG liquid masses are given. Which one was used in the calc for conservatism? This should be indicated here.	Please see Section 7.1.	Accepted
5	Design Input Parameter 5.3.15. Two SG pressures are given. Which one was used in the calc for conservatism? This should be indicated here.	Please see Section 7.3.2.	Accepted
6	Design Input Parameter 5.5.4. Was there a sensitivity study performed that shows that the -10% value is conservative? Should indicate why this value was chosen.	It is a statement of fact that the lower recirculation flow is conservative for the CR dose like the lower (10% less) make up flow instead of higher (10% more) flow for the pressurized CR envelope.	Accepted
7	Design Input Parameter 5.5.7. The CR unfiltered inleakage value used in the MSLB calc is different that that for the LOCA. Although the 300 cfm is conservative, a statement needs to be included why it was used instead of the LOCA value.	It is a true statement. Please see clarification added in Section 5.5.7. A clarification statement will be added in the License Amendment Request.	Accepted
8	Section 8.2 revises the definition for DOSE EQUIVALENT I-131 to refer to FGR-11 thyroid inhalation dose conversion factors. It should be "effective", not thyroid.	The use of the thyroid inhaled DCFs produce conservatively higher iodine concentrations, therefore, used in the analysis. The effective inhaled DCFs will be used in the proposed changes for the definitions of I-131 DE and Xe-133 DE. Please see explanation added in Sections 2.1 & 4.1.1.	

Xcel Energy	Design Review Comment Form	
		Sheet ___ of ___
DOCUMENT NUMBER/ TITLE:	GEN-PI-078/ Main Steam Line Break (MSLB) Accident Analysis Using AST	
	REVISION: 0	DATE: _____

9	Attachment 13.5 (RADTRAD run PMSINPLI00.o0), Attachment 13.6 (RADTRAD run PMSINPNG00.o0), Attachment 13.9 (RADTRAD run PMSINCI00.o0), and Attachment 13.10 (RADTRAD run PMSINCNG00.o0): The CR X/Qs do not match up with any in the design input table. Please provide a reference and include in the design input table.	The X/Qs for these RADTRAD runs are from Table 13.	Accepted
END			

Reviewer: Thomas Mscisz Date: 06/15/2009	Preparer: Gopal J. Patel Date: 06/15/2009

REVISION HISTORY

Revision	Description
0	Initial issue
1	The TDAFW pump exhaust steam release path is re-evaluated as an Unit 2 Group 1 PORV release path

SHEET REVISION INDEX

SHEET	REV	SHEET	REV	SHEET	REV
1	1	27	1	53	1
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3	1	29	1	55	1
4	1	30	1	56	1
5	1	31	1	57	1
6	1	32	1	58	1
7	1	33	1	59	1
8	1	34	1	60	1
9	1	35	1	61	1
10	1	36	1	Attachment 13.1	1
11	1	37	1	Attachment 13.2	1
12	1	38	1	Attachment 13.3	1
13	1	39	1	Attachment 13.4	1
14	1	40	1	Attachment 13.5	1
15	1	41	1	Attachment 13.6	1
16	1	42	1	Attachment 13.7	1
17	1	43	1	Attachment 13.8	1
18	1	44	1	Attachment 13.9	1
19	1	45	1	Attachment 13.10	1
20	1	46	1		
21	1	47	1		
22	1	48	1		
23	1	49	1		
24	1	50	1		
25	1	51	1		
26	1	52	1		

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1.0 PURPOSE AND SUMMARY REPORT:

Purpose

The purpose of this calculation is to determine the Exclusion Area Boundary (EAB), Low Population Zone (LPZ), and Control Room (CR) doses due to a Main Steam Line Break (MSLB) accident using the Alternative Source Term (AST) methodology, the total effective dose equivalent (TEDE) dose criteria, and the plant-specific bounding design information applicable to the PINGP Units 1 & 2 steam generators. The dose consequences are analyzed using the maximum allowed accident induced primary-to-secondary (P-T-S) leak rate. The dose consequences are representative of a MSLB occurring in either Unit 1 or Unit 2. The following post-MSLB cases are analyzed:

1. Pre-accident Iodine Spike
2. Concurrent Accident Iodine Spike

Summary Report:

The resulting post-MSLB doses are shown in Section 8.0. These doses comply with the applicable regulatory allowable dose limits.

2. METHODOLOGY:

The design basis main steam line break accident is analyzed using a conservative set of assumptions and as-built design inputs. The numeric values of the critical design inputs are conservatively selected to assure an appropriate prudent safety margin against unpredicted events in the course of an accident and compensate for large uncertainties in facility parameters, accident progression, radioactive material transport, and atmospheric dispersion. The MSLB analysis is performed using the guidance in Regulatory Guide 1.183 and its Appendix E (Ref. 9.1).

For Prairie Island, no fuel damage is predicted to occur for the MSLB (Ref. 9.3.1, Item # 3). Per RG 1.183 (Ref. 9.1, Appendix E, Section 2.0), if no or minimal fuel damage is postulated for the MSLB event, then the activity released should be the maximum coolant activity allowed by the technical specifications, and two cases of iodine spiking corresponding to pre-accident iodine spike and concurrent iodine spike should be assumed.

2.1 Pre-accident Iodine Spike Release

In the pre-accident iodine spike release scenario, a reactor transient has occurred prior to the postulated MSLB accident and has raised the primary coolant (PC) (also referred to as reactor coolant system [RCS]) iodine concentration to the maximum value permitted by technical specifications. The new reduced PC iodine concentration limit of 30 μCi/gm Dose Equivalent (DE) I-131 for plant operations from 80 to 100% of rated thermal power (RTP) is obtained from References 9.14, Figure 3.4.17-1 and 9.6.6. These proposed limits are used in this analysis for DE I-131.

The plant-specific PC iodine concentration profile corresponding to 1% fuel defects is obtained from Reference 9.9 (Tables 2-2 & 6-1), and listed in Table 2. Technical Specification Section 1.10 (Ref. 9.6.2) defines DE I-131 as that concentration of I-131 (in μCi/gm) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present using the thyroid dose conversion factors (DCFs) specified in Table III of TID-14844; the TS Section 1.10 definition of DE I-131 will be revised to be based on the effective DCFs specified in Federal Guidance Report 11 (Ref. 9.7). Therefore, this analysis calculates DE I-131 in Table 1 in terms of the thyroid DCFs instead of the effective DCFs specified in FGR 11, which produce relatively a higher iodine concentration. The iodine dose conversion factors are developed in Table 1 using the information

in Reference 9.7, and then used in Table 2 to establish the iodine scaling factor which is used in Table 3 to convert the iodine concentration of 1% fuel defects to 0.50 μCi/gm DE I-131 in Table 3 (Refs. 9.6.5 & 9.14, LCO 3.4.17). The total PC isotopic iodine activity is conservatively calculated in Table 4 using the PC mass determined at "cooled" liquid conditions (Section 7.1). The PC noble gas concentrations corresponding to a new proposed indicator, Dose Equivalent Xenon-133, instead of the current indicator known as E Bar is discussed in Section 2.4 and established in Tables 5 & 5A. The total iodine plus noble gas isotopic activities released to the PC are calculated in Table 6, which are then used to develop the RADTRAD Nuclide Inventory File (NIF) "PIMSPRE_def.txt" for the pre-accident iodine spike case. The post-MSLB pre-accident iodine spike activity transport and CR response models are shown in Figures 1 & 3, which are used to determine the post-MSLB radiological consequences using the PINGP plant-specific as-built design inputs and assumptions listed in Sections 4 & 5. The EAB, LPZ, and CR doses are summarized in Section 8.1.1 for the pre-accident iodine spike case.

The activity transport paths from the faulted and intact SGs are described in the following sections. These activity transport paths are applicable to both the pre-accident and concurrent iodine spike cases.

Faulted SG Releases

Following a MSLB the faulted SG is assumed to steam dry. PC is assumed to leak into the faulted SG at the technical specification maximum leak rate of 1.0 gpm (Refs. 9.6.9 & 9.3.1, Item # 21). To maximize the offsite doses it is assumed that offsite power is lost so that the main steam condensers are not available. PC noble gas activity entering the faulted SG via Primary-to-Secondary (P-T-S) leakage is assumed to be released directly to the environment for 0-75 hrs through the sheet metal sidings of common area of auxiliary building as discussed in Section 2.1.1 using the applicable χ/Q values (Design Input 5.5.12) without reduction or mitigation. Since the faulted SG is assumed to be dried-out in 600 seconds (10 minutes) (Ref. 9.3.1, Item # 22), the PC iodine activity entering the faulted SG via P-T-S leakage is also assumed to be released directly to the environment (Figures 1 & 2). During the faulted SG dryout period, the SG liquid mass is instantaneously evaporated to steam and released to the common area of the Auxiliary Building (CAAB) and from there to the atmosphere at the surface closest to the intake for the Control Room Special Ventilation System (CRSVS). Following the dryout, the P-T-S leakage continues in the faulted SG, which is instantly and homogeneously distributed in the entire volume of the empty faulted SG (single well mixed volume) and released to the atmosphere via the CAAB. The P-T-S leakage iodine & noble gas and SG liquid iodine release during and following the faulted SG dryout are shown in Figures 1 & 2 and listed in Table 13. The release from the faulted SG is postulated as a ground level release to the environment.

Intact SG Releases

To maximize the calculated doses it is assumed that offsite power is lost so that the main steam condensers are not available. Consequently, following the MSLB transient the plant must cool down by releasing secondary coolant via the power operated relief valve (PORV) (Refs. 9.15.1, Step 8 and 9.15.2, Step 7). The steam release from the intact SG continues for 45.5 hours until the Residual Heat Removal (RHR) system is aligned to dissipate heat (Ref. 9.3.1, Item # 27). During the 45.5 hours before the RHR system is initialized, the PC is assumed to leak into the intact SG at 150 gpd (measured at 70°F) (Ref. 9.6.7). The PC noble gas activity entering the intact SG via P-T-S leakage is assumed to be released directly to the environment without reduction or mitigation. The PC iodine activity entering the intact SG via P-T-S leakage is assumed to be diluted within the intact SG liquid mass. An iodine partition coefficient of 10 (i.e., P-T-S leakage iodine retention in the intact SG) is conservatively assumed in lieu of the value of 100 recommended in Regulatory Guide 1.183 (Ref. 9.1, Appendix E, Section 5.5.4) to maximize the resulting dose. The P-T-S leakage noble gas & iodine activities and SG liquid iodine activity are assumed to be released to the environment at the SG steaming rates.

The P-T-S leakage iodine & noble gas and SG liquid iodine release from the intact SG are shown in Figures 1 & 2 and listed in Section 5.5.13. Due to uncertainty associated with the progression of the accident and to provide operational flexibility during the event, it is assumed that the tubes in the intact SG are uncovered during the first two hours of the event and that all iodine activity in the P-T-S leakage in this 2 hour time interval are flashed into vapor without scrubbing through the SG liquid.

The activity during the MSLB accident releases to the atmosphere via the following two distinct plant-specific release paths. These release paths are applicable to both the pre-accident and concurrent iodine spike cases:

1. Faulted SG Release via Common Area of Auxiliary Building
2. Intact SG Release via Unit 2 Group 1 PORV Release

In Revision 0 of this calculation, the post-MSLB long-term release was postulated to be through the turbine driven auxiliary feed water pump (TDAFWP) exhaust. In actuality, the steam is released through the TDAFW pump exhaust momentarily when offsite power is lost, until such time that the diesel generator completes its load sharing sequence and onsite power is available to safety related equipment, including the motor driven AFW pump (MDAFWP). Plant operating procedures provide guidance such that the operators would preferentially use the MDAFWP in lieu of the TDAFWP. Per shutdown procedure C1.3 (Ref. 9.26), only one AFW pump is running when one pump is able to maintain SG levels (Step 5.4.13). The MDAFW Pump is preferable to the TDAFW Pump (implied from Steps 5.4.5 and 5.4.6). In addition, speed of the TDAFWP is affected by the steam pressure in the SG. At lower steam pressures in the SG, the TDAFWP would slow down and provide inadequate FW inventory to cover the SG tube. Furthermore, the activity levels released from the TDAFWP steam exhaust are not accurately estimated during an event – see procedure F3-20, Step 5.1 (Ref. 9.25). In order to provide adequate SG tube coverage and more accurate estimates of releases, the MDAFW is obviously used.

There will be a steam release through the TDAFWP exhaust momentarily (less than a few minutes) until the onsite power is available through the diesel generator. The steam mass from the intact SG is conservatively postulated to release from the Unit 2 Group 1 PORV, which has less atmospheric dispersion (i.e., higher χ/Qs) than a release from the TDAFWP exhaust (Ref. 9.5, Table 8-5). Thus, use of the Unit 2 Group 1 PORV χ/Qs conservatively bounds the momentary steam release from the TDAFWP exhaust.

2.1.1 Faulted SG Release Via Common Area of Auxiliary Building

The SG associated with the MSLB is also known as a "faulted SG." The MSLB is postulated to occur upstream of the Main Steam Isolation Valve (MSIV) resulting in an un-isolable release from the faulted SG. The blowdown from the faulted SG is into the Auxiliary Building (AB). Following blowdown of the faulted SG, primary to secondary (P-T-S) leakage (total) of 1 gpm (at 70°F) is postulated to continue until the RCS is cooled to less than 212°F. This release is through the ruptured pipe into the Auxiliary Building. To preclude over-pressurization in the Auxiliary Building during a high energy line break (HELB) several doors with engineered ceramic pins are provided to open at a relatively low differential pressure. The differential pressure acting on the door will break the ceramic pin and the door will open to relieve the pressure. The open doors provide a flow path to the common area of the Auxiliary Building for both the initial release of the secondary side mass from the faulted SG and for the primary to secondary leakage. This release path is conservative for the following reasons:

- No credit is taken for mixing and dilution within the volume in the Auxiliary Building. The volume of the Auxiliary Building above the 715' floor elevation is greater than 700,000 ft^3 (Ref. 9.3.1, Item #30).

- No credit is taken for surface deposition in the Auxiliary Building. The available surface areas in the Auxiliary Building above the 715' floor elevation is greater than 300,000 ft^2 (Ref. 9.3.1, Item #31).
- No credit is taken for mixing and dilution in the common area of the Auxiliary Building. This is also a large volume area.

The P-T-S leakage iodine & noble gas and SG liquid iodine release from the faulted SG are shown in Table 12.

2.1.2 Intact SG Release Via Unit 2 Group 1 PORV Release

Following the event the intact SG is used to cooldown the RCS. The mass of the steam released and the release location during the cooldown are important considerations due to the 150 gpd leakage assumed for the intact SG (maximum allowed by Technical Specification 3.4.14) (Ref. 9.6.7). Assuming a loss of off-site power the unit would be cooled down using procedure ES-0.3A or ES-0.3B (Ref. 9.15) for cooling down using natural circulation. Per either procedure, the preferred means to release steam for the cooldown is by dumping steam to the condenser. If this path is not available, then the SG PORV is used (Refs. 9.15.1, Step 8 and 9.15.2, Step 7).

The locations of the Units 1 and 2 PORVs with respect to the locations of the Units 1 & 2 CR air intakes are such that the Unit 2 PORVs are located closer to the Unit 2 CR air intake, and thereby provide less atmospheric dispersion, than any other combination of PORV release points and CR air intakes (Ref. 9.27, Section 6). The location of the Unit 2 Group 1 PORV is located closer to the Unit 2 CR air intake, and provides less atmospheric dispersion, than the Unit 2 Group 2 PORV (Ref. 9.4, Sections 2.4 & 2.5). Therefore, the post-MSLB activity is postulated to release from the intact SG via Unit 2 Group 1 PORV to maximize the CR dose (Ref. 9.4, Table 8-5). The P-T-S leakage iodine & noble gas and SG liquid iodine release from the intact SG are shown in Table 13.

The post-MSLB activity transport and CR response models are shown in Figures 1 through 3, which are used to determine the post-MSLB radiological consequences using the plant-specific as-built design inputs and assumptions listed in Sections 4 & 5.

2.2 Concurrent Accident Iodine Spike Release

The primary system transient associated with the MSLB causes an iodine spike in the primary system. The increase in primary coolant iodine concentration is estimated using a spiking model that assumes that the iodine release rate from the fuel rods to the primary coolant (expressed in curies per unit time) increases to a value 500 times greater than the release rate corresponding to the iodine concentration at the equilibrium value of 0.50 μCi/gm DE I-131 specified in technical specifications LCO 3.4.17 (Ref. 9.6.5) approved in the PINGP Safety Evaluation Report (SER) (Ref. 9.14). A concurrent iodine spike need not be considered if fuel damage is postulated. The assumed iodine spike duration should be 8 hours (Ref. 9.1, Appendix E, Section 2.2).

The isotopic iodine appearance rates are calculated in Section 7.2 and Table 8 using the specific activity production and removal rates based on the most conservative letdown flow rate of 100 gpm @ 100^0F (Ref. 9.3.1, Item # 18). The total isotopic iodine activity is calculated in Table 9 using the spike duration of 8 hours. The total isotopic iodine and noble gas activities are listed in Table 10 and used to develop the RADTRAD NIF "PIMSCONC_def.txt" for the concurrent iodine spike case. The RADTRAD model postulates that the 99% of all fuel activity is released into the RCS within 8 hours at a calculated rate of 9.60 cfm (Section 7.4). The post-MSLB steam release paths for the concurrent iodine spike are the same as those described in Sections 2.1.1 through 2.1.3. The post-MSLB concurrent iodine spike activity transport and CR response models are shown in Figures 2 & 3, which are used to determine the post-MSLB radiological consequences using the PINGP plant-specific as-built design inputs and assumptions

listed in Sections 4 & 5. The EAB, LPZ, and CR doses are summarized in Section 8.1.2 for the concurrent iodine case.

2.3 RCS Noble Gas Inventory

Per Technical Specification LCO 3.4.17 (Refs. 9.6.5 & 9.14, LCO 3.4.17), the maximum permitted equilibrium RCS non-iodine concentration is 100/E-BAR. The parameter E-BAR is defined in Technical Specification Section 1.1 (Ref. 9.6.3) as the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives greater than 15 minutes, making up at least 95% of the total non-iodine activity in the coolant.

The PINGP licensing proposes the deletion of the E-BAR definition and revision of the RCS Specific Activity Tech Specification to utilize a new indicator, Dose Equivalent Xenon-133, instead of the current indicator known as E-BAR. The current limits on primary coolant gross specific activity will be replaced with limits on primary coolant noble gas activity. The noble gas activity would be based on DOSE EQUIVALENT XE-133 and would take into account only the noble gas activity in the primary coolant. The determination of Dose Equivalent Xe-133 will be performed in a similar manner to that currently used in determining DE I-131, except that the calculation of Dose Equivalent Xe-133 is based on the acute dose to the whole body and considers the noble gases which are significant in terms of contribution to whole body dose. Some noble gas isotopes are not included due to low concentration, short half-life, or small dose conversion factor.

Per TSTF-490 traveler (Ref. 9.13), the DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (μCi/gm) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides [Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m. Xe-133, Xe-135m, Xe-135, and Xe-138] actually present. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, 1993. "External Exposure to Radionuclides in Air, Water, and Soil".

The XE-133 Dose Equivalent concentration is established in Table 5 as defined in the TSTF-490 design specification using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12 (Ref. 9.8) and 1% failed fuel noble gas isotopic concentrations in Reference 9.9, Table 2-2 for HB x 1.04. The proposed XE-133 Dose Equivalent concentration limit for noble gas activity is calculated to be 580 μCi/gm XE-133 DE (Table 5), and is used in this analysis with the noble gas isotopic concentrations in Table 5A.

2.4 RCS Alkali Metal Inventory

Westinghouse Letter NSP-07-59, LTR-PEP-07-26 (Ref. 9.9, Table 2-2) presents the PINGP Units 1 and 2 RCS non-iodine activity concentrations based on a 1% fuel defect level. The alkali metals (Cs, Rb) present in the source term are omitted from the RADTRAD analysis since they have a negligible impact on the analysis results, primarily because the dose contribution from alkali metals is insignificant compared to the dose contribution from noble gases which are released directly to the environment without hold-up.

In the intact steam generator in which the tubes are covered by liquid for the event duration, the release of alkali metals is facilitated solely by steam generator moisture carryover of no more than 0.25% (Ref. 9.21) (i.e., a factor of 400 less than the noble gas release rate). In addition, the alkali metals introduced into the intact SG are diluted within the SG space of approximately 1700 cubic feet (per Section 7.1), and then gradually released as this SG liquid volume is steamed to the environment at a rate of no more than 40 cfm (per Section 7.3.2). This release rate of approximately 0.025 SG volumes per minute (= 40 cfm / 1700 cf) is 40 times lower than the noble gas release rate to the environment. Combining the moisture carryover and hold-up effects indicates that the alkali metal release rate is 16,000 times (= 400

x 40) lower than the noble gas release rate to the environment. This hold-up of the alkali metal within the intact SG significantly reduces the alkali metal activity released to the environment in comparison to the noble gas activity released to the environment.

In the faulted steam generator which is assumed to dry out, the alkali metals introduced into the faulted SG are diluted within the empty SG space of approximately 1700 cubic feet (per Section 7.1.2), and then gradually released as this SG air volume is displaced to the environment at the primary-to-secondary leak rate of 0.181 cfm. This alkali metal release rate of approximately 0.0001 SG volumes per minute (= 0.181 cfm / 1700 cf) is 10,000 times lower than the noble gas release rate to the environment. This hold-up of the alkali metal within the faulted SG significantly reduces the alkali metal activity released to the environment in comparison to the noble gas activity released to the environment.

In addition, the control room dose contribution from alkali metals is further minimized by their removal via the 99% efficient control room HEPA recirculation filter (Ref. 9.3.2, Item #14), which would reduce the alkali metal CR dose contribution by an additional factor of 100.

The activity released during the vent contributes to the external dose (whole body gamma – DDE) and internal dose (inhaled – CEDE). All alkali isotopes including the daughters are naturally beta emitters; therefore, they do not contribute to any external dose. The inhaled dose conversion factors for the rubidium and cesium isotopes are calculated in Table 14, which shows that the alkali isotopes are inherently low thyroid inhalation dose contributors. These dose characteristics combined with the extremely low fractional release of less than 1/10,000 will result in inconsequential CR and offsite doses, which will be eliminated as being less than the significant figure rounding error.

2.5 CR Air Intake Radiation Monitor Response

Post-accident Xe-133 activity in the CR @ 0.0833 hr (5 minutes)

= 2.9936E-02 Ci (RADTRAD Run PMSFPNG01.o0)

Control room volume 61,315 ft^3 (Section 5.5.1) = 61,315 ft^3 / $(3.28\ ft/m)^3$ = 1,737.58 m^3

Xe-133 activity concentration in the CR @ 0.0036 hr (0.22 minute)

= 2.9936E-02 Ci / 1,737.58 m^3 = 1.723E-05 Ci/m^3 = 1.723E-05 μCi/cc, which exceeds the CR monitor setpoint of 1E-05 μCi/cc for Xe-133 (Ref. 9.3.2, Item # 9).

Since the Xe-133 activity in the CR is circulated by the CR recirculation flow through the CR air supply duct (Ref. 9.24), the monitor setpoint is exceeded within 5 minutes due to the P-T-S leakage noble gas release from the faulted SG alone. Therefore, the CR actuation delay of 5 minutes following a MSLB accident is considered extremely conservative, and does not require any further justification.

3.0 ACCEPTANCE CRITERIA:

The following NRC regulatory requirement and guidance documents are applicable to this PINGP MSLB accident analysis:

- Regulatory Guide 1.183 (Ref. 9.1)
- 10CFR50.67 (Ref. 9.12)
- Standard Review Plan section 15.0.1 (Ref. 9.17)

Dose Acceptance Criteria are:

Regulatory Dose Limits

Dose Type	Accident Case	Control Room (rem)	EAB and LPZ (rem)
TEDE Dose	Pre-accident Iodine Spike	5	25
	Concurrent Iodine Spike	5	2.5

4.0 ASSUMPTIONS:

Regulatory Guide 1.183 (Ref. 9.1) provides guidance on modeling assumptions that are acceptable to the NRC staff for the evaluation of the radiological consequences of a MSLB accident. The following sections address the applicability of these modeling assumptions to the PINGP Units 1 and 2 MSLB accident analysis. These assumptions are incorporated as design inputs in Sections 5.3 through 5.6.

The radioactivity material releases and radiation levels used in the control room dose analysis are determined using the same source term, transport, and release assumptions used for determining the exclusion area boundary (EAB) and the low population zone (LPZ) TEDE values (Ref 9.1, Section 4.2.2).

There are no unverified assumptions in this calculation.

4.1 Source Terms

Per Reference 9.3.1, Item # 3, no fuel damage is postulated for the MSLB accident. Per RG 1.183 (Ref. 9.1, Appendix E, Section 2), since no or minimal fuel damage is postulated for the limiting event, the released activity is the maximum coolant activity allowed by the technical specifications. Two cases of iodine spiking, a pre-accident case and a concurrent case, are assumed.

4.1.1 Pre-accident Iodine Spike Source Term

It is assumed for the pre-accident iodine spike that a reactor transient has occurred prior to the postulated MSLB and has raised the primary coolant iodine concentration to the maximum value permitted by the technical specifications (Ref. 9.1, Appendix E, Section 2.1).

Per Technical Specification (TS) LCO for Specific Activity (Ref. 9.14, LCO 3.4.17), the proposed maximum primary coolant iodine concentration permitted by the technical specifications at full power is shown in TS Figure 3.4.17-1 (Ref. 9.6.6), which will be 30 μCi/gm Dose Equivalent (DE) I-131 approved in the PINGP Safety Evaluation Report (SER) (Ref. 9.14). Technical Specification Section 1.10 (Ref. 9.6.2) defines DE I-131 as that concentration of I-131 (in μCi/gm) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present using the thyroid dose conversion factors (DCFs) specified in Table III of TID-14844; the TS Section 1.10 definition of DE I-131 will be revised to be based on the effective DCFs specified in Federal Guidance Report 11 (Ref. 9.7). Therefore, this analysis calculates DE-131 in Table 1 in terms of the thyroid DCFs instead of the effective DCFs specified in FGR 11, which produce relatively a higher iodine concentration. The pre-accident iodine spike isotopic iodine concentrations are calculated in Table 4.

4.1.2 Concurrent Iodine Spike Source Term

Consistent with Regulatory Guide 1.183 (Ref. 9.1, Appendix E, Section 2.2), it is assumed for the concurrent iodine spike that the primary system transient associated with the MSLB causes an iodine spike in the primary system. The increase in primary coolant iodine concentration is estimated using a spiking model that assumes that the iodine release rate from the fuel rods to the primary coolant (expressed in curies per unit time) increases to a value 500 times greater than the release rate corresponding to the iodine concentration at the equilibrium value specified in technical specifications (i.e., concurrent iodine spike case). The assumed iodine spike is conservatively assumed to persist for the maximum 8 hour duration specified in RG 1.183.

Per Technical Specification LCO for reactor coolant specific activity (Ref. 9.14, LCO 3.4.17), the approved equilibrium primary coolant iodine concentration permitted by the technical specifications will be 0.50 μCi/gm DE I-131.. The concurrent iodine spike isotopic iodine activity release rates are calculated in Table 8.

4.1.3 Noble Gas Source Term

As discussed in Section 2.3, the noble gas isotopic concentrations are calculated in Tables 5 & 5A using the proposed a new indicator, XE-133 Dose Equivalent, instead of the current indicator known as E-Bar (Ref. 9.6.3). The noble gas isotopic concentration based on 580 μCi/gm DE XE-133 are used for both the pre-accident and concurrent iodine spike cases as shown in Tables 6 and 10.

4.1.4 Activity Release from the Fuel into the Primary Coolant

It is assumed consistent with RG 1.183 (Ref. 9.1, Appendix E, Section 3) that the activity released from the fuel (for both the pre-accident and concurrent iodine spike cases) is released instantaneously and homogeneously through the primary coolant.

4.1.5 Iodine Chemical Form

It is assumed that the chemical forms of iodine released from the steam generators to the environment are 97% elemental and 3% organic (Ref. 9.1, Appendix E, Section 4). The chemical form of iodine released from the fuel is irrelevant, given that the chemical form of iodine released from the SGs is specified.

4.2 Transport

4.2.1 Primary-to-Secondary Leak Rates

It is assumed that the maximum allowed accident induced steam generator (SG) leak rate is 1 gallon/minute at 70°F per the Technical Specification 3.4.14 Bases (Ref. 9.6.9) for the faulted SG (Ref. 9.3.1, Item # 21) and 150 gallons/day at 70°F of P-T-S leakage for the intact SG (Ref. 9.6.7). It is conservatively assumed that the intact SG tubes are uncovered for 2 hours after onset of the event.

4.2.2 Primary-to-Secondary Leak Primary Coolant Density

It is assumed that the primary coolant (i.e., RCS) density is 1.0 gm/cc (62.4 lb/ft^3) (Ref. 9.1, Appendix E, Section 5.2) used in converting the volumetric primary-to-secondary leak rates (e.g., gpm) to mass leak rates (e.g., lb/hr).

4.2.3 Primary-to-Secondary Leak Duration

It is assumed consistent with RG 1.183 (Ref. 9.1, Appendix E, Section 5.3), that the primary-to-secondary (P-T-S) leakage continues until the primary system pressure is less than the secondary system pressure, or until the temperature of the leakage is less than 212°F, and the release of radioactivity is assumed to continue until shutdown cooling is in operation and releases from the steam generator have terminated. In this analysis RCS is conservatively assumed to leak into the intact SG for 45.5 hours until the RHR system is initialized (Ref. 9.3.1, Item #27).

P-T-S Leakage into the faulted SG is assumed to continue for a total of 75 hours, until the faulted SG temperature decreases to 200°F (Ref. 9.3.1, Item #26).

The release of fission products from the secondary system is evaluated with the assumption of a coincident loss of offsite power (LOOP). The offsite power is assumed to be lost so that the main steam condensers are not available for removal of the decay heat.

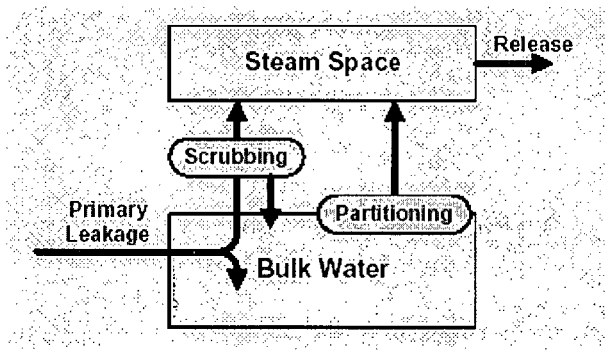
4.2.4 Noble Gas Releases to the Environment

It is assumed that all noble gas radionuclides released from the primary system (via the primary-to-secondary leak) are released to environment without reduction or mitigation. (Ref. 9.1, Appendix E, Section 5.4)

4.2.5 Transport Model

RG 1.183 (Ref. 9.1, Appendix E, Section 5.5) presents the following generic steam generator transport model for use in evaluating an MSLB accident:

STEAM GENERATOR TRANSPORT MODEL



Release via the Faulted Steam Generator:

Per RG 1.183 (Appendix E, Section 5.5.1) a portion of the primary-to-secondary leakage will flash to vapor, based on the thermodynamic conditions in the reactor and secondary coolant. During periods of faulted SG dryout, all of the primary-to-secondary leakage is assumed to flash to vapor and be released to the environment without mitigation. Per RG 1.183 (Appendix E, Section 5.6) operating experience and analyses have shown that for some steam generator designs, tube uncovery may occur for a short period following any reactor trip. The potential impact of tube uncovery on the transport model parameters (e.g., flash fraction, scrubbing credit) is considered in the analysis.

In this analysis the faulted steam generator is assumed to steam dry. Consistent with RG 1.183 (Appendix E, Section 5.5.1), during the period of faulted steam generator dryout, all of the 1.0 gpm primary-to-secondary leakage into the faulted steam generator is assumed to flash to vapor and all of the iodine and noble gas activity P-T-S leakage into the faulted steam generator is assumed to be released directly to the environment with no credit taken for iodine partitioning or scrubbing in the faulted steam generator.

Release via the Intact Steam Generator:

Per RG 1.183 (Appendix E, Section 5.5.1) with regard to the unaffected (i.e., intact) steam generator used for plant cooldown, the 150 gpd primary-to-secondary leakage can be assumed to mix with the secondary water without flashing during periods of total tube submergence after two hours. The tubes are conservatively assumed to be uncovered during the first two hours after onset of the event and all of the iodine activity in the P-T-S leakage is assumed to flash to vapor and be released to the environment at the steaming rate of the intact SG (See Table 13). After two hours, the tubes in the intact SG are assumed to be totally submerged and the

iodine activity in the P-T-S leakage is mixed with the SG liquid and assumed to become vapor at a rate that is a function of the steaming rate and an assumed iodine partition coefficient of 10 to maximize the resulting dose. All of the noble gas activity in the P-T-S leakage into the intact SG is assumed to be released directly to the environment. Consistent with RG 1.183, Appendix E, Section 5.5.4, the radioactivity in the bulk water of the intact SG steam generators is assumed to become vapor at a rate that is a function of the steaming rate and an assumed iodine partition coefficient of 1 to maximize the resulting dose.

4.3 Offsite Dose Consequences

Regulatory Guide 1.183 (Ref. 9.1, Section 4.1) provides guidance to be used in determining the total effective dose equivalent (TEDE) for persons located at the exclusion area boundary (EAB) and at the outer boundary of the low population zone (LPZ). The following sections address the applicability of this guidance to the PINGP MSLB accident analysis. These assumptions are incorporated as design inputs in Section 5.6.

4.3.1 Modeling of Parent and Daughter Isotopes

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.1.1) that the dose calculation determines the TEDE, which is the sum of the committed effective dose equivalent (CEDE) from inhalation and the deep dose equivalent (DDE) from external exposure; and these two components of the TEDE consider all radionuclides, including progeny from the decay of parent radionuclides that are significant with regard to dose consequences and the released radioactivity. These isotopes are listed in Section 5.3.

4.3.2 CEDE (Inhalation) Dose Conversion Factors

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.1.2), that the exposure-to-CEDE factors for inhalation of radioactive material are derived from the data provided in ICRP Publication 30, "Limits for Intakes of Radionuclides by Workers". This calculation models the CEDE dose conversion factors (DCFs) in the column headed "effective" yield doses in Table 2.1 of Federal Guidance Report 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" (Ref. 9.7).

4.3.3 Offsite Breathing Rates

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.1.3), that for the first 8 hours, the breathing rate of persons offsite is assumed to be 3.5×10^{-4} cubic meters per second. From 8 to 24 hours following the accident, the breathing rate is assumed to be 1.8×10^{-4} cubic meters per second. After that and until the end of the accident, the rate is assumed to be 2.3×10^{-4} cubic meters per second. These offsite breathing rates are listed in Section 5.6.

4.3.4 DDE (Immersion) Dose Conversion Factors

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.1.4), that the DDE is calculated assuming submergence in semi-infinite cloud assumptions with appropriate credit for attenuation by body tissue. The DDE is nominally equivalent to the effective dose equivalent (EDE) from external exposure if the whole body is irradiated uniformly. Since this is a reasonable assumption for submergence exposure situations, EDE is used in lieu of DDE in determining the contribution of external dose to the TEDE. This calculation models the EDE dose conversion factors in the column headed "effective" in Table III.1 of Federal Guidance Report 12, "External Exposure to Radionuclides in Air, Water, and Soil" (Ref. 9.8).

4.3.5 Exclusion Area Boundary Dose Acceptance Criteria

It is assumed consistent with RG 1.183 (Ref. 9.1, Sections 4.1.5 and 4.4), that the TEDE is determined for the most limiting person at the EAB. The maximum EAB TEDE for any two-hour period following the start of the radioactivity release is determined and used in determining compliance with the dose criteria in 10 CFR 50.67 (Ref. 9.12). For the MSLB the postulated EAB doses should not exceed the criteria established in RG 1.183 Table 6. This assumption is incorporated as a design input in Section 5.5.

EAB Dose Acceptance Criterion (pre-accident iodine spike case):	25 Rem TEDE
EAB Dose Acceptance Criterion (concurrent iodine spike case):	2.5 Rem TEDE

The MSLB event release via the intact SG is until cold shutdown is established at 45.5 hours (Reference 9.3.1, Item # 27). The MSLB event release via the faulted SG is until the faulted SG temperature decreases to 200°F at 75 hours (Ref. 9.3.1, Item #26). Dose contributions to the EAB end when the release stops at 75 hours.

The RADTRAD3.03 Code (Ref. 9.2) used in this analysis determines the maximum two-hour TEDE by calculating the postulated dose for a series of small time increments and performing a "sliding" sum over the increments for successive two-hour periods. The time increments appropriately reflect the progression of the accident to capture the peak dose interval between the start of the event and the end of radioactivity release.

4.3.6 Low Population Zone Outer Boundary Dose Acceptance Criteria

It is assumed consistent with RG 1.183 (Ref. 9.1, Sections 4.1.6 and 4.4), that the TEDE is determined for the most limiting receptor at the outer boundary of the low population zone (LPZ) and is used in determining compliance with the dose criteria in 10 CFR 50.67 (Ref. 9.12). For the MSLB accident the postulated LPZ doses should not exceed the criteria established in RG 1.183 Table 6. This assumption is incorporated as a design input in Section 5.5.7.

LPZ Dose Acceptance Criterion (pre-accident iodine spike case):	25 Rem TEDE
LPZ Dose Acceptance Criterion (concurrent iodine spike case):	2.5 Rem TEDE

The MSLB event release via the intact SG is until cold shutdown is established at 45.5 hours (Reference 9.3.1, Item # 27). The MSLB event release via the faulted SG is until the faulted SG temperature decreases to 200°F at 75 hours (Ref. 9.3.1, Item #26). Dose contributions to the LPZ end when the release stops at 75 hours.

4.3.7 Effluent Plume Depletion

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.1.7), that no correction is made for depletion of the effluent plume by deposition on the ground.

4.4 Control Room Offsite Dose Consequences

Regulatory Guide 1.183 (Ref. 9.1, Section 4.2) provides guidance to be used in determining the total effective dose equivalent (TEDE) for persons located in the control room (CR). The following sections address the applicability of this guidance to the MSLB accident analysis. These assumptions are incorporated as design inputs in Section 5.5.

4.4.1 Control Room Operator Dose Contributors

Consistent with RG 1.183 (Ref. 9.1, Section 4.2.1), the CR TEDE analysis considers the following sources of radiation that will cause exposure to control room personnel:

- Contamination of the control room atmosphere by the filtered CR ventilation inflow through the CR air intake and by unfiltered inleakage of the radioactive material contained in the post-accident radioactive plume released from the facility,
- Contamination of the control room atmosphere by filtered CR ventilation inflow via the CR air intake and by unfiltered inleakage of airborne radioactive material from areas and structures adjacent to the control room envelope,
- * Radiation shine from the external radioactive plume released from the facility (i.e., external airborne cloud shine dose),
- Radiation shine from radioactive material in the reactor containment (i.e., containment shine dose). This form of radiation shine is not applicable to a MSLB accident in which the activity is not released into the containment air space, and
- * Radiation shine from radioactive material in systems and components inside or external to the control room envelope (e.g., radioactive material buildup in CR intake and recirculation filters [i.e., CR filter shine dose]).

* Note: The external airborne cloud shine dose and the CR filter shine dose due to a MSLB accident are expected to be considerably less than those due to a LOCA as a result of source term differences (i.e., the LOCA releases significantly more activity from failed fuel than does the MSLB event per RG 1.183 [Ref. 9.1, Table 2 for LOCA compared to no fuel failure and only iodine spiking for the MSLB]). Therefore, the post-LOCA external airborne cloud and CR filter shine doses are conservatively applied to the MSLB accident in Section 8.1.1 and 8.1.2.

4.4.2 Control Room Source Term

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.2.2), that the radioactive material releases and radiation levels used in the control room dose analysis are determined using the same source term, transport, and release assumptions used for determining the EAB and the LPZ TEDE values. The parameters assumed for determining the EAB and LPZ TEDE values also result in conservative dose projections to the control room personnel.

4.4.3 Control Room Transport

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.2.3), that the models used to transport radioactive material into and through the control room, and the shielding models used to determine radiation dose rates from external sources, are structured to provide suitably conservative estimates of the exposure to control room personnel. These conservative assumptions include conservative values for unfiltered inleakage, minimum clean-up air flow rates, and minimum filter efficiencies. The shielding models are not developed to determine radiation dose rates from external sources because their dose contributions are conservatively assumed to be same as those due to a LOCA and added to the dose contributions from other sources in Section 8.1.1 and 8.1.2.

4.4.4 Control Room Response

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.2.4), that engineered safety features (ESF) that mitigate airborne radioactive material within the control room are credited. Such features include control room

recirculation filtration. CR isolation is actuated by radiation monitors (RMs). The Xe-133 concentration at the CR air intake instantaneously exceeds the CR air intake radiation monitor setpoint of 1.0E-05 μCi/ml due to the noble gas released from the P-T-S leakage through the intact SG (see Section 2). Therefore, a delay of 5 minutes for the CR isolation to be fully operational is considered to be conservative and no further sensitivity of delay time is required.

4.4.5 Control Room Operator Use of Dose Mitigating Devices

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.2.5), that credit is not taken for the use of personal protective equipment (e.g., protective beta radiation resistant clothing, eye protection, or self-contained breathing apparatus) or prophylactic drugs (i.e., potassium iodide [KI] pills).

4.4.6 Control Room Occupancy Factors and Breathing Rates

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.2.6), that the CR dose receptor for these analyses is the hypothetical maximum exposed individual who is present in the control room for 100% of the time during the first 24 hours after the event, 60% of the time between 1 and 4 days, and 40% of the time from 4 days to 30 days. For the duration of the event, the breathing rate of this individual should be assumed to be 3.5×10^{-4} cubic meters per second. These assumptions are incorporated as design inputs in Section 5.5.

4.4.7 Control Room Dose Conversion Factors

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.2.7), that the control room doses are calculated using the offsite dose analysis dose conversion factors identified in RG 1.183 Regulatory Position 4.1 (see above Sections 4.3.2 & 4.3.4). The deep dose equivalent (DDE) from photons is corrected for the difference between finite cloud geometry in the control room and the semi-infinite cloud assumption used in calculating the dose conversion factors. The RADTRAD Code (Ref. 9.2) used in this analysis uses the following expression to correct the semi-infinite cloud dose, DDE_{∞}, to a finite cloud dose, DDE_{finite}, where the control room is modeled as a hemisphere that has a volume, V, in cubic feet, equivalent to that of the control room:

$$DDE_{finite} = (DDE_{\infty} \times V^{0.338}) / 1173$$

4.4.8 Control Room Operator Dose Acceptance Criteria

It is assumed consistent with RG 1.183 (Ref. 9.1, Section 4.4), that for the MSLB accident the postulated CR doses should not exceed the 5 Rem TEDE criterion established in 10 CFR 50.67 (Ref. 9.12):

CR Dose Acceptance Criterion (pre-accident iodine spike case):	5 Rem TEDE
CR Dose Acceptance Criterion (concurrent iodine spike case):	5 Rem TEDE

5.0 DESIGN INPUTS:

5.1.1 Applicability of Prior Licensing Basis

The PINGP plant specific design inputs and assumptions used in the current facility's design basis MSLB accident analysis were assessed for their validity to represent the as-built condition of the plant and evaluated for their compatibility to meet the AST and TEDE methodology. The analysis in this calculation ensures that analysis assumptions, design inputs, and methods are compatible with the AST and comply with RG 1.183, Appendix E requirements.

5.1.2 Credit for Engineered Safety Features

Credit is taken only for those accident mitigation features that are classified as safety-related, are required to be operable by technical specifications, are powered by emergency power sources, and are either automatically actuated or, in limited cases, have actuation requirements explicitly addressed in emergency operating procedures. The dose mitigation feature of the Control Room Special Ventilation System (CRSVS) are credited in the analysis. This system is safety related and operable by Technical Specification LCO 3.7.10 (Ref. 9.6.12). The CRSVS HEPA particulate removal filtration efficiency, and the CRSVS charcoal iodine removal filtration efficiencies used in the analysis are verified by the Ventilation Filter Testing Program in Technical Specification 5.5.9 (Ref. 9.6.8), which comply with Generic Letter (GL) 99-02 as demonstrated in Section 7.5. The CRSVS air intake monitors are required to be operable by TS 3.3.6 and Table 3.3.6-1 (Refs. 9.6.10 & 9.6.11) in Modes 1, 2, 3, & 4 and during movement of irradiated fuel assemblies. The CRSVS actuation during the MSLB accident is credited in the analysis with a 5-minutes system response delay.

5.1.3 Assignment of Numeric Input Values

The numeric values chosen as inputs to this analysis are compatible to AST and TEDE dose criteria and selected with the objective of maximizing the postulated dose. The loss of offsite power for the entire duration of the event disabling the condenser, single failure of the motor driven AFW pump, use of more than measured CR unfiltered inleakage, 5 minutes delay for CRSVS actuation and a 10% lower CR recirculation flow rate are conservatively used to maximize the resulting doses (see Section 2.5).

5.1.4 Meteorology Considerations

The control room atmospheric dispersion factors (χ/Qs) are developed in References 9.4 using the NRC sponsored ARCON96 computer code and guidance provided for the use of ARCON96 in the Regulatory Guide 1.194. The release point for activity released to the environment is the common area of auxiliary building Units 2 Group 1 PORV locations (Sections 2.1.1 & 2.1.2). The EAB and LPZ χ/Qs were originally developed for the plant operating license and were accepted by the staff in the previous licensing amendments.

5.2 Accident-Specific Design Inputs/Assumptions

The design inputs and assumptions utilized in this EAB, LPZ, and CR dose consequence analysis are listed in the following sections. The design inputs are compatible with the requirements of the AST and TEDE dose criteria and the assumptions are consistent with those identified in Section 4 and Appendix E of RG 1.183 (Ref. 9.1). The design inputs and assumptions in the following sections represent the as-built design of the plant.

Design Input Parameter	Value Assigned	Reference
Main Steam Line Break Accident Parameters		
5.3 Source Terms		
5.3.1 Licensed reactor core power level	1,650 MW_t 1,683 MW_t (= 102% of 1,650 MW_t) 1,852 MW_t (= 110% of 1,683 MW_t)	9.6.1 10% EPU Power Level Used in the analysis
5.3.2 Primary Coolant (PC) (iodine) specific activity in the Technical Specifications	0.50 μCi/gm DE I-131	9.6.2, 9.6.5, & 9.14, LCO 3.4.17
5.3.3 PC (non-iodine) specific activity in the proposed Technical Specifications	100 / E-bar 580 μCi/gm DE of XE-133	9.6.3 Section 2.3, Tables 5 & 5A, Used in the analysis
5.3.4 Maximum PC (iodine) specific activity permitted by the Technical Specifications	30 μCi/gm DE I-131	9.6.6 & 9.14, Figure 3.4.17-1
5.3.5 Concurrent Iodine Spiking Factor	500 (for a MSLB accident)	9.1, Appendix E, Section 2.2
5.3.6 Duration of concurrent iodine spike	8 hours (for a MSLB accident)	9.1, Appendix E, Section 2.2
5.3.7 Secondary coolant (iodine) specific activity in the Technical Specifications	0.1 μCi/gm DE Iodine-131	9.6.2 & 9.6.4
5.3.8 Nominal reactor coolant system (RCS) volume	5,290 ft^3	9.9, Table 6-1
5.3.9 RCS temperature & pressure	560^0F @ 2235 psia	9.3.1, Item # 25
5.3.10 Maximum allowed accident induced SG leak rate	1 gpm @ 70^0F	9.3.1, Item # 21 & 9.6.9
5.3.11 Faulted SG dryout time	600 seconds = 10 minutes	9.3.1, Item # 22

5.3.12 PC iodine activity concentration based on 1% fuel defects — 9.9, Table 2-2, HB x 1.04

Isotope	Activity (μCi/gm)	Isotope	Activity (μCi/gm)	Isotope	Activity (μCi/gm)
I-131	2.55E+00	I-133	3.88E+00	I-135	2.20E+00
I-132	2.80E+00	I-134	5.82E-01		

5.3.13 PC noble gas activity based on 1% fuel defects — 9.9, Table 2-2, HB x 1.04

Isotope	Activity (μCi/gm)	Isotope	Activity (μCi/gm)	Isotope	Activity (μCi/gm)
Kr-83M	3.92E-01	Kr-88	2.89E+00	Xe-135M	5.02E-01
Kr-85M	1.59E+00	Xe-131M	2.05E+00	Xe-135	8.24E+00
Kr-85	1.09E+01	Xe-133M	3.65E+00	Xe-138	6.09E-01
Kr-87	1.03E+00	Xe-133	2.60E+02		

5.3.14 Steam Generator Liquid Mass U1 Framatome ANP Model 56/19 U2 Westinghouse Model 51	 107,100 lbm @ Full Power 107,420 lbm @ Full Power	9.3.1, Item # 10
5.3.15 SG saturated pressure at hot full power	806.8 psia – Unit 1 728 psia – Unit 2	9.3.1, Item # 32

Design Input Parameter	Value Assigned	Reference
5.3.16 RCS operational leakage Pressure boundary Unidentified leakage Identified leakage Primary –to-secondaryleakage	 None 1 gpm 10 gpm 150 gpd through any one SG	9.6.7
5.3.17 Normal letdown flow rate	40 gpm	9.23
5.4 Activity Transport Models (Figures 1 & 2)		
5.4.1 Not Used		
5.4.2 Steam mass released from faulted SG to the environment	107,100 lb (Unit 1) or 107,420 lb (Unit 2) total liquid mass dries outs in 600 seconds	9.3.1, Item #s 10 & 22
5.4.3 PC leakage to faulted SG	0.104 gpm (= 150 gallons/day maximum P-T-S leakage through any one steam generator, at assumed measured density of 1.0 gm/cc (62.4 lb/ft^3)	9.6.7 & 9.3.1, Item # 9
5.4.4 Termination of release from faulted SG	75 hours	9.3.1, Item # 26
5.4.5 Termination of release from intact SG	45.5 hours	9.3.1, Item # 27
5.4.6 Steam mass released from intact SG to the environment 0 – 2 hr 2 – 8 hr 8 – 24 hr 24 hr – 45.5 hr	 226,414 lbm 406,952 lbm 796,899 lbm 863,053 lbm	9.3.4, Attachment A
5.4.7 Intact SG liquid iodine partition coefficient	100 10 (used in the analysis)	9.1, Appendix E, Section 5.5.4
5.4.8 Letdown system flow rate	100 gpm	9.3.1, Item # 18
5.4.9 Letdown system temperature	100^{0}F	9.3.1, Item # 18
5.4.10 Steam generator moisture carryover: Unit 1 Unit 2	 ≤ 0.10 % ≤ 0.25 %	9.21
5.5 Control Room Model Parameters (Figure 3)		
5.5.1 CR Volume	61,315 ft^3	9.3.2, Item # 6
5.5.2 CRSVS Normal Flow Rate	1,818 cfm ± 10% 2,000 cfm < 5 minutes	9.3.2, Item # 10 Used in the analysis
5.5.3 CRSVS Makeup Rate	0 cfm > 5 minutes	9.3.2, Item #4 (CR operates in a recirculation mode)
5.5.4 CRSVS Recirc Flow Rate	4,000 cfm ± 10% 3,600 cfm > 5 minutes	9.3.2, Item # 13
5.5.5 CRSVS Charcoal Filter Efficiencies	95% for elemental iodine 95% for organic iodide	Section 7.5.1
5.5.6 CRSVS HEPA Filter Efficiency	99%	Section 7.5.2

Design Input Parameter	Value Assigned	Reference
5.5.6A CR Monitor Setpoint	1.0E-05 μCi/ml for Xe-133	9.3.2, Item # 9
5.5.6B CR Recirculation Flow Rate	10,000 cfm	9.24
5.5.7 CR Unfiltered Inleakage Determined By Tracer Gas Testing	300 cfm (includes 10 cfm for ingress and egress) (nominal value including uncertainty)	9.3.2, Item # 11, higher CR unfiltered inleakage than LOCA analysis is conservatively used
5.5.8 CR Breathing Rate	3.5E-04 m^3/sec	9.1, Section 4.2.6
5.5.9 CR Allowable Dose Limit	5 rem TEDE for the event duration	9.4
5.5.10 CR occupancy factors		
Time (Hr)	**%**	9.1, Section 4.2.6
0-24	100	
24-96	60	
96-720	40	
5.5.11 Not Used		
5.5.12 Unit 2 CR air intake χ/Qs for Common Area of Auxiliary Building Release – Faulted SG		
Time (Hr)	**X/Q (sec/m^3)**	9.4, Table 8-3 (these U2 CR air intake χ/Qs conservatively provide less dispersion than the U1 CR air intake χ/Qs from time 2 hours to the end of the event at 75 hours)
0-2	4.79E-03	
2-8	3.60E-03	
8-24	1.60E-03	
24-96	1.21E-03	
96-720	9.55E-04	
5.5.13 Unit 2 CR air intake χ/Qs for Unit 2 Group 1 PORV Release – Intact SG		
Time (Hr)	**X/Q (sec/m^3)**	9.4, Table 8-5
0-2	3.07E-02	
2-8	2.49E-02	
8-24	1.12E-02	
24-96	7.78E-03	
96-720	6.17E-03	
5.6 Site Boundary Release Model Parameters		
5.6.1 EAB Atmospheric Dispersion Factor (χ/Q)	6.49E-04 sec/m^3	9.3.3, Item # 2
5.6.2 EAB Breathing Rate (m^3/sec)	3.5E-04	9.1, Section 4.1.3
5.6.3 LPZ Distance	2,414 m	9.3.3, Item # 3
5.6.4 LPZ atmospheric dispersion factors (χ/Qs)		
Time (Hr)	**χ/Q (sec/m^3)**	9.3.3, Item # 3
0-8	1.77E-04	
8-24	3.99E-05	
24-96	7.12E-06	
96-720	1.04E-06	
5.6.5 LPZ breathing rates (m^3/sec)		
Time (Hr)	**BR (m^3/sec)**	9.1, Section 4.1.3
0-8	3.5E-04	
8-24	1.8E-04	
24-720	2.3E-04	

Design Input Parameter	Value Assigned	Reference
5.6.6 EAB & LPZ allowable dose limit		9.1, Table 6
Pre-accident Iodine Spike Case	25 rem TEDE	
Concurrent Iodine Spike Case	2.5 rem TEDE	

6. COMPUTER CODES & COMPLIANCE WITH REGULATORY REQUIREMENTS

6.1 COMPUTER CODES

RADTRAD 3.03 (Ref. 9.2): This is an NRC-sponsored code approved for use in determining control room and offsite doses from releases due to reactor accidents. This code was used by the most of the AST license amendments that have been approved by the NRC. A rigorous high quality code qualification process was adopted to develop and procure the code by testing of the program elements, verification of input/output files, and examination of design specification. Therefore the RADTRAD3.03 computer code is considered to be qualified to comply with the quality assurance requirements of 10 CFR50, Appendix B and it can be safely used to perform the design basis accident analyses.

Calculation GEN-PI-079 (Ref. 9.18, Sections 2.6 & 8.2) documents a V&V of the RADTRAD3.03 code. Suitable acceptance test cases for the PWR radiological analysis were incrementally selected, initially defining simplified cases that could verified against analytical solutions, then adding complexity (typically a control room) and comparing the results against the RADTRAD3.03 and HABIT code analyses, adding more complexity (e.g., removal by decay chain) and comparing the results with the RADTRAD3.03 and HABIT codes again. The selected PWR code cases cover all essential characteristics of an MSLB accident AST analysis, including transportation of activity within the compartment and in the atmosphere. All radiological features of the RADTRAD3.03 code were verified and validated by running the selected PWR code cases in the Microsoft Window XP environment. The results of V&V code cases were summarized in Calculation GEN-PI-079, Section 8.2, and compared with the RADTRAD3.03 and HABIT code results, which showed an excellent agreement.

Therefore, the code is considered validated for use in the PINGP AST analysis.

6.2 COMPLIANCE WITH REGULATORY REQUIREMENTS:

As discussed in Section 4.0, Assumptions, the analysis in this calculation complies with the line-by-line requirements in Regulatory Guide 1.183 including its Appendix E.

7.0 CALCULATIONS:

This calculation addresses two cases, a pre-accident iodine spiking case and a concurrent iodine spiking case. Due to the limitations of the RADTRAD code, the MSLB dose consequences for each case are determined by summing together the results from RADTRAD code analyses that separately calculate the dose contributions from the primary-to-secondary (P-T-S) leakage pre-accident or concurrent iodine spike iodine activity release, the P-T-S leakage noble gas activity release, and the secondary liquid iodine release.

7.1 Reactor Coolant & Steam Generator Coolant Mass:

RCS Mass:

RCS water volume = 5,290 ft^3 @ 560 ^{0}F and 2235 psia (Ref. 9.9, Table 6-1)

RCS water density at cooled liquid conditions = 62.4 lb/ft^3 (Ref. 9.1, Appendix E, Section 5.2)

RCS operating conditions = 560^{0}F and 2235 psia (Ref. 9.3.1, Item # 25)

Specific volume of RCS water @ 560 ^{0}F and 2235 psia = 0.02165 ft^3/lbm (Ref. 9.11, page 281)

RCS density = 1 / 0.02165 ft^3/lbm = 46.19 lb/ft^3

RCS water mass = 5,290 ft^3 x 62.4 lb/ft^3 x 453.6 gm/lbm = 1.497E+08 gm used for calculating the RCS activity in Tables 4 & 5 (a larger mass yields a greater RCS activity inventory available for leakage)

RCS water mass = 5,290 ft^3 x 46.19 lbm/ft^3 x 453.6 gm/lbm = 1.108E+08 gm used for calculating the iodine appearance rate in Section 7.2 (a smaller mass maximizes the RCS iodine appearance rate)

SG Mass:

SG Mass For PC Iodine Activity Release:

Faulted SG volume = 107,100 lb x (1/62.4) ft^3/lb = 1,716.35 $ft^3 \approx$ 1,716 ft^3

Faulted SG liquid mass = 107,100 lb x 453.6 g/lb = 4.858E+07 gm

Intact SG volume = 107,420 lb x (1/62.4) ft^3/lb = 1,721.47 $ft^3 \approx$ 1,721 ft^3

Intact SG liquid mass = 107,420 lb x 453.6 gm/lb = 4.873E+07 gm

The maximum SG liquid mass of 4.873E+07 gm is conservatively used to calculate the SG liquid iodine activity in Table 11 (a larger mass yields a greater SG liquid activity inventory available for release).

The minimum SG liquid volume of 1716 ft^3 is conservatively used in the RADTRAD model for the Faulted Steam Generator.

The maximum SG liquid volume of 1721 ft^3 is conservatively used in the RADTRAD model for the Intact Steam Generator.

7.2 Iodine Spike Appearance Rate:

Letdown coolant temperature before entering demineralizer = 100^{0}F (Ref. 9.3.1, Item # 18)

Letdown demineralizer decontamination factor (DF) = ∞ (infinite)

Specific volume of letdown coolant at 100^{0}F and 14.7 psia = 0.01613 ft^3/lb (Ref. 9.11, page 186)

RCS mass = 1.108E+08 gm (Section 7.1)

Total purification flow rate:

Normal letdown flow rate = 40 gpm (Ref. 9.23)

Maximum number of letdown orifices used = 2 (Ref. 9.22)

Unidentfied RCS leakage = 1 gpm (Ref. 9.6.7)

Identified RCS leakage = 10 gpm (includes the P-T-S leakage)

Total RCS leakage = 10 gpm + 1 gpm = 11 gpm

Total purification flow rate

= (2 x 40 gpm) x 1.10 (10% flow uncertainty) + 11 gpm = 80 gpm x 1.10 + 11 gpm = 99 gpm

Letdown flow rate of 100 gpm is used to determine the equilibrium iodine appearance rate as follows:

$$= 100 \frac{gal}{min} \times \frac{1\ ft^3}{7.481\ gal} \times \frac{1\ lb}{0.01613\ ft^3} \times \frac{453.6\ gm}{lb} \times \frac{1\ min}{60\ sec} = 6{,}265.1\ g/sec$$

At steady-state pre-accident conditions, the RCS Iodine Appearance Rate is equal to the iodine removal rate (λ_{total}) due to letdown demineralizer removal ($\lambda_{purification}$) and decay removal (λ_{decay}).

$\lambda_{total} = \lambda_{purification} + \lambda_{decay}$ = [(letdown flow / RCS mass) (1 – 1/DF)] + [decay removal rate]

Conservatively assuming letdown demineralizer has an infinite DF, which results in a demineralizer iodine removal efficiency of 100%.

Letdown purification rate = $\lambda_{purification}$ = (Letdown flow rate/RCS mass) x $(1 - 1/\infty)$

$$= \frac{6{,}265.1\ gm}{sec} \times \frac{1}{1.108E{+}08\ gm} \times (1 - 1/\infty) = 5.654E{-}05\ sec^{-1}$$

Iodine Appearance Rate = $A_i \times \lambda_{total} = A_i \times (5.654E{-}05\ sec^{-1} + \lambda_{decay}\ sec^{-1})$

Where A_i = total isotopic iodine activity

The isotopic concurrent iodine spike appearance rates are calculated in Table 8 using the isotopic iodine total activity, $\lambda_{purification}$ and λ_{decay}.

7.3 Post-MSLB Release Rates

7.3.1 Faulted SG - Iodine and Noble Gas Release Rate (P-T-S Leakage):

No noble gas hold-up or decay is modeled in the Faulted SG. All RCS mass released to the faulted SG is treated as if it were released directly to the environment.

Maximum accident induced leak rate into faulted SG = 1 gpm (= maximum leak rate into any one SG) (Ref. 9.3.1 Item #21 and Ref. 9.6.9). This leakage continues through the dried-out Faulted SG for 75 hours (Ref. 9.3.1 Item #26).

Per Regulatory Guide 1.183 (Ref. 9.1, Appendix E, Section 5.2), the density of this leakage at time of measurement is assumed to be 1.0 gm/cc (62.4 lb/ft^3). Therefore, the P-T-S volumetric and mass leakage rates into the faulted SG at measured conditions are:

P-T-S volumetric leakage rate at measured conditions = (1 gal/min) × (0.13368 ft^3/gal) = 0.13368 cfm

P-T-S mass leakage rate at measured conditions = (0.13368 ft^3/min) × (62.4 lb/ft^3) = 8.342 lb/min

However, per Section 7.1.1, at the time of the MSLB the RCS is operating at 560°F and 2235 psia with an RCS specific volume of 0.02165 ft^3/lb. Therefore, the iodine and noble gas P-T-S volumetric leakage rate into the faulted SG during the MSLB is:

P-T-S volumetric leakage rate at op. conditions = (8.342 lb/min) × (0.02165 ft^3/lb) = 0.181 cfm of RCS liquid

Iodine partition coefficient = 1.0 (no credit taken for P-T-S leakage iodine retention in the dried-out Faulted SG)

0-75 hr iodine P-T-S release rate from RCS to environment through dried-out Faulted SG

= (0.181 cfm of RCS liquid) x (1/1.0) = 0.181 cfm of RCS liquid

0-75 hr iodine P-T-S leakage release from RCS to the environ via the faulted SG = 0.181 cfm of RCS liquid

0-75 hr noble gas P-T-S leakage release from RCS to the environ via the faulted SG = 0.181 cfm of RCS liquid

7.3.2 Intact SG - Iodine Release & Steaming Rates (P-T-S Leakage):

RCS release rate into intact SG = 0.104 gpm (=150 gpd / 24 hr/day x 60 minutes/hr = 0.104 gpm)

Per Regulatory Guide 1.183 (Ref. 9.1, Appendix E, Section 5.2), the density of this leakage at time of measurement is assumed to be 1.0 gm/cc (62.4 lb/ft^3). Therefore, the P-T-S volumetric and mass leakage rates into the intact SG at measured conditions are:

P-T-S volumetric leakage rate at measured conditions = (0.104 gal/min) × (0.13368 ft^3/gal) = 0.01390 cfm

P-T-S mass leakage rate at measured conditions = (0.01390 ft^3/min) × (62.4 lb/ft^3) = 0.867 lb/min

However, per Section 7.1.1, at the time of the MSLB the RCS is operating at 560°F and 2235 psia with an RCS specific volume of 0.02165 ft^3/lb. Therefore, the iodine P-T-S volumetric leakage rate into the intact SG during the MSLB is:

0-45.5 hr P-T-S volumetric leakage rate at op. conditions = (0.867 lb/min) × (0.02165 ft^3/lb)

0-45.5 hr P-T-S iodine volumetric leakage rate at op. conditions = 0.0188 cfm of RCS liquid

The steam mass release is equivalent to the liquid mass release. To maximize the liquid volume release, the intact SG is modeled with a maximum liquid specific volume.

Unit 1 SG saturated steam pressure @ full power = 806.8 psia (Ref. 9.3.1, Item #32)

Unit 1 SG liquid specific volume = 0.02089 ft^3/lbm (Ref. 9.11, page 182)

Unit 2 SG saturated steam pressure @ full power = 728 psia (Ref. 9.3.1, Item #32)

Unit 2 SG liquid specific volume = 0.02061 ft^3/lbm (Ref. 9.11, page 182)

Unit 1 SG liquid specific volume of 0.02089 ft^3/lbm is conservatively used in the following section:

Iodine partition coefficient of 1 is used in the first 2 hours of the event, due to assumed SG tube uncovery.

Iodine partition coefficient of 10 is used 2 hours after onset of the event following SG level recovery.

Total mass of steam released from intact SG to the environment (0 – 2 hr) = 226,414 lb (Ref. 9.3.4, Attachment A)

Intact SG steaming rate (0 – 2 hr) = $\frac{226{,}414 \text{ lb} \times 0.02089 \text{ ft}^3/\text{lb}}{120 \text{ minutes}}$ x (1/1) = 39.42 cfm of Intact SG liquid

Total mass of steam released from intact SG to the environment (2 – 8 hr) = 406,952 (Ref. 9.3.4, Attachment A)

Intact SG steaming rate (2 – 8 hr) = $\frac{406{,}952 \text{ lb} \times 0.02089 \text{ ft}^3/\text{lb}}{360 \text{ minutes}}$ x (1/10) = 2.361 cfm of Intact SG liquid

Total mass of steam released from intact SG to the environment (8 – 24 hrs) = 796,899 lb (Ref. 9.3.4, Attachment A)

Intact SG steaming rate (8 – 24 hr) = $\frac{796{,}899 \text{ lb} \times 0.02089 \text{ ft}^3/\text{lb}}{960 \text{ minutes}}$ x (1/10) = 1.734 cfm of Intact SG liquid

Total mass of steam released from intact SG to the environment (24 – 45.5 hrs) = 863,053 lb (Ref. 9.3.4, Attachment A)

Intact SG steaming rate (24 – 45.5 hr) = $\frac{863{,}053 \text{ lb} \times 0.02089 \text{ ft}^3/\text{lb}}{1290 \text{ minutes}}$ x (1/10) = 1.398 cfm of Intact SG liquid

0-45.5 hr iodine P-T-S leakage from RCS to intact SG = 0.0188 cfm of RCS liquid

0 - 2 hr iodine P-T-S leakage release from intact SG to the environment = 39.42 cfm of Intact SG liquid

2 - 8 hr iodine P-T-S leakage release from intact SG to the environment = 2.361 cfm of Intact SG liquid

8 - 24 hr iodine P-T-S leakage release from intact SG to the environment = 1.734 cfm of Intact SG liquid

24 – 45.5 hr iodine P-T-S leakage release from intact SG to the environment = 1.398 cfm of Intact SG liquid

7.3.3 Intact SG - Noble Gas Release Rate (P-T-S Leakage):

No noble gas hold-up or decay is modeled in the Intact SG. All RCS mass released to the intact SG is treated as if it were released directly to the environment.

RCS release rate into Intact SG = 0.104 gpm (Section 7.3.2)

RCS specific volume = 0.02165 ft^3/lbm (Section 7.1)

P-T-S volumetric leakage rate at measured conditions = (0.104 gal/min) × (0.13368 ft^3/gal) = 0.01390 cfm

P-T-S mass leakage rate at measured conditions = (0.01390 ft^3/min) × (62.4 lb/ft^3) = 0.867 lb/min

Therefore, the noble gas P-T-S volumetric leakage rate into the intact SG during the MSLB is:

0-45.5 hr P-T-S volumetric leakage rate at op. conditions = (0.867 lb/min) × (0.02165 ft^3/lb)

0-45.5 hr P-T-S noble gas volumetric leakage rate at op. conditions = 0.0188 cfm of RCS liquid

7.3.4 Faulted SG – Iodine Release Rate – Secondary Liquid

Steam mass released from faulted SG (0 – 10 minutes) = 107,100 lb (entire faulted SG liquid mass assumed to dry out in 10 minutes)

Steam mass released from faulted SG (10 minutes -45.5 hrs) = 0 lb

Unit 1 SG saturated steam pressure @ full power = 806.8 psia (Ref. 9.13.1, Item #32)

Unit 1 SG liquid specific volume = 0.02089 ft^3/lbm (Ref. 9.11, page 182)

Unit 2 SG saturated steam pressure @ full power = 728 psia (Ref. 9.3.1, Item #32)

Unit 2 SG liquid specific volume = 0.02061 ft^3/lbm (Ref. 9.11, page 182)

Unit 1 SG specific volume of 0.02089 ft^3/lbm is conservatively used in the following section:

Iodine partition coefficient = 1.0 (no credit taken for secondary liquid iodine retention in faulted SG liquid)

0-0.167 hr Faulted SG steaming rate = $\frac{107{,}100 \text{ lb} \times 0.02089 \text{ ft}^3/\text{lb} \times (1/1.0)}{10 \text{ minutes}}$ = 223.73 cfm of Faulted SG liquid

0-0.167 hr iodine release from faulted SG secondary liquid to the envion. = 223.73 cfm of Faulted SG liquid

0.167-45.5 hr iodine release from faulted SG secondary liquid to the environ. = 0.0 cfm of Faulted SG liquid

7.3.5 Intact SG – Iodine Release Rate – Secondary Liquid

The steaming rates for the secondary liquid iodine releases from the intact steam generator are the intact SG iodine release rates from Section 7.3.2. An iodine partition coefficient of 1 is conservatively applied to the intact steam generator prior to 2 hours, and an iodine PC of 10 is conservatively applied to the intact steam generator after 2 hours (i.e., credit is taken for secondary liquid iodine retention in the intact SG liquid):

0 - 2 hr iodine secondary liquid release from intact SG to the environment = 39.42 cfm of Intact SG liquid

2 - 8 hr iodine secondary liquid release from intact SG to the environment = 2.361 cfm of Intact SG liquid

8 - 24 hr iodine secondary liquid release from intact SG to the environment = 1.734 cfm of Intact SG liquid

24 – 45.5 hr iodine secondary liquid release from intact SG to the environment = 1.398 cfm of Intact SG liquid

7.4 Fuel Activity Release Rate for Concurrent Iodine Spike Model

The release rate from the source node – fuel to RCS – is calculated such that 99% of the activity in the fuel is released to the RCS in the eight hour duration of the concurrent iodine spike (Ref. 9.1, Appendix E, Section 2.2). The 1% of the activity remaining in the fuel is an insignificant dose contribution. The volume of the fuel is inconsequential, given that 99% of the activity will be released irrespective of the fuel volume.

$A = A_0 e^{-\lambda t}$

Where;

A_0 = Initial Activity in Fuel Node

A = Final Activity in Fuel Node

λ = Removal Rate (vol/hr)

t = Removal Time (hr) = 8.0 hr

Assuming that 99% of activity is released into the environment,

$A/A_0 = 0.01$

Therefore,

$A / A_0 = e^{-\lambda t}$

$0.01 = e^{-8\lambda}$

$\ln(0.01) = -8\lambda \ln(e)$

$-4.605 = -8\lambda$

$\lambda = -4.605/-8 = 0.5756$ volume/hr

Assuming an arbitrary fuel volume of 1,000 cubic feet, the Fuel Release Rate is:

$= 0.5756$ 1/hr x 1,000 ft^3 x 1 hr/60 min $\cong 9.60$ ft^3/min

7.5 CRSVS Filter Efficiency

The CRSVS charcoal and HEPA filter efficiencies are calculated based on Generic Letter (GL) 99-02 requirements (Ref. 9.10).

7.5.1 CRSVS Charcoal Filter Efficiency

Laboratory penetration testing acceptance criteria for the safety related Charcoal filters are as follows:

CRSVS Charcoal Filter – in-laboratory testing methyl iodide penetration < 2.5% (Ref. 9.6.8, Section 5.5.9.c)

Generic Letter 99-02 (Ref. 9.10) requires a safety factor of at least 2 to be used to determine the filter efficiencies to be credited in the design basis accident.

Testing methyl iodide penetration (%) = (100% - η)/safety factor = (100% - η)/2

Where η = charcoal filter efficiency to be credited in the analysis

CRSVS Charcoal Filter

2.5% = (100% - η)/2

5% = (100% - η)

η = 100% - 5% = 95%

7.5.2 CRSVS HEPA Filter Efficiency

CRSVS HEPA Filter – in-place DOP penetration < 0.05% (Ref. 9.6.8, Section 5.5.9.a)

Generic Letter 99-02 (Ref. 9.10) requires a safety factor of at least 2 to be used to determine the filter efficiencies to be credited in the design basis accident.

Testing DOP penetration (%) = (100% - η)/safety factor = (100% - η)/2

Where η = HEPA filter efficiency to be credited in the analysis

CRSVS HEPA Filter

0.05% = (100% - η)/2

0.10% = (100% - η)

η = 100% - 0.10% = 99.9%

HEPA filter efficiency of 99% is used in the analysis

Safety Grade	Filter Efficiency Credited (%)

Filter	Aerosol	Elemental	Organic
CRSVS	99	95	95

8.0 RESULTS SUMMARY/CONCLUSIONS:

8.1 Result Summary:

8.1.1 The results of the MSLB accident with the pre-accident iodine spike are summarized in the following table:

	MSLB Accident - Preaccident Iodine Case TEDE Dose (rem)		
	Receptor Location		
	Control Room	**EAB**	**LPZ**
P-T-S Iodine Release FSG PMSFPI01.o0	1.16E-01	2.63E-02 (occurs at t = 24.0 hrs)	1.57E-02
Dryout SG Liquid Iodine Release FSG PMSFPDLI01.o0	8.75E-02	3.18E-02 (occurs at t = 0.0 hrs)	8.68E-03
P-T-S NG Release FSG PMSFPNG01.o0	1.85E-03	1.43E-03 (occurs at t = 0.0 hrs)	1.68E-03
P-T-S Iodine Release ISG PMSINPI01.o0	2.63E-01	1.10E-02 (occurs at t = 0.0 hrs)	9.52E-03
Liquid Iodine Release ISG PMSINPLI01.o0	2.50E-01	4.05E-02 (occurs at t = 0.0 hrs)	1.14E-02
P-T-S NG Release ISG PMSINPNG01.o0	1.15E-03	1.48E-04 (occurs at t = 0.0 hrs)	1.69E-04
External Cloud*	4.51E-02	0.00E+00	0.00E+00
CR Filter Shine*	2.33E-02	0.00E+00	0.00E+00
Total	7.88E-01	1.11E-01	4.71E-02
Allowable TEDE Limit	**5.00E+00**	**2.50E+01**	**2.50E+01**

FSG = Faulted SG ISG = Intact SG

* Post-LOCA External Cloud & CR Filter Shine Doses Used From Reference 9.18, Section 8.1

8.1.2 The results of the MSLB accident with the concurrent iodine spike are summarized in the following table:

	MSLB Accident - Concurrent Iodine Case TEDE Dose (rem)		
	Receptor Location		
	Control Room	**EAB**	**LPZ**
P-T-S Iodine Release FSG PMSFCI01.o0	1.13E+00	3.53E-01 (occurs at t = 24.0 hrs)	1.47E-01
Dryout SG Liquid Iodine Release FSG PMSFPDLI01.o0	8.75E-02	3.18E-02 (occurs at t = 0.0 hrs)	8.68E-03
P-T-S NG Release FSG PMSFCNG01.o0	1.52E-03	9.55E-04 (occurs at t = 2.6 hrs)	1.36E-03
P-T-S Iodine Release ISG PMSINCI01.o0	2.50E+00	1.23E-01 (occurs at t = 24.0 hrs)	8.99E-02
Liquid Iodine Release ISG PMSINPLI01.o0	2.50E-01	4.05E-02 (occurs at t = 0.0 hrs)	1.14E-02
P-T-S NG Release ISG PMSINCNG01.o0	9.19E-04	9.96E-05 (occurs at t = 2.6 hrs)	1.36E-04
External Cloud*	4.51E-02	0.00E+00	0.00E+00
CR Filter Shine*	2.33E-02	0.00E+00	0.00E+00
Total	4.04E+00	5.49E-01	2.58E-01
Allowable TEDE Limit	**5.00E+00**	**2.50E+00**	**2.50E+00**

8.2 Conclusions:

The results of MSLB accident analyses in Sections 8.1.1 & 8.1.2 indicate that the EAB, LPZ, and CR doses due to a MSLB accident are within their allowable limits. The calculated doses have adequate margins over the allowable dose limits for future safe operation of the plant. The proposed new LCO 3.4.17 for Reactor Coolant System Specific Activity is 580 μCi/gm DE of XE-133 based on the primary coolant noble gas activity corresponding to 1% failed fuel with the following changes:

- Delete the definition of "E-Bar," AVERAGE DISINTEGRATION ENERGY
- Add a new definition for DOSE EQUIVALENT XE-133
- Revise definition for DOSE EQUIVALENT I-131 to refer to FGR-11 Effective inhalation dose conversion factors
- Revise LCO 3.4.17, "RCS Specific Activity, to delete references to gross specific activity
- Reference limit on DOSE EQUIVALENT XE-133
- Revise SR 3.4.16.1 to verify the limit for DOSE EQUIVALENT XE-133

9.0 REFERENCES:

1. U.S. NRC Regulatory Guide 1.183, Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, July 2000
2. S.L. Humphreys et. al., "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation," NUREG/CR-6604, USNRC, December 1997
3. Design Input Transmittal Nos.
   - 3.1 DIT No. 13720-08, Rev. 1, MSLB Input Parameters
   - 3.2 DIT No. 13720-07, Rev. 1, Control Room Input Parameters
   - 3.3 DIT No. 13720-03, Rev. 0, Meteorological Input Parameters
   - 3.4 DIT No. 13720-16, Rev 0, Steam Release Pathway Inputs for Main Steam Line Break (MSLB), Steam Generator Tube Rupture (SGTR), Locked Rotor Accident (LRA) and Control Rod Ejection Accident (CREA)
4. PINGP Calculation No. GEN-PI-080, Rev 1, Prairie Island Atmospheric Dispersion Factors (χ/Qs) – AST Additional Releases
5. PINGP Calculation No. GEN-PI-049, Rev 0 (including Addendum 2), PI Control Room Atmospheric Dispersion Factors (χ/Q)
6. PINGP Units 1 & 2 Technical Specifications (TS):
   - 6.1 Specification 1.1, PINGP Units 1 & 2, Rated Thermal Power
   - 6.2 Specification 1.1, PINGP Units 1 & 2, Dose Equivalent I-131
   - 6.3 Specification 1.1, PINGP Units 1 & 2, E-bar Average Disintegration Energy
   - 6.4 Specification 3.7.14, PINGP Units 1 & 2 Limiting Condition for Operation (LCO) for Secondary Specific Activity
   - 6.5 Specification 3.4.17, PINGP Units 1 & 2 LCO for RCS Specific Activity
   - 6.6 PINGP Units 1 & 2 TS Figure 3.4.17-1 for Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity Limit Versus Percentage of RATED THERMAL POWER
   - 6.7 Specification 3.4.14, PINGP Units 1 & 2 LCO FOR RCS Operational Leakage
   - 6.8 Specification 5.5.9, PINGP Units 1 & 2 Ventilation Filter Testing Program (VFTP)
   - 6.9 PINGP Units 1 & 2 TS Basis B3.4.14
   - 6.10 PINGP Units 1 & 2 TS Basis B3.3.6
   - 6.11 Specification 3.3.6, PINGP Units 1 & 2 LCO for Control Room Special Ventilation System (CRSVS) Actuation Instrument and Table 3.3-6, PINGP Unit 1/Unit 2 LCO for Radiation Monitoring Instrumentation
   - 6.12 Specification 3.7.10, PINGP Units 1 & 2 LCO for Control Room Special Ventilation System (CRSVS)
7. Federal Guidance Report 11, EPA-520/1-88-020, Environmental Protection Agency
8. Federal Guidance Report 12, EPA-402-R-93-081, Environmental Protection Agency

9. Westinghouse Letter NSP-07-59 LTR-PEP-07-26, Nuclear Management Company, Prairie Island Units 1 & 2, MUR Power Uprate Program, Core Activity Inventory and Coolant Activity Concentration, November 2, 2007.

10. USNRC Generic Letter 99-02, "Laboratory Testing of Nuclear-Grade Activated Charcoal", June 3, 1999

11. ASME Steam Tables, Sixth Edition

12. 10 CFR 50.67, "Accident Source Term"

13. Technical Specification Task Force Improved Standard Technical Specifications Change Traveler TSTF-490, Rev 0, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec"

14. Prairie Island Nuclear Generating Plant, Units 1 And 2 - Issuance Of Amendments Re: Revision To Loss-Of-Coolant (LOCA) Accident And Main Steam Line Break (MSLB) Accident Radiological Dose Consequences Analyses And Affected Technical Specifications (TAC Nos. MD9140 And MD9141)

15. PINGP Procedure Nos:

    15.1 1ES-0.3A, Rev 14, Natural Circulation Cooldown With CRDM Fans

    15.2 1ES-0.3B, Rev 11, Natural Circulation Cooldown Without CRDM Fans

16. PINGP Drawing No. NF-38513, Rev T, Architectural, Plant Roof Plan

17. NUREG-0800, Standard Review Plan, "Radiological Consequence Analyses Using Alternative Source Terms," SRP 15.0.1, Rev. 0, July 2000

18. PINGP Calculation No. GEN-PI-079, Rev 0, Post-LOCA EAB, LPZ, and CR Doses - AST

19. PINGP Calculation No.12400604-UR(B)-005, Rev 0, Dose Consequences At The Site Boundary & Control Room Following a MSLB

20. PINGP USAR Section 14.5.5.6, Rev 29P, Dose Analysis for MSLB Outside Containment

21. PINGP USAR Section 4.3.2.1.1, Rev 28, Steam Generators

22. PINGP USAR Section 10.2.3.2.4.b, Rev 29, Letdown Orifices

23. PINGP USAR Table 10.2-7, Rev 27, Chemical and Volume control System Performance Requirements

24. PINGP Flow Diagram No. NF-39603-1, Rev 76, Including T-Mod EC 14090, Admin Bldg, Screen House, & Control RM Flow Diagram

25. PINGP Emergency Plan Implementing Procedure No. F3-20, Rev 22, Determination of Radioactive Release Concentrations

26. PINGP Operating Procedure Nos.

    26.1 1C1.3, Rev 68, Unit 1 Shutdown

    26.2 2C1.3, Rev 67, Unit 2 Shutdown

27. PINGP Calculation No. 12400604-UR(B)-001, Rev 0, ARCON96 Atmospheric Dispersion Factors (χ/Qs) for Post-LOCA Gaseous Releases

10.0 TABLES:

Table 1
Iodine Isotopic Dose Conversion Factors

Isotope	Isotopic Dose Conversion Factor (Sv/Bq) A	Conversion Factor (rem/Ci/Sv/Bq) B	Iodine Dose Conversion Factor (rem/Ci) C=AxB
I-131	2.92E-07	3.70E+12	1.08E+06
I-132	1.74E-09	3.70E+12	6.44E+03
I-133	4.86E-08	3.70E+12	1.80E+05
I-134	2.88E-10	3.70E+12	1.07E+03
I-135	8.46E-09	3.70E+12	3.13E+04

A From Reference 9.7, Page 136

Table 2
Iodine Scaling Factor for Dose Equivalent I-131

Isotope	1% Failed Fuel Iodine Activity Concentration (µCi/gm) A	Iodine Dose Conversion Factor (rem/Ci) B	Product (µCi.rem / Ci.gm) (A x B)
I-131	2.55E+00	1.08E+06	2.75E+06
I-132	2.80E+00	6.44E+03	1.80E+04
I-133	3.88E+00	1.80E+05	6.98E+05
I-134	5.82E-01	1.07E+03	6.20E+02
I-135	2.20E+00	3.13E+04	6.89E+04
Total			3.54E+06

A From Reference 9.9, Table 2-2 for HB x 1.04

DE I-131 Based on 1% FF Iodine Concentration	3.28E+00
Iodine Scaling Factor Based on 0.50 µCi/gm DE I-131	1.526E-01

Table 3
Pre-accident Iodine Spike RCS Isotopic Iodine Concentration

Isotope	Normal Iodine Activity Concentration (µCi/gm) A	Iodine Scaling Factor B	0.50 µCi/gm DE I-131 Activity Concentration (µCi/gm) C = A x B
I-131	2.55E+00	1.526E-01	3.891E-01
I-132	2.80E+00	1.526E-01	4.272E-01
I-133	3.88E+00	1.526E-01	5.920E-01
I-134	5.82E-01	1.526E-01	8.880E-02
I-135	2.20E+00	1.526E-01	3.357E-01

A From Reference 9.9, Table 2-2 for HB x 1.04
B Scaling Factor Based on 0.5 µCi/gm DE I-131 From Table 2

Table 4
Total RCS Iodine Activity – Pre-accident Iodine Spike Case

Isotope	Tech Spec RCS Activity Concentration (µCi/gm) A	Reactor Coolant Mass (gm) B	Total RCS Activity	
			0.50 µCi/gm DE I-131 (Ci) C=AxB/1E-6	30.0 µCi/gm DE I-131 (Ci) Cx60
I-131	3.891E-01	1.497E+08	5.825E+01	3.495E+03
I-132	4.272E-01	1.497E+08	6.396E+01	3.837E+03
I-133	5.920E-01	1.497E+08	8.862E+01	5.317E+03
I-134	8.880E-02	1.497E+08	1.329E+01	7.976E+02
I-135	3.357E-01	1.497E+08	5.025E+01	3.015E+03

A From Table 3
B Reactor coolant mass from Section 7.1

Table 5
Dose Equivalent of Xenon-133

Noble Gas Nuclide	1% Failed Fuel RCS Activity (µCi/gm) A	Submersion Dose Coefficient (Sv / Bq s m^3) B	Product (µCi/gm * Sv / Bq s m3) C = A x B
KR-85	1.09E+01	1.19E-16	1.297E-15
KR-85M	1.59E+00	7.48E-15	1.189E-14
KR-87	1.03E+00	4.12E-14	4.244E-14
KR-88	2.89E+00	1.02E-13	2.948E-13
XE-131M	2.05E+00	3.89E-16	7.975E-16
XE-133	2.60E+02	1.56E-15	4.056E-13
XE-133M	3.65E+00	1.37E-15	5.001E-15
XE-135	8.24E+00	1.19E-14	9.806E-14
XE-135M	5.02E-01	2.04E-14	1.024E-14
Xe-138	6.09E-01	5.77E-14	3.514E-14
Total (µCi/gm * Sv / Bq s m^3)			**9.052E-13**
Xe-133 DE Based on 1% FF NG Concentration			**580**

A From Reference 9.9, Table 2-2 for HB x 1.04 (Kr-83M omitted per Xe-133 DE definition)
B From FGR 12, Table III.1 (Ref. 9.8)

Table 5A
Total RCS Noble Gas Activity - Pre-accident Iodine Spike

Isotope	Noble Gas Activity Concentration (µCi/gm) A	Primary Coolant Mass (gm) B	Total Noble Gas Activity (Ci) C=(AxB/1E6)
Kr-83m	3.92E-01	1.497E+08	5.868E+01
Kr-85m	1.59E+00	1.497E+08	2.380E+02
Kr-85	1.09E+01	1.497E+08	1.632E+03
Kr-87	1.03E+00	1.497E+08	1.542E+02
Kr-88	2.89E+00	1.497E+08	4.326E+02
Xe-131m	2.05E+00	1.497E+08	3.069E+02
Xe-133m	3.65E+00	1.497E+08	5.464E+02
Xe-133	2.60E+02	1.497E+08	3.892E+04
Xe-135m	5.02E-01	1.497E+08	7.515E+01
Xe-135	8.24E+00	1.497E+08	1.234E+03
Xe-138	6.09E-01	1.497E+08	9.117E+01

A From Table 5 (with Kr-83M per Reference 9.9, Table 2-2 for HB x 1.04)
B From Section 7.1

Table 6
Total Iodine & Noble Gas Activities in RCS
Pre-accident Iodine Spike

Isotope	Iodine & Noble Gas Total Activity (Ci) A	Core Thermal Power (MW_t) B	RADTRAD Nuclide Inventory File (Ci/MW_t) C=A/B
I-131	3.495E+03	1683	.2076E+01
I-132	3.837E+03	1683	.2280E+01
I-133	5.317E+03	1683	.3159E+01
I-134	7.976E+02	1683	.4739E+00
I-135	3.015E+03	1683	.1791E+01
Kr-83m	5.868E+01	1683	.3487E-01
Kr-85m	2.380E+02	1683	.1414E+00
Kr-85	1.632E+03	1683	.9695E+00
Kr-87	1.542E+02	1683	.9162E-01
Kr-88	4.326E+02	1683	.2571E+00
Xe-131m	3.069E+02	1683	.1823E+00
Xe-133m	5.464E+02	1683	.3247E+00
Xe-133	3.892E+04	1683	.2313E+02
Xe-135m	7.515E+01	1683	.4465E-01
Xe-135	1.234E+03	1683	.7329E+00
Xe-138	9.117E+01	1683	.5417E-01

A - Iodine Activity from Table 4
A - Noble gas activity from Table 5A
B - Isotopic Core Inventory From Reference 9.9, Table 2-1 based on 1683 MWt

Table 7
Iodine Isotopic Decay Constant

Isotope	Half Life $T_{1/2}$ A	Half Life $T_{1/2}$ (second) Bi	Decay Constant λ $(sec)^{-1}$ Ci=(LN2)/Bi
I-131	8.04d	694656	9.978E-07
I-132	2.30h	8280	8.371E-05
I-133	20.8h	74880	9.257E-06
I-134	52.6m	3156	2.196E-04
I-135	6.61h	23796	2.913E-05

A from Reference 9.8, Appendix A

Table 8
Iodine Appearance Rate for Concurrent Iodine Spike

Isotope	0.50 µCi/gm DE I-131 Iodine Activity (Ci) A	Decay Constant λ $(sec)^{-1}$ B	Letdown Purification Removal Rate $(sec)^{-1}$ C	Iodine Appearance Rate (Ci/sec) D=Ax(B+C)	Iodine Spike Appearance Rate (Ci/sec) E=Dx500
I-131	5.825E+01	9.978E-07	5.654E-05	3.351E-03	1.676
I-132	6.396E+01	8.371E-05	5.654E-05	8.970E-03	4.485
I-133	8.862E+01	9.257E-06	5.654E-05	5.831E-03	2.916
I-134	1.329E+01	2.196E-04	5.654E-05	3.671E-03	1.836
I-135	5.025E+01	2.913E-05	5.654E-05	4.305E-03	2.152
Total Appearance Rate (Ci/sec)					13.064

A From Table 4
B From Table 7
C From Section 7.2

Table 9
Total Iodine Activity In Fuel - Concurrent Iodine Spike

Isotope	Iodine Spike Appearance Rate (Ci/sec) A	Concurrent Iodine Spike Duration (hrs) B	Concurrent Iodine Spike Total Iodine Activity (Ci) AxBx3600
I-131	1.676	8	4.826E+04
I-132	4.485	8	1.292E+05
I-133	2.916	8	8.397E+04
I-134	1.836	8	5.287E+04
I-135	2.152	8	6.199E+04

A From Table 8
B From Reference 9.1, Appendix E, Section 2.2

Table 10
Total Iodine & Noble Gas Activities In Fuel
Concurrent Iodine Spike

Isotope	Iodine & Noble Gas Total Activity (Ci) A	Core Thermal Power (MW_t) B	RADTRAD Nuclide Inventory File (Ci/MW_t) C=A/B
I-131	4.826E+04	1683	.2867E+02
I-132	1.292E+05	1683	.7675E+02
I-133	8.397E+04	1683	.4989E+02
I-134	5.287E+04	1683	.3141E+02
I-135	6.199E+04	1683	.3683E+02
Kr-83m	5.868E+01	1683	.3487E-01
Kr-85m	2.380E+02	1683	.1414E+00
Kr-85	1.632E+03	1683	.9695E+00
Kr-87	1.542E+02	1683	.9162E-01
Kr-88	4.326E+02	1683	.2571E+00
Xe-131m	3.069E+02	1683	.1823E+00
Xe-133m	5.464E+02	1683	.3247E+00
Xe-133	3.892E+04	1683	.2313E+02
Xe-135m	7.515E+01	1683	.4465E-01
Xe-135	1.234E+03	1683	.7329E+00
Xe-138	9.117E+01	1683	.5417E-01

A - Iodine activity from Table 9
A - Noble gas from Table 6
B From Reference 9.6.1

Table 11
Secondary Side Iodine Activity - Faulted/Intact Steam Generators

Isotope	0.50 µCi/gm DE I-131 Activity Concentration (µCi/gm) A	Tech Spec Secondary Coolant Activity Limit (µCi/gm) B	Coolant Mass In Intact Steam Generator (gm) C	Secondary Side Activity (Ci) D=AxBxC/0.50 x1E6	Core Thermal Power (MW_t) E	RADTRAD Nuclide Inventory File (Ci) F=D/E
I-131	3.891E-01	0.10	4.873E+07	3.792	1683	.2253E-02
I-132	4.272E-01	0.10	4.873E+07	4.164	1683	.2474E-02
I-133	5.920E-01	0.10	4.873E+07	5.770	1683	.3428E-02
I-134	8.880E-02	0.10	4.873E+07	0.865	1683	.5142E-03
I-135	3.357E-01	0.10	4.873E+07	3.271	1683	.1944E-02

A From Table 3
B From References 9.6.4
C From Section 7.1
E - Isotopic Core Inventory From Reference 9.9, Table 2-1 based on 1683 MWt

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Table 12
Faulted SG Release

Release Category	Faulted SG P-T-S Leakage	
	Pre-Dryout (cfm) A	Post-Dryout (cfm) B
Iodine Release	0.181 0-0.167 hr	0.181 0.167-75 hr
Noble Gas Release	0.181 0-75 hr	
SG Liquid Iodine Release	223.73 0-0.167 hr	0.00 > 0.167 hr
Release Point	Common Area of AB	

A & B For Iodine & Noble Gas Releases From Section 7.3.1

A & B For SG Liquid Iodine Release From Section 7.3.5

Table 13
Post-MSLB Intact SG Release

Release Category	P-T-S Leakage To Intact SG (cfm) A	Intact SG Release Iodine, Noble gas, & SG Liquid Iodine Release			
		(cfm) B	(cfm) C	(cfm) D	(cfm) E
Iodine Release	0.0188 0-45.5 hr	39.42 0-2 hr	2.361 2-8 hr	1.734 8-24 hr	1.398 24-45.5
Noble Gas Release	0.0188 0-45.5 hr	0.0188 0-45.5 hr			
SG Liquid Iodine Release	N/A	3.942 0-2 hr	2.361 2-8 hr	1.734 8-24 hr	1.398 24-45.5
Release Point	Unit 2 Group 1 PORV Release Point				

A Through E For Iodine Release From Section 7.3.2
A Through E For Noble Gas Release From Section 7.3.3
B Through E For SG Liquid Iodine Release From 7.3.5

Table 14
Alkali Inhaled Isotopic Dose Conversion Factors

Isotope	Isotopic Dose Conversion Factor (Sv/Bq) A	Conversion Factor (rem/Ci/Sv/Bq) B	Iodine Dose Conversion Factor (rem/Ci) C=AxB	Fractional Iodine Dose Conversion Factor D=C/1.08E+06
I131	**2.92E-07**	**3.70E+12**	**1.08E+06**	**1.00E+00**
Rb-86	1.33E-09	3.70E+12	4.92E+03	4.56E-03
Rb-88	1.37E-12	3.70E+12	5.07E+00	4.69E-06
Rb-89	1.61E-12	3.70E+12	5.96E+00	5.52E-06
Cs-134	1.11E-08	3.70E+12	4.11E+04	3.80E-02
Cs-136	1.73E-09	3.70E+12	6.40E+03	5.93E-03
Cs-137	7.93E-09	3.70E+12	2.93E+04	2.72E-02
Cs-138	3.57E-12	3.70E+12	1.32E+01	1.22E-05

A From Reference 9.7, Table 2.1, Thyroid Inhalation

11.0 FIGURES:

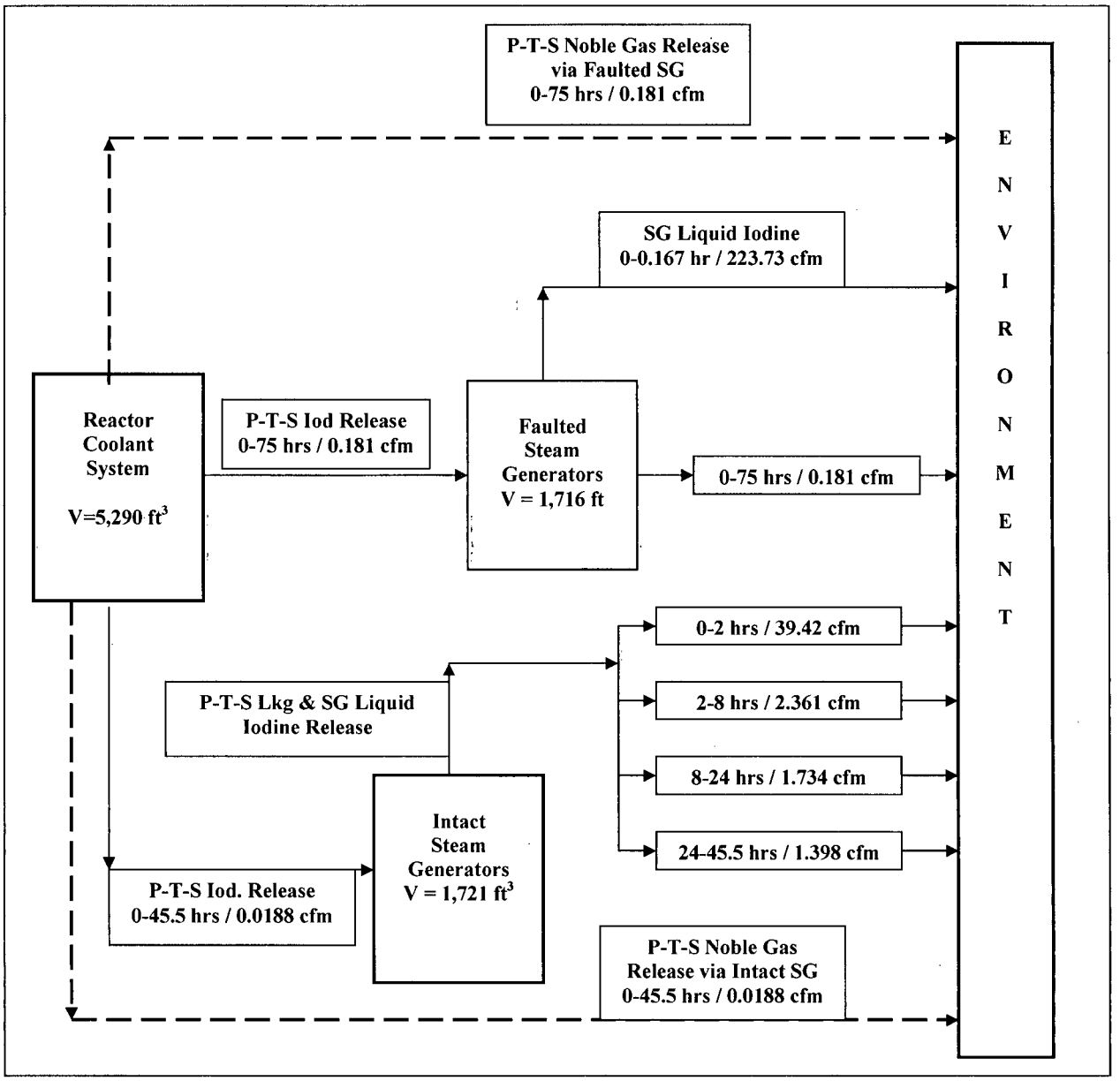

Figure 1: RADTRAD Nodalization For MSLB Pre-accident Iodine Spike Faulted/Intact SG Releases

——— P-T-S Leakage Iodine Release Path

— — Noble Gas Release Path

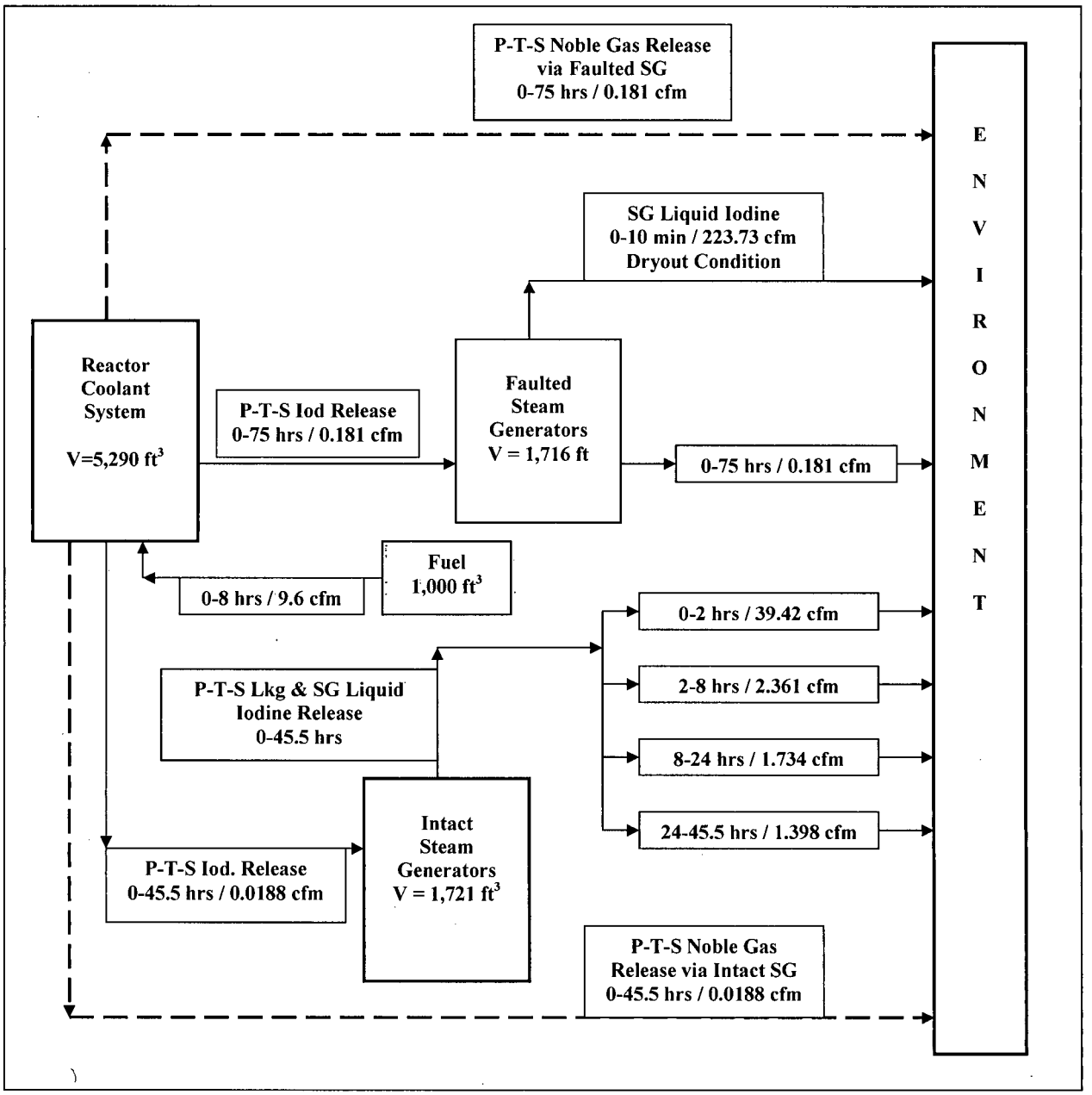

Figure 2: RADTRAD Nodalization For MSLB Concurrent Iodine Spike Faulted/Intact SG Releases

——— P-T-S Leakage Iodine Release Path

— — Noble Gas Release Path

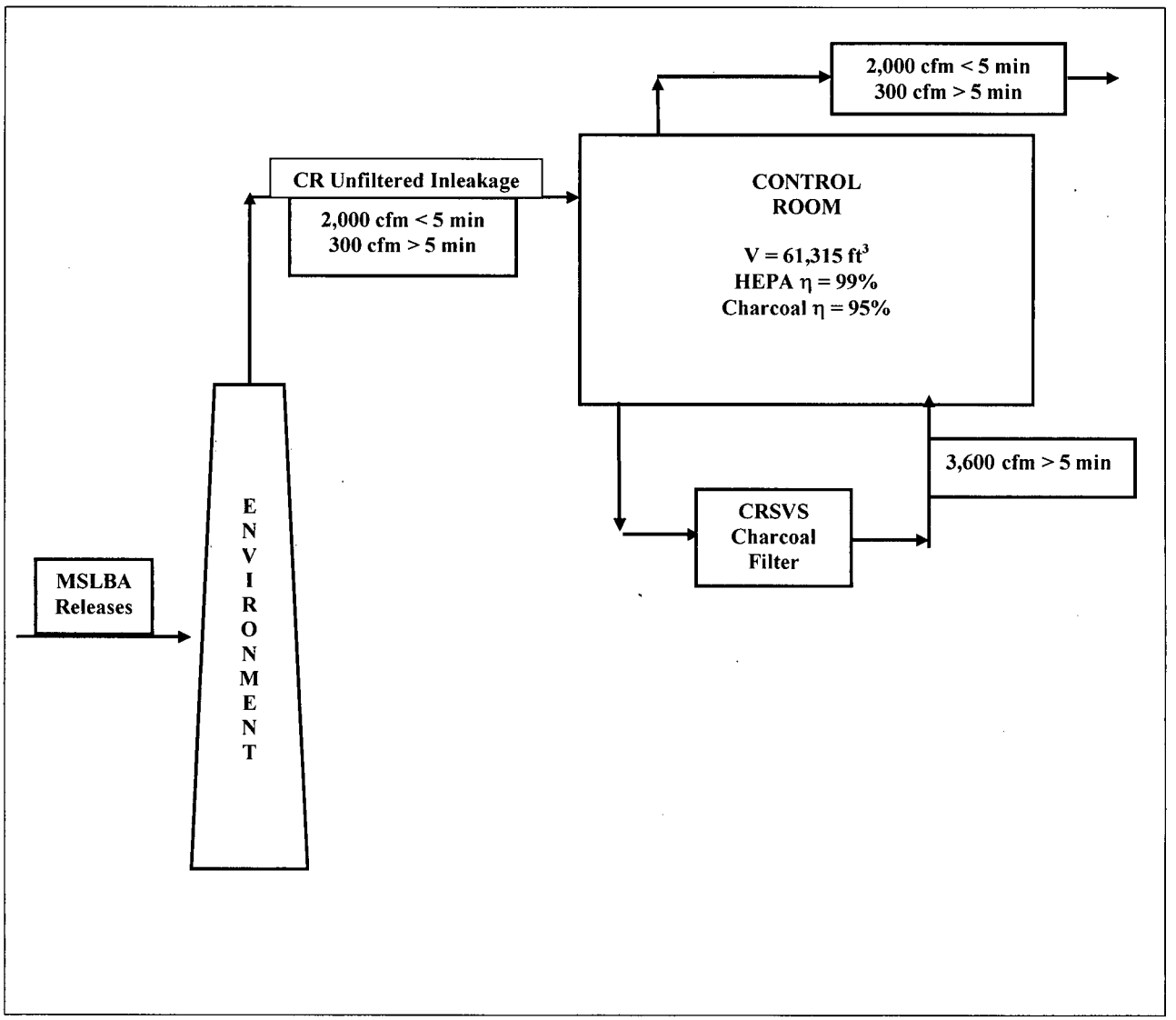

Figure 3 – PINGP Post-MSLBA Control Room Response AST RADTRAD Nodalization

12.0 AFFECTED DOCUMENTS:

Upon approval of the AST Licensing Change Request, the following documents will be revised or superseded:

12.1 PINGP Calculation No.12400604-UR(B)-005, Rev 0, Dose Consequences At The Site Boundary & Control Room Following a MSLB

12.2 PINGP USAR Section 14.5.5.6, Dose Analysis for MSLB Outside Containment

13.0 ATTACHMENTS:

Attachment 13.1	PMSFPI01.o0	P-T-S Iodine Release FSG
Attachment 13.2	PMSFPDLI01.o0	Dryout SG Liquid Iodine Release FSG
Attachment 13.3	PMSFPNG01.o0	P-T-S NG Release FSG
Attachment 13.4	PMSINPI01.o0	P-T-S Iodine Release ISG
Attachment 13.5	PMSINPLI01.o0	Liquid Iodine Release ISG
Attachment 13.6	PMSINPNG01.o0	P-T-S NG Release ISG
Attachment 13.7	PMSFCI01.o0	P-T-S Iodine Release FSG
Attachment 13.8	PMSFCNG01.o0	P-T-S NG Release FSG
Attachment 13.9	PMSINCI01.o0	P-T-S Iodine Release ISG
Attachment 13.10	PMSINCNG01.o0	P-T-S NG Release ISG

Attachment 13.1
RADTRAD Output File PMSFPI01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:30:23
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078\PMSFPI01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimspre_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt



    #####    ####   #####    #  #     #  #####   #    #  #####
    #    #  #       #        #  ##    #  #    #  #    #    #
    #    #  #       #        #  # #   #  #    #  #    #    #
    #####    ####   ####     #  #  #  #  #####   #    #    #
    #            #  #        #  #   # #  #       #    #    #
    #            #  #        #  #    ##  #       #    #    #
    #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Pre-accident Iodine Spike with Iodine Release
From Faulted SG During and Following Dryout
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimspre_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  4
Compartment 1:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
Compartment 2:
Faulted SG
  3
 1.7160E+03
  0
  0
  0
  0
  0
Compartment 3:
Environment
  2
 0.0000E+00
```

```
  0
  0
  0
  0
  0
Compartment 4:
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Pathways:
  5
Pathway 1:
RCS to Environment
  1
  3
  2
Pathway 2:
RCS to Faulted SG
  1
  2
  2
Pathway 3:
Environment to Control Room
  3
  4
  2
Pathway 4:
Control Room to Environment
  4
  3
  2
Pathway 5:
Faulted SG to  Environment
  2
  3
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
```

```
  0
Compartments:
  4
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  5
Pathway 1:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
```

```
  0
  0
  0
  0
  1
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  3
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  3
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
```

```
Effective Volume Location:
  1
  6
  0.0000E+00   4.7900E-03
  2.0000E+00   3.6000E-03
  8.0000E+00   1.6000E-03
  2.4000E+01   1.2100E-03
  9.6000E+01   9.5500E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o3
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:30:23
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   4

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: RCS to Environment
   Exit Pathway Number    2: RCS to Faulted SG

Compartment number  2
Name: Faulted SG
Compartment volume =   1.7160E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   2: RCS to Faulted SG
   Exit Pathway Number    5: Faulted SG to  Environment

Compartment number  3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  3
   Inlet Pathway Number   1: RCS to Environment
   Inlet Pathway Number   4: Control Room to Environment
   Inlet Pathway Number   5: Faulted SG to  Environment
   Exit Pathway Number    3: Environment to Control Room

Compartment number  4
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   3: Environment to Control Room
   Exit Pathway Number    4: Control Room to Environment

Total number of pathways =   5
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:30:23
#######################################################################

#######################################################################
                      Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	1.0000E+00	0.0000E+00	0.0000E+00	3.756E-02
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
I-131	2	2.076E+00	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	2.280E+00	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	3.159E+00	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	4.739E-01	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	1.791E+00	2.380E+04	8.294E-14	8.460E-09	3.320E-10

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01
Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: RCS

Compartment number 2: Faulted SG

Compartment number 3: Environment

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: RCS to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8100E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.5000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: RCS to Faulted SG

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-01	1.8100E-01	0.0000E+00	0.0000E+00	0.0000E+00
7.5000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: Faulted SG to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

```
  1.6700E-01    1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01    0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00

LOCATION DATA
     Location Exclusion Area Boundary     is in compartment   3

     Location X/Q Data
      Time (hr)          X/Q (s * m^-3)
       0.0000E+00           6.4900E-04
       7.2000E+02           0.0000E+00

     Location Breathing Rate Data
      Time (hr)          Breathing Rate (m^3 * sec^-1)
       0.0000E+00                 3.5000E-04
       7.2000E+02                 0.0000E+00
     Location Low Population Zone     is in compartment   3

     Location X/Q Data
      Time (hr)          X/Q (s * m^-3)
       0.0000E+00           1.7700E-04
       8.0000E+00           3.9900E-05
       2.4000E+01           7.1200E-06
       9.6000E+01           1.0400E-06
       7.2000E+02           0.0000E+00

     Location Breathing Rate Data
      Time (hr)          Breathing Rate (m^3 * sec^-1)
       0.0000E+00                 3.5000E-04
       8.0000E+00                 1.8000E-04
       2.4000E+01                 2.3000E-04
       7.2000E+02                 0.0000E+00
     Location Control Room     is in compartment   4

     Location X/Q Data
      Time (hr)          X/Q (s * m^-3)
       0.0000E+00           4.7900E-03
       2.0000E+00           3.6000E-03
       8.0000E+00           1.6000E-03
       2.4000E+01           1.2100E-03
       9.6000E+01           9.5500E-04
       7.2000E+02           0.0000E+00

     Location Breathing Rate Data
      Time (hr)          Breathing Rate (m^3 * sec^-1)
       0.0000E+00                 3.5000E-04
       7.2000E+02                 0.0000E+00

     Location Occupancy Factor Data
      Time (hr)          Occupancy Factor
       0.0000E+00            1.0000E+00
       2.4000E+01            6.0000E-01
       9.6000E+01            4.0000E-01
       7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time             Time step
      0.0000E+00       1.0000E-01
      2.0000E+00       5.0000E-01
      8.0000E+00       1.0000E+00
      2.4000E+01       2.0000E+00
```

```
9.6000E+01        4.0000E+00
7.2000E+02        0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:30:23
#######################################################################

     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #

#######################################################################
           Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.7949E-06	4.4804E-03	1.4952E-04
Accumulated dose (rem)	9.7949E-06	4.4804E-03	1.4952E-04

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6713E-06	1.2219E-03	4.0778E-05
Accumulated dose (rem)	2.6713E-06	1.2219E-03	4.0778E-05

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.0081E-09	9.0583E-05	2.8319E-06
Accumulated dose (rem)	7.0081E-09	9.0583E-05	2.8319E-06

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
I-131	6.4084E-05	5.1691E-13	2.3763E+12	2.1811E+07
I-132	7.0306E-05	6.8111E-15	3.1074E+10	2.3938E+07
I-133	9.7504E-05	8.6073E-14	3.8973E+11	3.3187E+07
I-134	1.4587E-05	5.4682E-16	2.4575E+09	4.9698E+06
I-135	5.5266E-05	1.5737E-14	7.0200E+10	1.8812E+07
Xe-131m	5.0244E-12	5.9985E-20	2.7575E+05	2.5908E-01
Xe-133	1.5295E-09	8.1714E-18	3.6999E+07	7.8873E+01
Xe-133m	1.0962E-10	2.4430E-19	1.1062E+06	5.6526E+00
Xe-135	1.0523E-08	4.1208E-18	1.8382E+07	5.4261E+02
Xe-135m	6.6158E-08	7.2627E-19	3.2398E+06	3.4025E+03

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	6.0003E+07	0.0000E+00
Elemental I (atoms)	2.7836E+12	0.0000E+00
Organic I (atoms)	8.6092E+10	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	4.7428E-14
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	5.6171E-14
Total I (Ci)		3.0175E-04

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.8259E+06
Elemental I (atoms)	0.0000E+00	2.7903E+12
Organic I (atoms)	0.0000E+00	8.6297E+10
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	2.7510E+04	0.0000E+00
Elemental I (atoms)	6.5406E+09	0.0000E+00
Organic I (atoms)	2.0229E+08	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.3342E-04	1.9836E-01	6.6194E-03
Accumulated dose (rem)	4.4321E-04	2.0284E-01	6.7689E-03

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1820E-04	5.4098E-02	1.8053E-03
Accumulated dose (rem)	1.2088E-04	5.5320E-02	1.8461E-03

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.5442E-06	1.1049E-01	3.4544E-03
Accumulated dose (rem)	8.5512E-06	1.1058E-01	3.4572E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
I-131	2.6873E-03	2.1676E-11	9.9645E+13	2.8554E+10
I-132	2.8790E-03	2.7892E-13	1.2725E+12	3.0958E+10
I-133	4.0790E-03	3.6008E-12	1.6304E+13	4.3394E+10
I-134	5.7451E-04	2.1536E-14	9.6785E+10	6.3002E+09
I-135	2.2989E-03	6.5460E-13	2.9201E+12	2.4526E+10
Xe-131m	5.9159E-09	7.0629E-17	3.2468E+08	2.0951E+03
Xe-133	1.7988E-06	9.6098E-15	4.3513E+10	6.3771E+05
Xe-133m	1.2891E-07	2.8730E-16	1.3009E+09	4.5689E+04
Xe-135	1.2350E-05	4.8362E-15	2.1574E+10	4.3748E+06
Xe-135m	7.7160E-05	8.4705E-16	3.7786E+09	2.4814E+07

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	7.0490E+10	0.0000E+00	
Elemental I (atoms)	1.1663E+14	0.0000E+00	
Organic I (atoms)	3.6072E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.9873E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.3513E-12
Total I (Ci)			1.2519E-02

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.4977E+09
Elemental I (atoms)	0.0000E+00	1.2632E+14
Organic I (atoms)	0.0000E+00	3.9069E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	1.9330E+08	0.0000E+00
Elemental I (atoms)	9.5673E+12	0.0000E+00
Organic I (atoms)	2.9590E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.4616E-04	2.0803E-01	6.9322E-03
Accumulated dose (rem)	8.8937E-04	4.1087E-01	1.3701E-02

Low Population Zone Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2168E-04	5.6735E-02	1.8906E-03
Accumulated dose (rem)	2.4256E-04	1.1205E-01	3.7367E-03

Control Room Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.6142E-05	2.1259E-01	6.6445E-03
Accumulated dose (rem)	2.4693E-05	3.2318E-01	1.0102E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 0.1670	Ci	kg	Atoms	Decay
I-131	2.3668E-03	1.9091E-11	8.7761E+13	5.5496E+10
I-132	2.4732E-03	2.3960E-13	1.0931E+12	5.9472E+10
I-133	3.5836E-03	3.1635E-12	1.4324E+13	8.4240E+10

I-134	4.7373E-04	1.7758E-14	7.9807E+10	1.1878E+10
I-135	2.0076E-03	5.7167E-13	2.5501E+12	4.7479E+10
Xe-131m	1.2280E-08	1.4661E-16	6.7396E+08	8.7439E+04
Xe-133	3.7292E-06	1.9923E-14	9.0210E+10	2.6579E+07
Xe-133m	2.6715E-07	5.9537E-16	2.6958E+09	1.9042E+06
Xe-135	2.6011E-05	1.0186E-14	4.5436E+10	1.8283E+08
Xe-135m	1.3932E-04	1.5294E-15	6.8224E+09	1.0220E+09

Control Room Transport Group Inventory:

Time (h) = 0.1670	Atmosphere	Sump	
Noble gases (atoms)	1.4584E+11	0.0000E+00	
Elemental I (atoms)	1.0263E+14	0.0000E+00	
Organic I (atoms)	3.1742E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.7489E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.0671E-12
Total I (Ci)			1.0905E-02

Time (h) = 0.1670	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.0620E+13
Organic I (atoms)	0.0000E+00	9.4702E+11
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.1670	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.6138E+10
Elemental I (atoms)	0.0000E+00	1.4575E+14
Organic I (atoms)	0.0000E+00	4.5079E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.1670	Pathway Filtered	Transported
Noble gases (atoms)	2.3351E+09	0.0000E+00
Elemental I (atoms)	1.2253E+13	0.0000E+00
Organic I (atoms)	3.7897E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.7550E-04	4.4498E-01	1.4248E-02
Accumulated dose (rem)	1.3649E-03	8.5584E-01	2.7949E-02

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2968E-04	1.2136E-01	3.8859E-03
Accumulated dose (rem)	3.7224E-04	2.3341E-01	7.6226E-03

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.5889E-05	8.4795E-01	2.6436E-02
Accumulated dose (rem)	8.0582E-05	1.1711E+00	3.6538E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
I-131	4.9749E-05	4.0128E-13	1.8447E+12	1.5474E+11
I-132	5.0456E-06	4.8881E-16	2.2301E+09	1.3680E+11
I-133	5.9677E-05	5.2681E-14	2.3853E+11	2.2796E+11
I-134	2.0926E-08	7.8442E-19	3.5253E+06	2.4160E+10
I-135	1.9090E-05	5.4358E-15	2.4248E+10	1.2108E+11
Xe-131m	7.0466E-08	8.4128E-16	3.8674E+09	3.1331E+07
Xe-133	1.9259E-05	1.0289E-13	4.6587E+11	8.9704E+09
Xe-133m	1.3278E-06	2.9591E-15	1.3399E+10	6.2649E+08
Xe-135	8.8677E-05	3.4724E-14	1.5490E+11	5.1378E+10
Xe-135m	6.6733E-06	7.3259E-17	3.2679E+08	1.9702E+10

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	6.3836E+11	0.0000E+00	
Elemental I (atoms)	2.0464E+12	0.0000E+00	
Organic I (atoms)	6.3292E+10	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.4710E-14
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.8860E-14
Total I (Ci)			1.3358E-04

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.5200E+14
Organic I (atoms)	0.0000E+00	4.7011E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.0404E+12
Elemental I (atoms)	0.0000E+00	1.7765E+14
Organic I (atoms)	0.0000E+00	5.4945E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	6.9217E+11	0.0000E+00
Elemental I (atoms)	2.2901E+13	0.0000E+00
Organic I (atoms)	7.0828E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7620E-03	3.1562E+00	9.8853E-02
Accumulated dose (rem)	3.1269E-03	4.0121E+00	1.2680E-01

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0833E-04	9.9793E-02	3.1781E-03

Accumulated dose (rem)	4.8057E-04	3.3320E-01	1.0801E-02

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7813E-05	6.2439E-01	1.9226E-02
Accumulated dose (rem)	9.8395E-05	1.7955E+00	5.5764E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
I-131	6.0872E-05	4.9100E-13	2.2572E+12	2.4777E+11
I-132	5.2648E-08	5.1005E-18	2.3270E+07	1.3827E+11
I-133	4.5377E-05	4.0057E-14	1.8138E+11	3.1373E+11
I-135	4.6209E-06	1.3158E-15	5.8696E+09	1.3679E+11
Xe-131m	3.7598E-07	4.4887E-15	2.0635E+10	4.3102E+08
Xe-133	8.1761E-05	4.3680E-13	1.9778E+12	1.0311E+11
Xe-133m	5.2299E-06	1.1655E-14	5.2775E+10	6.8236E+09
Xe-135	1.2211E-04	4.7818E-14	2.1331E+11	2.7406E+11
Xe-135m	2.6161E-06	2.8719E-17	1.2811E+08	2.8009E+10

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	2.2646E+12	0.0000E+00	
Elemental I (atoms)	2.3711E+12	0.0000E+00	
Organic I (atoms)	7.3333E+10	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.9487E-14
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.2268E-14
Total I (Ci)			1.1092E-04

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	2.4342E+14
Organic I (atoms)	0.0000E+00	7.5284E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	8.7487E+12
Elemental I (atoms)	0.0000E+00	2.7760E+14
Organic I (atoms)	0.0000E+00	8.5857E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	6.5595E+12	0.0000E+00
Elemental I (atoms)	3.0920E+13	0.0000E+00
Organic I (atoms)	9.5628E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.1820E-03	2.1713E+01	6.6983E-01

Accumulated dose (rem)	9.3089E-03	2.5726E+01	7.9663E-01

Low Population Zone Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.7821E-05	1.5654E-01	4.8523E-03
Accumulated dose (rem)	5.4839E-04	4.8974E-01	1.5653E-02

Control Room Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6657E-05	1.9538E+00	5.9741E-02
Accumulated dose (rem)	1.2505E-04	3.7493E+00	1.1551E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 75.0000	Ci	kg	Atoms	Decay
I-131	9.8335E-05	7.9319E-13	3.6463E+12	7.7223E+11
I-133	1.6091E-05	1.4205E-14	6.4318E+10	4.9829E+11
I-135	4.2654E-08	1.2146E-17	5.4180E+07	1.4275E+11
Xe-131m	2.3658E-06	2.8245E-14	1.2984E+11	8.9177E+09
Xe-133	2.6279E-04	1.4039E-12	6.3568E+12	1.3036E+12
Xe-133m	1.2754E-05	2.8423E-14	1.2870E+11	7.2634E+10
Xe-135	1.0545E-05	4.1293E-15	1.8420E+10	6.1785E+11
Xe-135m	2.4217E-08	2.6585E-19	1.1859E+06	3.2056E+10

Control Room Transport Group Inventory:

Time (h) = 75.0000	Atmosphere	Sump	
Noble gases (atoms)	6.6338E+12	0.0000E+00	
Elemental I (atoms)	3.5994E+12	0.0000E+00	
Organic I (atoms)	1.1132E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		5.8180E-14
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		5.9116E-14
Total I (Ci)			1.1447E-04

Time (h) = 75.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	7.3261E+14
Organic I (atoms)	0.0000E+00	2.2658E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	8.1702E+13
Elemental I (atoms)	0.0000E+00	8.1206E+14
Organic I (atoms)	0.0000E+00	2.5115E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	7.3788E+13	0.0000E+00
Elemental I (atoms)	7.3832E+13	0.0000E+00
Organic I (atoms)	2.2834E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	9.3089E-03	2.5726E+01	7.9663E-01

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.4839E-04	4.8974E-01	1.5653E-02

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.8739E-07	2.5038E-02	7.6414E-04
Accumulated dose (rem)	1.2554E-04	3.7743E+00	1.1627E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Xe-131m	4.7259E-09	5.6421E-17	2.5937E+08	9.8319E+09
Xe-133	4.9461E-07	2.6424E-15	1.1965E+10	1.4042E+12
Xe-133m	2.0318E-08	4.5281E-17	2.0503E+08	7.7390E+10
Xe-135	4.4695E-09	1.7502E-18	7.8074E+06	6.2112E+11

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	1.2437E+10	0.0000E+00	
Elemental I (atoms)	2.0870E-21	0.0000E+00	
Organic I (atoms)	6.4547E-23	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.3589E-47
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.3882E-47
Total I (Ci)			6.2522E-38

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	7.3346E+14
Organic I (atoms)	0.0000E+00	2.2684E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	8.1702E+13
Elemental I (atoms)	0.0000E+00	8.1206E+14
Organic I (atoms)	0.0000E+00	2.5115E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	8.0302E+13	0.0000E+00
Elemental I (atoms)	7.3906E+13	0.0000E+00
Organic I (atoms)	2.2858E+12	0.0000E+00

```
Aerosols (kg)          0.0000E+00  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)  9.3089E-03  2.5726E+01  7.9663E-01

Low Population Zone Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)  5.4839E-04  4.8974E-01  1.5653E-02

Control Room Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        3.1009E-10  9.6370E-36  3.1009E-10
Accumulated dose (rem)  1.2554E-04  3.7743E+00  1.1627E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000       Ci           kg          Atoms      Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000    Atmosphere     Sump
Noble gases (atoms)    1.2598E-71  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          0.0000E+00  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                       Deposition Recirculating
Time (h) = 720.0000     Surfaces     Filter
Noble gases (atoms)    0.0000E+00  0.0000E+00
Elemental I (atoms)    0.0000E+00  7.3346E+14
Organic I (atoms)      0.0000E+00  2.2684E+13
Aerosols (kg)          0.0000E+00  0.0000E+00

Environment to Control Room Transport Group Inventory:

                         Pathway
Time (h) = 720.0000     Filtered   Transported
Noble gases (atoms)    0.0000E+00  8.1702E+13
Elemental I (atoms)    0.0000E+00  8.1206E+14
Organic I (atoms)      0.0000E+00  2.5115E+13
Aerosols (kg)          0.0000E+00  0.0000E+00

Control Room to Environment Transport Group Inventory:

                         Pathway
Time (h) = 720.0000     Filtered   Transported
Noble gases (atoms)    8.0314E+13  0.0000E+00
Elemental I (atoms)    7.3906E+13  0.0000E+00
Organic I (atoms)      2.2858E+12  0.0000E+00
Aerosols (kg)          0.0000E+00  0.0000E+00

    840
```

```
#######################################################################
                              I-131 Summary
#######################################################################
```

Time (hr)	RCS I-131 (Curies)	Faulted SG I-131 (Curies)	Environment I-131 (Curies)
0.000	5.9332E+02	0.0000E+00	3.3835E-04
0.004	3.8447E+03	0.0000E+00	1.4207E-02
0.083	3.8430E+03	0.0000E+00	6.4304E-01
0.167	3.8411E+03	0.0000E+00	1.3032E+00
0.500	3.8339E+03	2.6191E+00	1.3059E+00
0.800	3.8274E+03	4.9671E+00	1.3131E+00
1.100	3.8210E+03	7.3040E+00	1.3248E+00
1.400	3.8145E+03	9.6301E+00	1.3408E+00
1.700	3.8080E+03	1.1945E+01	1.3613E+00
2.000	3.8016E+03	1.4250E+01	1.3862E+00
2.300	3.7952E+03	1.6543E+01	1.4154E+00
2.600	3.7887E+03	1.8826E+01	1.4490E+00
2.900	3.7823E+03	2.1098E+01	1.4869E+00
3.200	3.7759E+03	2.3359E+01	1.5291E+00
3.500	3.7695E+03	2.5610E+01	1.5756E+00
3.800	3.7632E+03	2.7850E+01	1.6263E+00
4.100	3.7568E+03	3.0079E+01	1.6813E+00
4.400	3.7504E+03	3.2298E+01	1.7405E+00
4.700	3.7441E+03	3.4507E+01	1.8039E+00
5.000	3.7378E+03	3.6705E+01	1.8715E+00
5.300	3.7314E+03	3.8892E+01	1.9432E+00
5.600	3.7251E+03	4.1070E+01	2.0191E+00
5.900	3.7188E+03	4.3236E+01	2.0992E+00
6.200	3.7125E+03	4.5393E+01	2.1833E+00
6.500	3.7062E+03	4.7539E+01	2.2715E+00
6.800	3.7000E+03	4.9675E+01	2.3638E+00
7.100	3.6937E+03	5.1801E+01	2.4601E+00
7.400	3.6875E+03	5.3917E+01	2.5604E+00
7.700	3.6812E+03	5.6022E+01	2.6648E+00
8.000	3.6750E+03	5.8117E+01	2.7731E+00
8.300	3.6688E+03	6.0203E+01	2.8854E+00
8.600	3.6626E+03	6.2278E+01	3.0016E+00
8.900	3.6564E+03	6.4344E+01	3.1218E+00
9.200	3.6502E+03	6.6399E+01	3.2459E+00
9.500	3.6440E+03	6.8444E+01	3.3739E+00
9.800	3.6378E+03	7.0480E+01	3.5058E+00
10.100	3.6317E+03	7.2506E+01	3.6415E+00
10.400	3.6255E+03	7.4522E+01	3.7810E+00
24.000	3.3576E+03	1.5619E+02	1.3826E+01
75.000	2.5177E+03	3.3101E+02	9.7016E+01
96.000	2.3347E+03	3.0695E+02	9.7016E+01
720.000	2.4817E+02	3.2628E+01	9.7016E+01

Time (hr)	Control Room I-131 (Curies)
0.000	1.5292E-06
0.004	6.4084E-05
0.083	2.6873E-03
0.167	2.3668E-03
0.500	7.0467E-04
0.800	2.3931E-04
1.100	8.5178E-05
1.400	3.5342E-05

1.700	2.0456E-05
2.000	1.7275E-05
2.300	1.4973E-05
2.600	1.5547E-05
2.900	1.7080E-05
3.200	1.8927E-05
3.500	2.0873E-05
3.800	2.2846E-05
4.100	2.4822E-05
4.400	2.6793E-05
4.700	2.8756E-05
5.000	3.0710E-05
5.300	3.2655E-05
5.600	3.4591E-05
5.900	3.6517E-05
6.200	3.8435E-05
6.500	4.0343E-05
6.800	4.2242E-05
7.100	4.4133E-05
7.400	4.6014E-05
7.700	4.7886E-05
8.000	4.9749E-05
8.300	3.2198E-05
8.600	2.6860E-05
8.900	2.5612E-05
9.200	2.5732E-05
9.500	2.6309E-05
9.800	2.7036E-05
10.100	2.7810E-05
10.400	2.8598E-05
24.000	6.0872E-05
75.000	9.8335E-05
96.000	5.7481E-38
720.000	0.0000E+00

```
#######################################################################
                        Cumulative Dose Summary
#######################################################################
```

	Exclusion Area Bounda		Low Population Zone		Control Room	
Time (hr)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	4.4804E-03	1.4952E-04	1.2219E-03	4.0778E-05	9.0583E-05	2.8319E-06
0.083	2.0284E-01	6.7689E-03	5.5320E-02	1.8461E-03	1.1058E-01	3.4572E-03
0.167	4.1087E-01	1.3701E-02	1.1205E-01	3.7367E-03	3.2318E-01	1.0102E-02
0.500	4.1174E-01	1.3730E-02	1.1229E-01	3.7445E-03	7.8656E-01	2.4578E-02
0.800	4.1400E-01	1.3805E-02	1.1291E-01	3.7649E-03	9.1733E-01	2.8660E-02
1.100	4.1764E-01	1.3925E-02	1.1390E-01	3.7977E-03	9.6226E-01	3.0061E-02
1.400	4.2266E-01	1.4090E-02	1.1527E-01	3.8426E-03	9.7904E-01	3.0584E-02
1.700	4.2903E-01	1.4298E-02	1.1701E-01	3.8995E-03	9.8695E-01	3.0831E-02
2.000	4.3675E-01	1.4550E-02	1.1911E-01	3.9682E-03	9.9242E-01	3.1001E-02
2.300	4.4580E-01	1.4845E-02	1.2158E-01	4.0486E-03	9.9710E-01	3.1147E-02
2.600	4.5618E-01	1.5182E-02	1.2441E-01	4.1405E-03	1.0016E+00	3.1286E-02
2.900	4.6786E-01	1.5560E-02	1.2760E-01	4.2438E-03	1.0064E+00	3.1436E-02
3.200	4.8084E-01	1.5980E-02	1.3114E-01	4.3582E-03	1.0117E+00	3.1601E-02
3.500	4.9510E-01	1.6441E-02	1.3503E-01	4.4838E-03	1.0175E+00	3.1782E-02
3.800	5.1064E-01	1.6941E-02	1.3926E-01	4.6203E-03	1.0240E+00	3.1981E-02
4.100	5.2743E-01	1.7482E-02	1.4385E-01	4.7677E-03	1.0309E+00	3.2198E-02
4.400	5.4548E-01	1.8061E-02	1.4877E-01	4.9258E-03	1.0385E+00	3.2432E-02

4.700	5.6477E-01	1.8680E-02	1.5403E-01	5.0946E-03	1.0466E+00	3.2683E-02
5.000	5.8529E-01	1.9337E-02	1.5962E-01	5.2738E-03	1.0552E+00	3.2951E-02
5.300	6.0703E-01	2.0033E-02	1.6555E-01	5.4634E-03	1.0644E+00	3.3236E-02
5.600	6.2997E-01	2.0766E-02	1.7181E-01	5.6634E-03	1.0742E+00	3.3538E-02
5.900	6.5412E-01	2.1536E-02	1.7840E-01	5.8736E-03	1.0844E+00	3.3856E-02
6.200	6.7945E-01	2.2344E-02	1.8530E-01	6.0938E-03	1.0953E+00	3.4191E-02
6.500	7.0596E-01	2.3188E-02	1.9253E-01	6.3241E-03	1.1066E+00	3.4542E-02
6.800	7.3364E-01	2.4069E-02	2.0008E-01	6.5643E-03	1.1185E+00	3.4910E-02
7.100	7.6247E-01	2.4986E-02	2.0795E-01	6.8143E-03	1.1309E+00	3.5293E-02
7.400	7.9246E-01	2.5938E-02	2.1613E-01	7.0741E-03	1.1438E+00	3.5692E-02
7.700	8.2359E-01	2.6926E-02	2.2461E-01	7.3436E-03	1.1572E+00	3.6107E-02
8.000	8.5584E-01	2.7949E-02	2.3341E-01	7.6226E-03	1.1711E+00	3.6538E-02
8.300	8.8922E-01	2.9007E-02	2.3447E-01	7.6568E-03	1.1824E+00	3.6886E-02
8.600	9.2371E-01	3.0099E-02	2.3556E-01	7.6922E-03	1.1906E+00	3.7141E-02
8.900	9.5931E-01	3.1226E-02	2.3668E-01	7.7286E-03	1.1980E+00	3.7370E-02
9.200	9.9599E-01	3.2386E-02	2.3784E-01	7.7661E-03	1.2053E+00	3.7594E-02
9.500	1.0338E+00	3.3580E-02	2.3904E-01	7.8047E-03	1.2126E+00	3.7821E-02
9.800	1.0726E+00	3.4808E-02	2.4027E-01	7.8444E-03	1.2202E+00	3.8054E-02
10.100	1.1125E+00	3.6068E-02	2.4153E-01	7.8851E-03	1.2279E+00	3.8293E-02
10.400	1.1535E+00	3.7361E-02	2.4282E-01	7.9269E-03	1.2358E+00	3.8538E-02
24.000	4.0121E+00	1.2680E-01	3.3320E-01	1.0801E-02	1.7955E+00	5.5764E-02
75.000	2.5726E+01	7.9663E-01	4.8974E-01	1.5653E-02	3.7493E+00	1.1551E-01
96.000	2.5726E+01	7.9663E-01	4.8974E-01	1.5653E-02	3.7743E+00	1.1627E-01
720.000	2.5726E+01	7.9663E-01	4.8974E-01	1.5653E-02	3.7743E+00	1.1627E-01

```
#####################################################################
                        Worst Two-Hour Doses
#####################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
24.0	2.4243E-04	8.5151E-01	2.6268E-02

Attachment 13.2
RADTRAD Output File PMSFPDLI01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:09:47
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078\PMSFPDLI01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimsliq_iodine_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt



    #####    ####   #####    #  #     #  #####   #    #  #####
    #    #  #       #        #  ##    #  #    #  #    #    #
    #    #  #       #        #  # #   #  #    #  #    #    #
    #####    ####   ####     #  #  #  #  #####   #    #    #
    #            #  #        #  #   # #  #       #    #    #
    #            #  #        #  #    ##  #       #    #    #
    #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Pre-accident Iodine Spike with SG Liquid Iodine
Release During Faulted SG  Dryout
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimsliq_iodine_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  3
Compartment 1:
Faulted SG
  3
 1.7160E+03
  0
  0
  0
  0
  0
Compartment 2:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 3:
Control Room
  1
 6.1315E+04
```

```
  0
  0
  1
  0
  0
Pathways:
  3
Pathway 1:
Faulted SG to Environment
  1
  2
  2
Pathway 2:
Environment to Control Room
  2
  3
  2
Pathway 3:
Control Room to Environment
  3
  2
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  3
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
```

```
  0
  0
  0
  0
Compartment 3:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  3
Pathway 1:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   2.2370E+02   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
```

```
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  2
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  2
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  3
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   4.7900E-03
```

```
  2.0000E+00   3.6000E-03
  8.0000E+00   1.6000E-03
  2.4000E+01   1.2100E-03
  9.6000E+01   9.5500E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o2
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:09:47
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   3

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Faulted SG
Compartment volume =   1.7160E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Faulted SG to Environment

Compartment number  2
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Faulted SG to Environment
   Inlet Pathway Number   3: Control Room to Environment
   Exit Pathway Number    2: Environment to Control Room

Compartment number  3
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  3
   Inlet Pathway Number   2: Environment to Control Room
   Exit Pathway Number    3: Control Room to Environment

Total number of pathways =   3
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#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:09:47
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#######################################################################
                      Scenario Description
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Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	1.0000E+00	0.0000E+00	0.0000E+00	4.077E-05
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
I-131	2	2.253E-03	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	2.474E-03	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	3.428E-03	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	5.142E-04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	1.944E-03	2.380E+04	8.294E-14	8.460E-09	3.320E-10

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01
Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: Faulted SG

Compartment number 2: Environment

Compartment number 3: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01

7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: Faulted SG to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.2370E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	6.4900E-04
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Low Population Zone is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	1.7700E-04
8.0000E+00	3.9900E-05
2.4000E+01	7.1200E-06
9.6000E+01	1.0400E-06
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04

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  7.2000E+02                0.0000E+00
Location Control Room     is in compartment   3

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00          4.7900E-03
  2.0000E+00          3.6000E-03
  8.0000E+00          1.6000E-03
  2.4000E+01          1.2100E-03
  9.6000E+01          9.5500E-04
  7.2000E+02          0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                3.5000E-04
  7.2000E+02                0.0000E+00

Location Occupancy Factor Data
 Time (hr)          Occupancy Factor
  0.0000E+00            1.0000E+00
  2.4000E+01            6.0000E-01
  9.6000E+01            4.0000E-01
  7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
Time            Time step
 0.0000E+00       1.0000E-01
 2.0000E+00       5.0000E-01
 8.0000E+00       1.0000E+00
 2.4000E+01       2.0000E+00
 9.6000E+01       4.0000E+00
 7.2000E+02       0.0000E+00
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#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:09:47
#######################################################################


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    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #


#######################################################################
           Dose, Detailed model and Detailed Inventory Output
#######################################################################
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Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0120E-05	1.8353E-02	6.1247E-04
Accumulated dose (rem)	4.0120E-05	1.8353E-02	6.1247E-04

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0942E-05	5.0053E-03	1.6704E-04
Accumulated dose (rem)	1.0942E-05	5.0053E-03	1.6704E-04

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.8727E-08	3.7132E-04	1.1609E-05
Accumulated dose (rem)	2.8727E-08	3.7132E-04	1.1609E-05

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
I-131	2.6251E-04	2.1174E-12	9.7339E+12	8.9359E+07
I-132	2.8795E-04	2.7896E-14	1.2727E+11	9.8057E+07
I-133	3.9937E-04	3.5255E-13	1.5963E+12	1.3595E+08
I-134	5.9742E-05	2.2395E-15	1.0065E+10	2.0357E+07
I-135	2.2642E-04	6.4473E-14	2.8761E+11	7.7086E+07
Xe-131m	2.0572E-11	2.4560E-19	1.1291E+06	1.0583E+00
Xe-133	6.2620E-09	3.3454E-17	1.5148E+08	3.2214E+02
Xe-133m	4.4878E-10	1.0002E-18	4.5287E+06	2.3087E+01
Xe-135	4.3094E-08	1.6875E-17	7.5276E+07	2.2168E+03
Xe-135m	2.7092E-07	2.9741E-18	1.3267E+07	1.3901E+04

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	2.4568E+08	0.0000E+00
Elemental I (atoms)	1.1402E+13	0.0000E+00
Organic I (atoms)	3.5265E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	1.9428E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	2.3009E-13
Total I (Ci)		1.2360E-03

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.1907E+07
Elemental I (atoms)	0.0000E+00	1.1430E+13
Organic I (atoms)	0.0000E+00	3.5350E+11
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	1.1279E+05	0.0000E+00
Elemental I (atoms)	2.6841E+10	0.0000E+00
Organic I (atoms)	8.3012E+08	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3150E-03	6.0185E-01	2.0084E-02
Accumulated dose (rem)	1.3551E-03	6.2020E-01	2.0696E-02

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5863E-04	1.6414E-01	5.4775E-03
Accumulated dose (rem)	3.6957E-04	1.6915E-01	5.6445E-03

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6116E-05	3.3774E-01	1.0559E-02
Accumulated dose (rem)	2.6144E-05	3.3812E-01	1.0571E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
I-131	8.1477E-03	6.5720E-11	3.0212E+14	8.6598E+10
I-132	8.7277E-03	8.4553E-13	3.8575E+12	9.3873E+10
I-133	1.2366E-02	1.0916E-11	4.9429E+13	1.3159E+11
I-134	1.7415E-03	6.5283E-14	2.9339E+11	1.9103E+10
I-135	6.9712E-03	1.9850E-12	8.8549E+12	7.4393E+10
Xe-131m	1.7937E-08	2.1414E-16	9.8441E+08	6.3495E+03
Xe-133	5.4532E-06	2.9133E-14	1.3191E+11	1.9325E+06
Xe-133m	3.9081E-07	8.7098E-16	3.9437E+09	1.3846E+05
Xe-135	3.7451E-05	1.4665E-14	6.5419E+10	1.3261E+07
Xe-135m	2.3398E-04	2.5686E-15	1.1458E+10	7.5216E+07

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	2.1372E+11	0.0000E+00	
Elemental I (atoms)	3.5362E+14	0.0000E+00	
Organic I (atoms)	1.0937E+13	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		6.0254E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		7.1288E-12
Total I (Ci)			3.7954E-02

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.5793E+09
Elemental I (atoms)	0.0000E+00	3.8624E+14
Organic I (atoms)	0.0000E+00	1.1946E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	6.5969E+08	0.0000E+00
Elemental I (atoms)	3.2667E+13	0.0000E+00
Organic I (atoms)	1.0103E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.1590E-04	3.3375E-01	1.1122E-02
Accumulated dose (rem)	2.0710E-03	9.5395E-01	3.1818E-02

Low Population Zone Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9525E-04	9.1023E-02	3.0332E-03
Accumulated dose (rem)	5.6482E-04	2.6017E-01	8.6777E-03

Control Room Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.7231E-05	6.2204E-01	1.9442E-02
Accumulated dose (rem)	7.3375E-05	9.6016E-01	3.0012E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 0.1670	Ci	kg	Atoms	Decay
I-131	6.6149E-03	5.3357E-11	2.4528E+14	1.6309E+11
I-132	6.9113E-03	6.6956E-13	3.0547E+12	1.7483E+11
I-133	1.0015E-02	8.8407E-12	4.0030E+13	2.4754E+11

I-134	1.3238E-03	4.9622E-14	2.2301E+11	3.4941E+10
I-135	5.6119E-03	1.5980E-12	7.1284E+12	1.3957E+11
Xe-131m	3.4556E-08	4.1255E-16	1.8965E+09	2.4975E+05
Xe-133	1.0493E-05	5.6058E-14	2.5383E+11	7.5908E+07
Xe-133m	7.5168E-07	1.6752E-15	7.5852E+09	5.4383E+06
Xe-135	7.3213E-05	2.8669E-14	1.2789E+11	5.2228E+08
Xe-135m	3.9188E-04	4.3020E-15	1.9191E+10	2.9222E+09

Control Room Transport Group Inventory:

Time (h) = 0.1670	Atmosphere	Sump	
Noble gases (atoms)	4.1038E+11	0.0000E+00	
Elemental I (atoms)	2.8685E+14	0.0000E+00	
Organic I (atoms)	8.8716E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		4.8880E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		5.7771E-12
Total I (Ci)			3.0477E-02

Time (h) = 0.1670	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	8.9752E+13
Organic I (atoms)	0.0000E+00	2.7758E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.1670	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.9252E+10
Elemental I (atoms)	0.0000E+00	4.1742E+14
Organic I (atoms)	0.0000E+00	1.2910E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.1670	Pathway Filtered	Transported
Noble gases (atoms)	6.9405E+09	0.0000E+00
Elemental I (atoms)	4.0540E+13	0.0000E+00
Organic I (atoms)	1.2538E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.0710E-03	9.5395E-01	3.1818E-02

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.6482E-04	2.6017E-01	8.6777E-03

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3425E-04	1.8406E+00	5.7482E-02
Accumulated dose (rem)	2.0762E-04	2.8008E+00	8.7495E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Xe-131m	7.8290E-09	9.3469E-17	4.2968E+08	3.0192E+07
Xe-133	2.3141E-06	1.2363E-14	5.5977E+10	9.0564E+09
Xe-133m	1.5589E-07	3.4742E-16	1.5731E+09	6.3623E+08
Xe-135	1.0687E-05	4.1848E-15	1.8668E+10	5.9754E+10

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	7.6648E+10	0.0000E+00	
Elemental I (atoms)	1.0942E+02	0.0000E+00	
Organic I (atoms)	3.3842E+00	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.8559E-24
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.0779E-24
Total I (Ci)			7.1425E-15

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.5249E+14
Organic I (atoms)	0.0000E+00	1.0902E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.9252E+10
Elemental I (atoms)	0.0000E+00	4.1742E+14
Organic I (atoms)	0.0000E+00	1.2910E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	7.4805E+11	0.0000E+00
Elemental I (atoms)	6.3588E+13	0.0000E+00
Organic I (atoms)	1.9666E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.0710E-03	9.5395E-01	3.1818E-02

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.6482E-04	2.6017E-01	8.6777E-03

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.7536E-08	7.0018E-13	9.7536E-08

Accumulated dose (rem)	2.0772E-04	2.8008E+00	8.7495E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
Xe-131m	6.8697E-11	8.2016E-19	3.7703E+06	3.3532E+07
Xe-133	1.9437E-08	1.0384E-16	4.7018E+08	1.0035E+10
Xe-133m	1.1513E-09	2.5658E-18	1.1618E+07	7.0059E+08
Xe-135	2.8779E-08	1.1270E-17	5.0272E+07	6.3457E+10

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	5.3584E+08	0.0000E+00	
Elemental I (atoms)	4.9560E-24	0.0000E+00	
Organic I (atoms)	1.5328E-25	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		8.2534E-50
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.8348E-50
Total I (Ci)			2.3184E-40

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.5249E+14
Organic I (atoms)	0.0000E+00	1.0902E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.9252E+10
Elemental I (atoms)	0.0000E+00	4.1742E+14
Organic I (atoms)	0.0000E+00	1.2910E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	8.1947E+11	0.0000E+00
Elemental I (atoms)	6.3588E+13	0.0000E+00
Organic I (atoms)	1.9666E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.0710E-03	9.5395E-01	3.1818E-02

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.6482E-04	2.6017E-01	8.6777E-03

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE

Delta dose (rem)	1.7507E-10	3.5516E-38	1.7507E-10
Accumulated dose (rem)	2.0772E-04	2.8008E+00	8.7495E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	2.1816E-01	0.0000E+00	
Elemental I (atoms)	5.2755-138	0.0000E+00	
Organic I (atoms)	1.6316-139	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		8.4906-164
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.5646-164
Total I (Ci)			1.5804-154

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.5249E+14
Organic I (atoms)	0.0000E+00	1.0902E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.9252E+10
Elemental I (atoms)	0.0000E+00	4.1742E+14
Organic I (atoms)	0.0000E+00	1.2910E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	8.1999E+11	0.0000E+00
Elemental I (atoms)	6.3588E+13	0.0000E+00
Organic I (atoms)	1.9666E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.0710E-03	9.5395E-01	3.1818E-02

Low Population Zone Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.6482E-04	2.6017E-01	8.6777E-03

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.4753E-21	2.4360-152	5.4753E-21
Accumulated dose (rem)	2.0772E-04	2.8008E+00	8.7495E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000	Ci	kg	Atoms	Decay

Control Room Transport Group Inventory:

Time (h) = 720.0000	Atmosphere	Sump	
Noble gases (atoms)	2.0778E-82	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 720.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.5249E+14
Organic I (atoms)	0.0000E+00	1.0902E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.9252E+10
Elemental I (atoms)	0.0000E+00	4.1742E+14
Organic I (atoms)	0.0000E+00	1.2910E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	8.1999E+11	0.0000E+00
Elemental I (atoms)	6.3588E+13	0.0000E+00
Organic I (atoms)	1.9666E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

840

##
I-131 Summary
##

Time (hr)	Faulted SG I-131 (Curies)	Environment I-131 (Curies)	Control Room I-131 (Curies)
0.000	6.4251E-01	1.3970E-03	6.3139E-06
0.004	4.1143E+00	5.8197E-02	2.6251E-04
0.083	2.2052E+00	1.9662E+00	8.1477E-03
0.167	1.1455E+00	3.0252E+00	6.6149E-03
0.500	1.1441E+00	3.0252E+00	1.9659E-03
0.800	1.1429E+00	3.0252E+00	6.5888E-04
1.100	1.1416E+00	3.0252E+00	2.2083E-04
1.400	1.1404E+00	3.0252E+00	7.4014E-05
1.700	1.1392E+00	3.0252E+00	2.4807E-05
2.000	1.1380E+00	3.0252E+00	8.3142E-06
2.300	1.1367E+00	3.0252E+00	2.7866E-06
2.600	1.1355E+00	3.0252E+00	9.3396E-07
2.900	1.1343E+00	3.0252E+00	3.1303E-07

3.200	1.1331E+00	3.0252E+00	1.0492E-07
3.500	1.1318E+00	3.0252E+00	3.5164E-08
3.800	1.1306E+00	3.0252E+00	1.1785E-08
4.100	1.1294E+00	3.0252E+00	3.9500E-09
4.400	1.1282E+00	3.0252E+00	1.3239E-09
4.700	1.1270E+00	3.0252E+00	4.4372E-10
5.000	1.1258E+00	3.0252E+00	1.4872E-10
5.300	1.1245E+00	3.0252E+00	4.9844E-11
5.600	1.1233E+00	3.0252E+00	1.6706E-11
5.900	1.1221E+00	3.0252E+00	5.5992E-12
6.200	1.1209E+00	3.0252E+00	1.8766E-12
6.500	1.1197E+00	3.0252E+00	6.2897E-13
6.800	1.1185E+00	3.0252E+00	2.1081E-13
7.100	1.1173E+00	3.0252E+00	7.0654E-14
7.400	1.1161E+00	3.0252E+00	2.3681E-14
7.700	1.1149E+00	3.0252E+00	7.9368E-15
8.000	1.1137E+00	3.0252E+00	2.6601E-15
8.300	1.1125E+00	3.0252E+00	8.9157E-16
8.600	1.1113E+00	3.0252E+00	2.9882E-16
8.900	1.1101E+00	3.0252E+00	1.0015E-16
9.200	1.1089E+00	3.0252E+00	3.3567E-17
9.500	1.1077E+00	3.0252E+00	1.1250E-17
9.800	1.1065E+00	3.0252E+00	3.7707E-18
10.100	1.1053E+00	3.0252E+00	1.2638E-18
10.400	1.1041E+00	3.0252E+00	4.2358E-19
24.000	1.0515E+00	3.0252E+00	1.2723E-40
96.000	8.1186E-01	3.0252E+00	1.4530-154
720.000	8.6298E-02	3.0252E+00	0.0000E+00

##

Cumulative Dose Summary

##

	Exclusion Area Bounda		Low Population Zone		Control Room	
Time (hr)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)	Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	1.8353E-02	6.1247E-04	5.0053E-03	1.6704E-04	3.7132E-04	1.1609E-05
0.083	6.2020E-01	2.0696E-02	1.6915E-01	5.6445E-03	3.3812E-01	1.0571E-02
0.167	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	9.6016E-01	3.0012E-02
0.500	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.2548E+00	7.0457E-02
0.800	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.6183E+00	8.1802E-02
1.100	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.7398E+00	8.5592E-02
1.400	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.7804E+00	8.6858E-02
1.700	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.7940E+00	8.7281E-02
2.000	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.7985E+00	8.7423E-02
2.300	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8000E+00	8.7470E-02
2.600	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8005E+00	8.7486E-02
2.900	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8007E+00	8.7491E-02
3.200	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7493E-02
3.500	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
3.800	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
4.100	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
4.400	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
4.700	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
5.000	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
5.300	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
5.600	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7494E-02
5.900	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
6.200	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02

6.500	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
6.800	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
7.100	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
7.400	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
7.700	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
8.000	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
8.300	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
8.600	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
8.900	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
9.200	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
9.500	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
9.800	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
10.100	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
10.400	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
24.000	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
96.000	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02
720.000	9.5395E-01	3.1818E-02	2.6017E-01	8.6777E-03	2.8008E+00	8.7495E-02

```
#######################################################################
                        Worst Two-Hour Doses
#######################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	2.0710E-03	9.5395E-01	3.1818E-02

Attachment 13.3
RADTRAD Output File PMSFPNG01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:38:31
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078\PMSFPNG01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimspre_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_ng_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt



     #####    ####   #####    #  #     #  #####   #    #  #####
     #    #  #       #        #  ##    #  #    #  #    #    #
     #    #  #       #        #  # #   #  #    #  #    #    #
     #####    ####   ####     #  #  #  #  #####   #    #    #
     #            #  #        #  #   # #  #       #    #    #
     #            #  #        #  #    ##  #       #    #    #
     #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Pre-accident Iodine Spike with Noble Gas
Release From Faulted SG During and Following Dryout
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimspre_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  3
Compartment 1:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
Compartment 2:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 3:
Control Room
  1
 6.1315E+04
```

```
  0
  0
  1
  0
  0
Pathways:
  3
Pathway 1:
RCS to Environment
  1
  2
  2
Pathway 2:
Environment to Control Room
  2
  3
  2
Pathway 3:
Control Room to Environment
  3
  2
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_ng_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  3
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
```

```
  0
  0
  0
  0
Compartment 3:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  3
Pathway 1:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
```

```
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  2
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  2
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  3
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   4.7900E-03
```

```
  2.0000E+00   3.6000E-03
  8.0000E+00   1.6000E-03
  2.4000E+01   1.2100E-03
  9.6000E+01   9.5500E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o4
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:38:31
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   3

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: RCS to Environment

Compartment number  2
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  2
   Inlet Pathway Number   1: RCS to Environment
   Inlet Pathway Number   3: Control Room to Environment
   Exit Pathway Number    2: Environment to Control Room

Compartment number  3
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  3
   Inlet Pathway Number   2: Environment to Control Room
   Exit Pathway Number    3: Control Room to Environment

Total number of pathways =   3
```

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#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:38:31
#######################################################################

#######################################################################
                      Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	1.0000E+00	0.0000E+00	0.0000E+00	4.811E+00
IODINE	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Kr-83m	1	3.487E-02	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	9.695E-01	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	1.414E-01	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	9.162E-02	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	2.571E-01	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Xe-131m	1	1.823E-01	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	2.313E+01	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	3.247E-01	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	7.329E-01	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	4.465E-02	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	5.417E-02	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol	=	0.0000E+00
Elemental	=	9.7000E-01
Organic	=	3.0000E-02

COMPARTMENT DATA

Compartment number 1: RCS

Compartment number 2: Environment

Compartment number 3: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: RCS to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8100E-01	0.0000E+00	0.0000E+00	0.0000E+00
7.5000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	6.4900E-04
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Low Population Zone is in compartment 2

```
Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           1.7700E-04
  8.0000E+00           3.9900E-05
  2.4000E+01           7.1200E-06
  9.6000E+01           1.0400E-06
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  8.0000E+00                 1.8000E-04
  2.4000E+01                 2.3000E-04
  7.2000E+02                 0.0000E+00
Location Control Room     is in compartment   3

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           4.7900E-03
  2.0000E+00           3.6000E-03
  8.0000E+00           1.6000E-03
  2.4000E+01           1.2100E-03
  9.6000E+01           9.5500E-04
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  7.2000E+02                 0.0000E+00

Location Occupancy Factor Data
 Time (hr)          Occupancy Factor
  0.0000E+00            1.0000E+00
  2.4000E+01            6.0000E-01
  9.6000E+01            4.0000E-01
  7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
Time            Time step
 0.0000E+00       1.0000E-01
 2.0000E+00       5.0000E-01
 8.0000E+00       1.0000E+00
 2.4000E+01       2.0000E+00
 9.6000E+01       4.0000E+00
 7.2000E+02       0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:38:31
#######################################################################

     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #

#######################################################################
            Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3234E-06	2.3555E-12	1.3234E-06
Accumulated dose (rem)	1.3234E-06	2.3555E-12	1.3234E-06

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.6092E-07	6.4240E-13	3.6093E-07
Accumulated dose (rem)	3.6092E-07	6.4240E-13	3.6093E-07

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.4688E-10	6.1077E-14	9.4776E-10
Accumulated dose (rem)	9.4688E-10	6.1077E-14	9.4776E-10

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
Kr-83m	1.0749E-06	5.2101E-17	3.7802E+08	3.6603E+05
Kr-85	2.9928E-05	7.6281E-11	5.4044E+14	1.0186E+07
Kr-85m	4.3625E-06	5.3010E-16	3.7557E+09	1.4851E+06
Kr-87	2.8227E-06	9.9652E-17	6.8979E+08	9.6137E+05
Kr-88	7.9295E-06	6.3238E-16	4.3276E+09	2.6996E+06
Rb-88	5.4378E-08	4.5301E-19	3.1001E+06	2.7984E+03
Xe-131m	5.6274E-06	6.7184E-14	3.0885E+11	1.9153E+06
Xe-133	7.1399E-04	3.8144E-12	1.7271E+13	2.4301E+08
Xe-133m	1.0023E-05	2.2337E-14	1.0114E+11	3.4113E+06
Xe-135	2.2621E-05	8.8579E-15	3.9514E+10	7.6995E+06
Xe-135m	1.3797E-06	1.5146E-17	6.7566E+07	4.7112E+05
Xe-138	1.6546E-06	1.7208E-17	7.5092E+07	5.6527E+05
Cs-138	6.3006E-09	1.4890E-19	6.4978E+05	3.2586E+02

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	5.5817E+14	0.0000E+00

Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	6.0191E-19	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.5948E+14
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	7.8640E-20

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	1.3115E+12	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.7643E-22	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.8603E-05	7.4835E-10	5.8614E-05
Accumulated dose (rem)	5.9927E-05	7.5070E-10	5.9938E-05

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5983E-05	2.0409E-10	1.5986E-05
Accumulated dose (rem)	1.6344E-05	2.0474E-10	1.6347E-05

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1553E-06	4.1810E-10	1.1613E-06
Accumulated dose (rem)	1.1562E-06	4.1816E-10	1.1623E-06

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
Kr-83m	4.3748E-05	2.1204E-15	1.5385E+10	4.7188E+08
Kr-85	1.2553E-03	3.1997E-09	2.2669E+16	1.3337E+10
Kr-85m	1.8074E-04	2.1963E-14	1.5560E+11	1.9322E+09
Kr-87	1.1337E-04	4.0023E-15	2.7704E+10	1.2310E+09
Kr-88	3.2620E-04	2.6015E-14	1.7803E+11	3.4996E+09
Rb-88	6.3112E-05	5.2576E-16	3.5980E+09	2.0698E+07
Xe-131m	2.3600E-04	2.8175E-12	1.2952E+13	2.5075E+09

Xe-133	2.9936E-02	1.5993E-10	7.2415E+14	3.1811E+11
Xe-133m	4.1997E-04	9.3596E-13	4.2380E+12	4.4642E+09
Xe-135	9.4343E-04	3.6943E-13	1.6480E+12	1.0050E+10
Xe-135m	4.6736E-05	5.1306E-16	2.2887E+09	5.5450E+08
Xe-138	5.4928E-05	5.7124E-16	2.4928E+09	6.5753E+08
Cs-138	6.5935E-06	1.5582E-16	6.7999E+08	2.4966E+06

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	2.3413E+16	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	6.8159E-16	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.5330E+16
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.5061E-17

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	1.9184E+15	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.9394E-18	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.3114E-03	4.5346E-06	4.3842E-03
Accumulated dose (rem)	4.3713E-03	4.5353E-06	4.4441E-03

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1758E-03	1.2367E-06	1.1957E-03
Accumulated dose (rem)	1.1922E-03	1.2369E-06	1.2120E-03

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.8877E-04	7.5129E-06	7.1109E-04
Accumulated dose (rem)	5.8993E-04	7.5133E-06	7.1225E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Kr-83m	1.0405E-05	5.0429E-16	3.6589E+09	4.5917E+10
Kr-85	5.9879E-03	1.5262E-08	1.0813E+17	5.1289E+12
Kr-85m	2.5331E-04	3.0780E-14	2.1807E+11	3.9223E+11
Kr-87	7.2273E-06	2.5515E-16	1.7661E+09	7.8616E+10
Kr-88	2.2536E-04	1.7973E-14	1.2299E+11	5.1638E+11
Rb-88	1.3301E-04	1.1081E-15	7.5829E+09	2.0505E+11
Xe-131m	1.1043E-03	1.3185E-11	6.0610E+13	9.5391E+11
Xe-133	1.3679E-01	7.3079E-10	3.3090E+15	1.1940E+14
Xe-133m	1.8046E-03	4.0217E-12	1.8210E+13	1.6187E+12
Xe-135	2.4643E-03	9.6499E-13	4.3047E+12	2.7870E+12
Cs-138	7.4410E-10	1.7585E-20	7.6739E+04	2.2513E+09

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump
Noble gases (atoms)	1.1152E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.1081E-15	0.0000E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	5.8941E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.2240E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.9004E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	2.1075E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	4.9633E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.3961E-03	1.0903E-06	5.4141E-03
Accumulated dose (rem)	9.7674E-03	5.6256E-06	9.8582E-03

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.3175E-04	3.4472E-08	3.3232E-04

Accumulated dose (rem)	1.5239E-03	1.2714E-06	1.5444E-03

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.9358E-04	1.6358E-06	6.2056E-04
Accumulated dose (rem)	1.1835E-03	9.1492E-06	1.3328E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
Kr-83m	1.1174E-08	5.4157E-19	3.9294E+06	4.8695E+10
Kr-85	2.7552E-03	7.0225E-09	4.9754E+16	1.2394E+13
Kr-85m	9.8054E-06	1.1915E-15	8.4416E+09	5.2387E+11
Kr-87	5.4246E-10	1.9151E-20	1.3256E+05	8.0041E+10
Kr-88	2.0886E-06	1.6657E-16	1.1399E+09	6.0147E+11
Rb-88	5.6010E-06	4.6660E-17	3.1931E+08	2.3178E+11
Xe-131m	4.8884E-04	5.8361E-12	2.6829E+13	2.2713E+12
Xe-133	5.7703E-02	3.0827E-10	1.3958E+15	2.7920E+14
Xe-133m	6.7232E-04	1.4984E-12	6.7845E+12	3.6178E+12
Xe-135	3.3478E-04	1.3109E-13	5.8479E+11	4.6472E+12

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump
Noble gases (atoms)	5.1184E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	4.6660E-17	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	6.7450E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.6288E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.0791E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.1139E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	5.6796E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE

Delta dose (rem)	1.2037E-02	4.2328E-08	1.2038E-02
Accumulated dose (rem)	2.1805E-02	5.6679E-06	2.1896E-02

Low Population Zone Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3206E-04	3.0515E-10	1.3206E-04
Accumulated dose (rem)	1.6560E-03	1.2717E-06	1.6764E-03

Control Room Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.9299E-04	2.7286E-08	4.9344E-04
Accumulated dose (rem)	1.6765E-03	9.1764E-06	1.8263E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 75.0000	Ci	kg	Atoms	Decay
Kr-85	1.8561E-03	4.7309E-09	3.3518E+16	2.5947E+13
Kr-85m	2.4727E-09	3.0047E-19	2.1288E+06	5.3072E+11
Xe-131m	2.9109E-04	3.4752E-12	1.5976E+13	4.5382E+12
Xe-133	2.9446E-02	1.5731E-10	7.1230E+14	5.2824E+14
Xe-133m	2.3112E-04	5.1507E-13	2.3322E+12	6.0539E+12
Xe-135	4.6177E-06	1.8082E-15	8.0662E+09	5.0911E+12

Control Room Transport Group Inventory:

Time (h) = 75.0000	Atmosphere	Sump	
Noble gases (atoms)	3.4248E+16	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	1.2353E-22	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 75.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	6.7525E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.1016E+18
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.0843E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.0668E+18	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	5.6859E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.1805E-02	5.6679E-06	2.1896E-02

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.6560E-03	1.2717E-06	1.6764E-03

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5603E-05	4.0022E-14	2.5603E-05
Accumulated dose (rem)	1.7021E-03	9.1764E-06	1.8519E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Kr-85	3.9008E-06	9.9426E-12	7.0442E+13	2.6670E+13
Xe-131m	5.8145E-07	6.9418E-15	3.1912E+10	4.6507E+12
Xe-133	5.5182E-05	2.9480E-13	1.3348E+12	5.3950E+14
Xe-133m	3.6819E-07	8.2055E-16	3.7154E+09	6.1400E+12
Xe-135	1.9570E-09	7.6635E-19	3.4186E+06	5.0925E+12

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	7.1812E+13	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	1.5287E-27	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	6.7525E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.1016E+18
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.0843E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.1009E+18	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00

```
Aerosols (kg)          5.6859E-15  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)  2.1805E-02  5.6679E-06  2.1896E-02

Low Population Zone Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)  1.6560E-03  1.2717E-06  1.6764E-03

Control Room Doses:

Time (h) = 720.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        3.2014E-08  3.3202E-19  3.2014E-08
Accumulated dose (rem)  1.7021E-03  9.1764E-06  1.8519E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000       Ci           kg         Atoms      Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000    Atmosphere     Sump
Noble gases (atoms)    1.9491E-66  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          3.0633-173  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                       Deposition Recirculating
Time (h) = 720.0000     Surfaces     Filter
Noble gases (atoms)    0.0000E+00  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          0.0000E+00  6.7525E-14

Environment to Control Room Transport Group Inventory:

                         Pathway
Time (h) = 720.0000     Filtered   Transported
Noble gases (atoms)    0.0000E+00  1.1016E+18
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          0.0000E+00  2.0843E-14

Control Room to Environment Transport Group Inventory:

                         Pathway
Time (h) = 720.0000     Filtered   Transported
Noble gases (atoms)    1.1010E+18  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          5.6859E-15  0.0000E+00

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```

```
#######################################################################
                              I-131 Summary
#######################################################################
```

Time (hr)	RCS I-131 (Curies)	Environment I-131 (Curies)	Control Room I-131 (Curies)
0.000	0.0000E+00	0.0000E+00	0.0000E+00
0.004	0.0000E+00	0.0000E+00	0.0000E+00
0.083	0.0000E+00	0.0000E+00	0.0000E+00
0.400	0.0000E+00	0.0000E+00	0.0000E+00
0.700	0.0000E+00	0.0000E+00	0.0000E+00
1.000	0.0000E+00	0.0000E+00	0.0000E+00
1.300	0.0000E+00	0.0000E+00	0.0000E+00
1.600	0.0000E+00	0.0000E+00	0.0000E+00
1.900	0.0000E+00	0.0000E+00	0.0000E+00
2.200	0.0000E+00	0.0000E+00	0.0000E+00
2.500	0.0000E+00	0.0000E+00	0.0000E+00
2.800	0.0000E+00	0.0000E+00	0.0000E+00
3.100	0.0000E+00	0.0000E+00	0.0000E+00
3.400	0.0000E+00	0.0000E+00	0.0000E+00
3.700	0.0000E+00	0.0000E+00	0.0000E+00
4.000	0.0000E+00	0.0000E+00	0.0000E+00
4.300	0.0000E+00	0.0000E+00	0.0000E+00
4.600	0.0000E+00	0.0000E+00	0.0000E+00
4.900	0.0000E+00	0.0000E+00	0.0000E+00
5.200	0.0000E+00	0.0000E+00	0.0000E+00
5.500	0.0000E+00	0.0000E+00	0.0000E+00
5.800	0.0000E+00	0.0000E+00	0.0000E+00
6.100	0.0000E+00	0.0000E+00	0.0000E+00
6.400	0.0000E+00	0.0000E+00	0.0000E+00
6.700	0.0000E+00	0.0000E+00	0.0000E+00
7.000	0.0000E+00	0.0000E+00	0.0000E+00
7.300	0.0000E+00	0.0000E+00	0.0000E+00
7.600	0.0000E+00	0.0000E+00	0.0000E+00
7.900	0.0000E+00	0.0000E+00	0.0000E+00
8.000	0.0000E+00	0.0000E+00	0.0000E+00
8.300	0.0000E+00	0.0000E+00	0.0000E+00
8.600	0.0000E+00	0.0000E+00	0.0000E+00
8.900	0.0000E+00	0.0000E+00	0.0000E+00
9.200	0.0000E+00	0.0000E+00	0.0000E+00
9.500	0.0000E+00	0.0000E+00	0.0000E+00
9.800	0.0000E+00	0.0000E+00	0.0000E+00
10.100	0.0000E+00	0.0000E+00	0.0000E+00
10.400	0.0000E+00	0.0000E+00	0.0000E+00
24.000	0.0000E+00	0.0000E+00	0.0000E+00
75.000	0.0000E+00	0.0000E+00	0.0000E+00
96.000	0.0000E+00	0.0000E+00	0.0000E+00
720.000	0.0000E+00	0.0000E+00	0.0000E+00

```
#######################################################################
                         Cumulative Dose Summary
#######################################################################
```

Time	Exclusion Area Bounda		Low Population Zone		Control Room	
	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	2.3555E-12	1.3234E-06	6.4240E-13	3.6093E-07	6.1077E-14	9.4776E-10
0.083	7.5070E-10	5.9938E-05	2.0474E-10	1.6347E-05	4.1816E-10	1.1623E-06

0.400	1.6667E-07	2.9770E-04	4.5457E-08	8.1192E-05	1.7300E-07	1.4979E-05
0.700	4.5031E-07	5.2299E-04	1.2281E-07	1.4263E-04	4.8843E-07	3.4008E-05
1.000	7.7083E-07	7.4324E-04	2.1023E-07	2.0270E-04	8.7239E-07	5.7002E-05
1.300	1.0915E-06	9.5661E-04	2.9769E-07	2.6089E-04	1.2899E-06	8.2938E-05
1.600	1.3977E-06	1.1627E-03	3.8118E-07	3.1710E-04	1.7236E-06	1.1114E-04
1.900	1.6841E-06	1.3617E-03	4.5930E-07	3.7136E-04	2.1635E-06	1.4110E-04
2.200	1.9499E-06	1.5539E-03	5.3180E-07	4.2379E-04	2.5956E-06	1.7210E-04
2.500	2.1959E-06	1.7399E-03	5.9888E-07	4.7452E-04	3.0019E-06	2.0293E-04
2.800	2.4233E-06	1.9201E-03	6.6090E-07	5.2366E-04	3.3882E-06	2.3358E-04
3.100	2.6336E-06	2.0950E-03	7.1827E-07	5.7135E-04	3.7559E-06	2.6401E-04
3.400	2.8283E-06	2.2649E-03	7.7136E-07	6.1769E-04	4.1053E-06	2.9417E-04
3.700	3.0087E-06	2.4302E-03	8.2054E-07	6.6277E-04	4.4366E-06	3.2403E-04
4.000	3.1758E-06	2.5912E-03	8.6612E-07	7.0670E-04	4.7501E-06	3.5355E-04
4.300	3.3307E-06	2.7483E-03	9.0838E-07	7.4954E-04	5.0462E-06	3.8273E-04
4.600	3.4745E-06	2.9017E-03	9.4759E-07	7.9137E-04	5.3255E-06	4.1153E-04
4.900	3.6079E-06	3.0516E-03	9.8397E-07	8.3226E-04	5.5885E-06	4.3996E-04
5.200	3.7317E-06	3.1983E-03	1.0177E-06	8.7227E-04	5.8359E-06	4.6801E-04
5.500	3.8467E-06	3.3420E-03	1.0491E-06	9.1145E-04	6.0683E-06	4.9568E-04
5.800	3.9534E-06	3.4828E-03	1.0782E-06	9.4987E-04	6.2864E-06	5.2297E-04
6.100	4.0525E-06	3.6210E-03	1.1052E-06	9.8756E-04	6.4909E-06	5.4989E-04
6.400	4.1445E-06	3.7567E-03	1.1303E-06	1.0246E-03	6.6825E-06	5.7644E-04
6.700	4.2300E-06	3.8901E-03	1.1536E-06	1.0609E-03	6.8619E-06	6.0263E-04
7.000	4.3093E-06	4.0213E-03	1.1753E-06	1.0967E-03	7.0296E-06	6.2848E-04
7.300	4.3831E-06	4.1503E-03	1.1954E-06	1.1319E-03	7.1864E-06	6.5399E-04
7.600	4.4515E-06	4.2775E-03	1.2141E-06	1.1666E-03	7.3330E-06	6.7917E-04
7.900	4.5151E-06	4.4028E-03	1.2314E-06	1.2008E-03	7.4698E-06	7.0403E-04
8.000	4.5353E-06	4.4441E-03	1.2369E-06	1.2120E-03	7.5133E-06	7.1225E-04
8.300	4.5929E-06	4.5671E-03	1.2387E-06	1.2196E-03	7.6325E-06	7.3605E-04
8.600	4.6465E-06	4.6885E-03	1.2404E-06	1.2270E-03	7.7367E-06	7.5841E-04
8.900	4.6962E-06	4.8083E-03	1.2420E-06	1.2343E-03	7.8292E-06	7.7950E-04
9.200	4.7423E-06	4.9267E-03	1.2434E-06	1.2416E-03	7.9118E-06	7.9944E-04
9.500	4.7852E-06	5.0437E-03	1.2448E-06	1.2488E-03	7.9858E-06	8.1836E-04
9.800	4.8251E-06	5.1594E-03	1.2461E-06	1.2559E-03	8.0521E-06	8.3635E-04
10.100	4.8621E-06	5.2739E-03	1.2472E-06	1.2629E-03	8.1117E-06	8.5349E-04
10.400	4.8964E-06	5.3872E-03	1.2483E-06	1.2698E-03	8.1653E-06	8.6986E-04
24.000	5.6256E-06	9.8582E-03	1.2714E-06	1.5444E-03	9.1492E-06	1.3328E-03
75.000	5.6679E-06	2.1896E-02	1.2717E-06	1.6764E-03	9.1764E-06	1.8263E-03
96.000	5.6679E-06	2.1896E-02	1.2717E-06	1.6764E-03	9.1764E-06	1.8519E-03
720.000	5.6679E-06	2.1896E-02	1.2717E-06	1.6764E-03	9.1764E-06	1.8519E-03

```
#####################################################################
                        Worst Two-Hour Doses
#####################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.3982E-03	1.7727E-06	1.4257E-03

Attachment 13.4
RADTRAD Output File PMSINPI01.o0

```
##########################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:29:26
 ##########################################################################

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

 Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078 R1\PMSINPI01.psf
 Inventory file       = g:\radtrad 3.03\defaults\pimspre_def.txt
 Release file         = g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
 Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt



     #####    ####   #####    #  #     #  #####   #    #  #####
     #    #  #       #        #  ##    #  #    #  #    #    #
     #    #  #       #        #  # #   #  #    #  #    #    #
     #####    ####   ####     #  #  #  #  #####   #    #    #
     #            #  #        #  #   # #  #       #    #    #
     #            #  #        #  #    ##  #       #    #    #
     #        ####   #        #  #     #  #        ####     #


 Radtrad 3.03 4/15/2001
 PINGP 1 & 2 MSLB Accident AST Analysis - Pre-accident Iodine Spike with  Iodine
Release From Intact SG  With Tube Uncovered for 2 Hours
 Nuclide Inventory File:
 g:\radtrad 3.03\defaults\pimspre_def.txt
 Plant Power Level:
  1.8520E+03
 Compartments:
   4
 Compartment 1:
 RCS
   3
  5.2900E+03
   0
   0
   0
   0
   0
 Compartment 2:
 Intact SG
   3
  1.7210E+03
   0
   0
   0
   0
   0
 Compartment 3:
```

```
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 4:
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Pathways:
  4
Pathway 1:
RCS to Intact SG
  1
  2
  2
Pathway 2:
Intact SG to Environment
  2
  3
  2
Pathway 3:
Environment to Control Room
  3
  4
  2
Pathway 4:
Control Room to Environment
  4
  3
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
```

```
  0
  0
Compartments:
  4
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  4
Pathway 1:
  0
  0
  0
  0
  0
```

```
  1
  2
  0.0000E+00   1.8800E-02   0.0000E+00   0.0000E+00   0.0000E+00
  4.5500E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  6
  0.0000E+00   3.9420E+01   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   2.3610E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   1.7340E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   1.3980E+00   0.0000E+00   0.0000E+00   0.0000E+00
  9.6000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  3
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  3
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   3.0700E-02
  2.0000E+00   2.4900E-02
```

```
  8.0000E+00   1.1200E-02
  2.4000E+01   7.7800E-03
  9.6000E+01   6.1700E-03
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o3
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:29:26
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   4

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: RCS to Intact SG

Compartment number  2
Name: Intact SG
Compartment volume =   1.7210E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   1: RCS to Intact SG
   Exit Pathway Number    2: Intact SG to Environment

Compartment number  3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  3
   Inlet Pathway Number   2: Intact SG to Environment
   Inlet Pathway Number   4: Control Room to Environment
   Exit Pathway Number    3: Environment to Control Room

Compartment number  4
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   3: Environment to Control Room
   Exit Pathway Number    4: Control Room to Environment

Total number of pathways =   4
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:29:26
#######################################################################

#######################################################################
                     Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	1.0000E+00	0.0000E+00	0.0000E+00	3.756E-02
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
I-131	2	2.076E+00	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	2.280E+00	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	3.159E+00	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	4.739E-01	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	1.791E+00	2.380E+04	8.294E-14	8.460E-09	3.320E-10

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01
Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: RCS

Compartment number 2: Intact SG

Compartment number 3: Environment

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: RCS to Intact SG

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8800E-02	0.0000E+00	0.0000E+00	0.0000E+00
4.5500E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Intact SG to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9420E+01	0.0000E+00	0.0000E+00	0.0000E+00
2.0000E+00	2.3610E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	1.7340E+00	0.0000E+00	0.0000E+00	0.0000E+00
2.4000E+01	1.3980E+00	0.0000E+00	0.0000E+00	0.0000E+00
9.6000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

```
LOCATION DATA
     Location Exclusion Area Boundary     is in compartment   3

     Location X/Q Data
      Time (hr)         X/Q (s * m^-3)
       0.0000E+00          6.4900E-04
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)         Breathing Rate (m^3 * sec^-1)
       0.0000E+00                3.5000E-04
       7.2000E+02                0.0000E+00
     Location Low Population Zone     is in compartment   3

     Location X/Q Data
      Time (hr)         X/Q (s * m^-3)
       0.0000E+00          1.7700E-04
       8.0000E+00          3.9900E-05
       2.4000E+01          7.1200E-06
       9.6000E+01          1.0400E-06
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)         Breathing Rate (m^3 * sec^-1)
       0.0000E+00                3.5000E-04
       8.0000E+00                1.8000E-04
       2.4000E+01                2.3000E-04
       7.2000E+02                0.0000E+00
     Location Control Room     is in compartment   4

     Location X/Q Data
      Time (hr)         X/Q (s * m^-3)
       0.0000E+00          3.0700E-02
       2.0000E+00          2.4900E-02
       8.0000E+00          1.1200E-02
       2.4000E+01          7.7800E-03
       9.6000E+01          6.1700E-03
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)         Breathing Rate (m^3 * sec^-1)
       0.0000E+00                3.5000E-04
       7.2000E+02                0.0000E+00

     Location Occupancy Factor Data
      Time (hr)         Occupancy Factor
       0.0000E+00           1.0000E+00
       2.4000E+01           6.0000E-01
       9.6000E+01           4.0000E-01
       7.2000E+02           0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
      0.0000E+00       1.0000E-01
      2.0000E+00       5.0000E-01
      8.0000E+00       1.0000E+00
```

```
2.4000E+01        2.0000E+00
9.6000E+01        4.0000E+00
7.2000E+02        0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:29:26
#######################################################################
```

```
 ####   #    #  #####  #####   #    #  #####
#    #  #    #    #    #    #  #    #    #
#    #  #    #    #    #    #  #    #    #
#    #  #    #    #    #####   #    #    #
#    #  #    #    #    #       #    #    #
#    #  #    #    #    #       #    #    #
 ####    ####     #    #        ####     #
```

```
#######################################################################
           Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.6757E-09	7.6653E-07	2.5581E-08
Accumulated dose (rem)	1.6757E-09	7.6653E-07	2.5581E-08

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.5702E-10	2.0905E-07	6.9766E-09
Accumulated dose (rem)	4.5702E-10	2.0905E-07	6.9766E-09

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.0773E-12	9.1477E-08	2.8599E-09
Accumulated dose (rem)	7.0773E-12	9.1477E-08	2.8599E-09

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
I-131	7.0310E-08	5.6713E-16	2.6071E+09	2.3482E+04
I-132	7.7136E-08	7.4729E-18	3.4093E+07	2.5771E+04
I-133	1.0698E-07	9.4436E-17	4.2760E+08	3.5729E+04
I-134	1.6005E-08	5.9995E-19	2.6962E+06	5.3504E+03
I-135	6.0636E-08	1.7266E-17	7.7021E+07	2.0253E+04
Xe-133	1.7600E-12	9.4027E-21	4.2575E+04	1.1260E-01
Xe-135	1.2110E-11	4.7420E-21	2.1153E+04	7.7468E-01

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	6.9045E+04	0.0000E+00
Elemental I (atoms)	3.0541E+09	0.0000E+00
Organic I (atoms)	9.4456E+07	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc) I-131 (Thyroid)	5.2036E-17
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	6.1629E-17
Total I (Ci)	3.3106E-07

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2868E+04
Elemental I (atoms)	0.0000E+00	3.0596E+09
Organic I (atoms)	0.0000E+00	9.4626E+07
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	2.7431E+01	0.0000E+00
Elemental I (atoms)	5.7929E+06	0.0000E+00
Organic I (atoms)	1.7916E+05	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4834E-06	1.1366E-03	3.7928E-05
Accumulated dose (rem)	2.4851E-06	1.1373E-03	3.7953E-05

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.7729E-07	3.0997E-04	1.0344E-05
Accumulated dose (rem)	6.7774E-07	3.1018E-04	1.0351E-05

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.0793E-07	3.9822E-03	1.2450E-04
Accumulated dose (rem)	3.0794E-07	3.9823E-03	1.2450E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
I-131	9.9088E-05	7.9926E-13	3.6742E+12	1.0521E+09
I-132	1.0616E-04	1.0285E-14	4.6920E+10	1.1407E+09
I-133	1.5041E-04	1.3277E-13	6.0119E+11	1.5989E+09
I-134	2.1184E-05	7.9410E-16	3.5688E+09	2.3213E+08
I-135	8.4767E-05	2.4137E-14	1.0767E+11	9.0368E+08
Xe-131m	2.1815E-10	2.6044E-18	1.1973E+07	7.7361E+01
Xe-133	6.6330E-08	3.5436E-16	1.6045E+09	2.3547E+04

Xe-133m	4.7536E-09	1.0594E-17	4.7969E+07	1.6871E+03
Xe-135	4.5542E-07	1.7833E-16	7.9552E+08	1.6154E+05
Xe-135m	2.8452E-06	3.1235E-17	1.3933E+08	9.1624E+05

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	2.5993E+09	0.0000E+00	
Elemental I (atoms)	4.3006E+12	0.0000E+00	
Organic I (atoms)	1.3301E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		7.3279E-14
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.6699E-14
Total I (Ci)			4.6160E-04

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.1720E+07
Elemental I (atoms)	0.0000E+00	4.5396E+12
Organic I (atoms)	0.0000E+00	1.4040E+11
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	4.6460E+06	0.0000E+00
Elemental I (atoms)	2.2944E+11	0.0000E+00
Organic I (atoms)	7.0962E+09	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.8959E-04	3.3445E-01	1.0994E-02
Accumulated dose (rem)	5.9208E-04	3.3559E-01	1.1032E-02

Low Population Zone Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.6080E-04	9.1213E-02	2.9984E-03
Accumulated dose (rem)	1.6148E-04	9.1523E-02	3.0087E-03

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.6435E-05	1.0625E+00	3.3115E-02
Accumulated dose (rem)	6.6743E-05	1.0665E+00	3.3239E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 2.0000	Ci	kg	Atoms	Decay
I-131	8.7198E-04	7.0335E-12	3.2333E+13	1.4822E+11
I-132	5.2792E-04	5.1144E-14	2.3333E+11	1.1308E+11
I-133	1.2503E-03	1.1037E-12	4.9974E+12	2.1727E+11
I-134	4.1241E-05	1.5459E-15	6.9476E+09	1.3566E+10
I-135	6.1434E-04	1.7493E-13	7.8035E+11	1.1269E+11
Xe-131m	1.4763E-07	1.7625E-15	8.1023E+09	1.2900E+07
Xe-133	4.3739E-05	2.3367E-13	1.0580E+12	3.8456E+09
Xe-133m	3.1058E-06	6.9218E-15	3.1341E+10	2.7372E+08
Xe-135	3.0357E-04	1.1887E-13	5.3027E+11	2.7148E+10
Xe-135m	2.0717E-04	2.2743E-15	1.0145E+10	3.0862E+10

Control Room Transport Group Inventory:

Time (h) = 2.0000	Atmosphere	Sump
Noble gases (atoms)	1.6379E+12	0.0000E+00
Elemental I (atoms)	3.7201E+13	0.0000E+00
Organic I (atoms)	1.1505E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	6.3416E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	7.3550E-13
Total I (Ci)		3.3057E-03

Time (h) = 2.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.5321E+14
Organic I (atoms)	0.0000E+00	4.7384E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 2.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.6393E+12
Elemental I (atoms)	0.0000E+00	2.0468E+14
Organic I (atoms)	0.0000E+00	6.3303E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 2.0000	Pathway Filtered	Transported
Noble gases (atoms)	3.0178E+11	0.0000E+00
Elemental I (atoms)	1.3669E+13	0.0000E+00
Organic I (atoms)	4.2275E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7664E-04	3.7081E-01	1.1849E-02
Accumulated dose (rem)	9.6872E-04	7.0639E-01	2.2881E-02

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0272E-04	1.0113E-01	3.2316E-03
Accumulated dose (rem)	2.6420E-04	1.9265E-01	6.2403E-03

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.6995E-05	1.3007E+00	4.0325E-02
Accumulated dose (rem)	1.2374E-04	2.3672E+00	7.3565E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
I-131	3.1647E-04	2.5527E-12	1.1735E+13	3.2349E+11
I-132	3.2096E-05	3.1095E-15	1.4186E+10	1.6032E+11
I-133	3.7962E-04	3.3511E-13	1.5174E+12	4.4574E+11
I-134	1.3311E-07	4.9899E-18	2.2425E+07	1.5344E+10
I-135	1.2143E-04	3.4579E-14	1.5425E+11	2.0313E+11
Xe-131m	4.5160E-07	5.3915E-15	2.4785E+10	1.8919E+08
Xe-133	1.2341E-04	6.5929E-13	2.9852E+12	5.3769E+10
Xe-133m	8.5087E-06	1.8963E-14	8.5862E+10	3.7512E+09
Xe-135	5.6827E-04	2.2252E-13	9.9265E+11	3.0024E+11
Xe-135m	4.2503E-05	4.6660E-16	2.0814E+09	6.6881E+10

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump
Noble gases (atoms)	4.0906E+12	0.0000E+00
Elemental I (atoms)	1.3018E+13	0.0000E+00
Organic I (atoms)	4.0262E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	2.2080E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	2.4720E-13
Total I (Ci)		8.4975E-04

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.4083E+14
Organic I (atoms)	0.0000E+00	1.0541E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.8793E+12
Elemental I (atoms)	0.0000E+00	3.8513E+14
Organic I (atoms)	0.0000E+00	1.1911E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	4.0865E+12	0.0000E+00
Elemental I (atoms)	3.0127E+13	0.0000E+00
Organic I (atoms)	9.3177E+11	0.0000E+00

Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1070E-03	1.9638E+00	6.1521E-02
Accumulated dose (rem)	2.0757E-03	2.6702E+00	8.4402E-02

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.8056E-05	6.2090E-02	1.9782E-03
Accumulated dose (rem)	3.3225E-04	2.5474E-01	8.2185E-03

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.1012E-05	2.7515E+00	8.4736E-02
Accumulated dose (rem)	2.0475E-04	5.1187E+00	1.5830E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
I-131	2.3965E-04	1.9330E-12	8.8862E+12	7.2977E+11
I-132	2.0727E-07	2.0080E-17	9.1610E+07	1.6737E+11
I-133	1.7865E-04	1.5770E-13	7.1406E+11	8.2409E+11
I-135	1.8192E-05	5.1802E-15	2.3108E+10	2.7414E+11
Xe-131m	1.5371E-06	1.8351E-14	8.4362E+10	1.9918E+09
Xe-133	3.3471E-04	1.7881E-12	8.0965E+12	4.8168E+11
Xe-133m	2.1401E-05	4.7696E-14	2.1596E+11	3.1959E+10
Xe-135	4.9986E-04	1.9574E-13	8.7316E+11	1.3466E+12
Xe-135m	1.0315E-05	1.1324E-16	5.0515E+08	1.0420E+11

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	9.2705E+12	0.0000E+00	
Elemental I (atoms)	9.3348E+12	0.0000E+00	
Organic I (atoms)	2.8870E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.5546E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.6641E-13
Total I (Ci)			4.3669E-04

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	7.4353E+14
Organic I (atoms)	0.0000E+00	2.2996E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.1096E+13
Elemental I (atoms)	0.0000E+00	8.2031E+14
Organic I (atoms)	0.0000E+00	2.5370E+13

Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	3.1101E+13	0.0000E+00
Elemental I (atoms)	6.5451E+13	0.0000E+00
Organic I (atoms)	2.0243E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0867E-03	3.1090E+00	9.6301E-02
Accumulated dose (rem)	3.1624E-03	5.7791E+00	1.8070E-01

Low Population Zone Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1922E-05	2.2413E-02	6.9835E-04
Accumulated dose (rem)	3.4417E-04	2.7716E-01	8.9169E-03

Control Room Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.4189E-05	1.8245E+00	5.5914E-02
Accumulated dose (rem)	2.3894E-04	6.9433E+00	2.1421E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 45.5000	Ci	kg	Atoms	Decay
I-131	1.7916E-04	1.4452E-12	6.6435E+12	1.1983E+12
I-132	2.5691E-10	2.4889E-20	1.1355E+05	1.6742E+11
I-133	7.0478E-05	6.2215E-14	2.8170E+11	1.0786E+12
I-135	1.5416E-06	4.3896E-16	1.9581E+09	2.8797E+11
Xe-131m	2.4922E-06	2.9753E-14	1.3678E+11	7.1050E+09
Xe-133	4.0189E-04	2.1471E-12	9.7218E+12	1.4227E+12
Xe-133m	2.3070E-05	5.1414E-14	2.3280E+11	8.8884E+10
Xe-135	1.3111E-04	5.1340E-14	2.2902E+11	2.0351E+12
Xe-135m	8.5413E-07	9.3766E-18	4.1827E+07	1.1372E+11

Control Room Transport Group Inventory:

Time (h) = 45.5000	Atmosphere	Sump	
Noble gases (atoms)	1.0320E+13	0.0000E+00	
Elemental I (atoms)	6.7193E+12	0.0000E+00	
Organic I (atoms)	2.0781E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.0997E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.1411E-13
Total I (Ci)			2.5118E-04

Time (h) = 45.5000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.1903E+15
Organic I (atoms)	0.0000E+00	3.6814E+13

Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 45.5000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.8108E+13
Elemental I (atoms)	0.0000E+00	1.3075E+15
Organic I (atoms)	0.0000E+00	4.0437E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 45.5000	Pathway Filtered	Transported
Noble gases (atoms)	8.5702E+13	0.0000E+00
Elemental I (atoms)	1.0464E+14	0.0000E+00
Organic I (atoms)	3.2364E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.8790E-04	2.7057E+00	8.3306E-02
Accumulated dose (rem)	3.8503E-03	8.4848E+00	2.6401E-01

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.5467E-06	1.9506E-02	6.0317E-04
Accumulated dose (rem)	3.5172E-04	2.9666E-01	9.5201E-03

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9106E-05	1.5905E+00	4.8585E-02
Accumulated dose (rem)	2.5804E-04	8.5338E+00	2.6280E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
I-131	1.2952E-05	1.0447E-13	4.8027E+11	1.6183E+12
I-133	1.1352E-06	1.0021E-15	4.5373E+09	1.1903E+12
I-135	6.6985E-10	1.9074E-19	8.5086E+05	2.8930E+11
Xe-131m	4.9387E-07	5.8962E-15	2.7105E+10	1.6636E+10
Xe-133	4.3513E-05	2.3247E-13	1.0526E+12	2.6569E+12
Xe-133m	1.8491E-06	4.1209E-15	1.8659E+10	1.5366E+11
Xe-135	3.9275E-07	1.5379E-16	6.8605E+08	2.2073E+12
Xe-135m	3.8250E-10	4.1991E-21	1.8731E+04	1.1459E+11

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump
Noble gases (atoms)	1.0990E+12	0.0000E+00
Elemental I (atoms)	4.7026E+11	0.0000E+00
Organic I (atoms)	1.4544E+10	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc) I-131 (Thyroid) 7.5686E-15

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Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    7.6346E-15
Total I (Ci)                                    1.4088E-05

                        Deposition Recirculating
Time (h) =  96.0000      Surfaces     Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
Elemental I (atoms)     0.0000E+00  1.5911E+15
Organic I (atoms)       0.0000E+00  4.9210E+13
Aerosols (kg)           0.0000E+00  0.0000E+00

Environment to Control Room Transport Group Inventory:

                         Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     0.0000E+00  1.6065E+14
Elemental I (atoms)     0.0000E+00  1.7377E+15
Organic I (atoms)       0.0000E+00  5.3742E+13
Aerosols (kg)           0.0000E+00  0.0000E+00

Control Room to Environment Transport Group Inventory:

                         Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     1.5616E+14  0.0000E+00
Elemental I (atoms)     1.3980E+14  0.0000E+00
Organic I (atoms)       4.3238E+12  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   3.8503E-03  8.4848E+00  2.6401E-01

Low Population Zone Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   3.5172E-04  2.9666E-01  9.5201E-03

Control Room Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         4.2721E-08  2.1715E-03  6.6218E-05
Accumulated dose (rem)   2.5809E-04  8.5360E+00  2.6287E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000        Ci            kg          Atoms       Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000     Atmosphere     Sump
Noble gases (atoms)     1.1354E-69  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
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Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 0.0000E+00
Total I (Ci) 0.0000E+00

Time (h) = 720.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.5912E+15
Organic I (atoms)	0.0000E+00	4.9214E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.6065E+14
Elemental I (atoms)	0.0000E+00	1.7377E+15
Organic I (atoms)	0.0000E+00	5.3742E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.5725E+14	0.0000E+00
Elemental I (atoms)	1.3981E+14	0.0000E+00
Organic I (atoms)	4.3241E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

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I-131 Summary
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Time (hr)	RCS I-131 (Curies)	Intact SG I-131 (Curies)	Environment I-131 (Curies)
0.000	5.9332E+02	3.5134E-05	8.9424E-09
0.004	3.8447E+03	1.4732E-03	2.4306E-06
0.083	3.8435E+03	6.3190E-02	3.6055E-03
0.400	3.8389E+03	2.5104E-01	7.4953E-02
0.700	3.8345E+03	3.6707E-01	2.0401E-01
1.000	3.8302E+03	4.4357E-01	3.7218E-01
1.300	3.8258E+03	4.9395E-01	5.6614E-01
1.600	3.8214E+03	5.2704E-01	7.7705E-01
1.900	3.8171E+03	5.4870E-01	9.9909E-01
2.000	3.8156E+03	5.5409E-01	1.0749E+00
2.300	3.8112E+03	7.8082E-01	1.0914E+00
2.600	3.8069E+03	1.0015E+00	1.1134E+00
2.900	3.8026E+03	1.2163E+00	1.1408E+00
3.200	3.7982E+03	1.4254E+00	1.1734E+00
3.500	3.7939E+03	1.6288E+00	1.2111E+00
3.800	3.7896E+03	1.8268E+00	1.2538E+00
4.100	3.7852E+03	2.0195E+00	1.3013E+00
4.400	3.7809E+03	2.2071E+00	1.3534E+00
4.700	3.7766E+03	2.3896E+00	1.4102E+00
5.000	3.7723E+03	2.5671E+00	1.4714E+00
5.300	3.7680E+03	2.7399E+00	1.5369E+00

5.600	3.7637E+03	2.9080E+00	1.6067E+00
5.900	3.7594E+03	3.0716E+00	1.6805E+00
6.200	3.7551E+03	3.2307E+00	1.7583E+00
6.500	3.7508E+03	3.3855E+00	1.8400E+00
6.800	3.7465E+03	3.5361E+00	1.9254E+00
7.100	3.7423E+03	3.6826E+00	2.0145E+00
7.400	3.7380E+03	3.8251E+00	2.1072E+00
7.700	3.7337E+03	3.9637E+00	2.2034E+00
8.000	3.7295E+03	4.0986E+00	2.3029E+00
8.300	3.7252E+03	4.2567E+00	2.3787E+00
8.600	3.7210E+03	4.4116E+00	2.4573E+00
8.900	3.7167E+03	4.5633E+00	2.5387E+00
9.200	3.7125E+03	4.7118E+00	2.6228E+00
9.500	3.7082E+03	4.8572E+00	2.7095E+00
9.800	3.7040E+03	4.9996E+00	2.7989E+00
10.100	3.6998E+03	5.1390E+00	2.8908E+00
10.400	3.6956E+03	5.2755E+00	2.9852E+00
24.000	3.5092E+03	9.1546E+00	9.1726E+00
45.500	3.2335E+03	1.2175E+01	2.0726E+01
96.000	2.6970E+03	8.6644E-01	3.1239E+01
720.000	2.8669E+02	9.2100E-02	3.1239E+01

Time (hr)	Control Room I-131 (Curies)
0.000	2.5906E-10
0.004	7.0310E-08
0.083	9.9088E-05
0.400	2.3488E-04
0.700	4.3112E-04
1.000	5.9653E-04
1.300	7.1762E-04
1.600	8.0138E-04
1.900	8.5776E-04
2.000	8.7198E-04
2.300	3.2869E-04
2.600	1.5842E-04
2.900	1.1285E-04
3.200	1.0877E-04
3.500	1.1830E-04
3.800	1.3209E-04
4.100	1.4703E-04
4.400	1.6208E-04
4.700	1.7690E-04
5.000	1.9137E-04
5.300	2.0547E-04
5.600	2.1920E-04
5.900	2.3256E-04
6.200	2.4556E-04
6.500	2.5821E-04
6.800	2.7051E-04
7.100	2.8248E-04
7.400	2.9412E-04
7.700	3.0545E-04
8.000	3.1647E-04
8.300	1.7939E-04
8.600	1.3618E-04
8.900	1.2437E-04

9.200	1.2304E-04
9.500	1.2515E-04
9.800	1.2838E-04
10.100	1.3192E-04
10.400	1.3551E-04
24.000	2.3965E-04
45.500	1.7916E-04
96.000	1.2952E-05
720.000	0.0000E+00

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Cumulative Dose Summary

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	Exclusion Area Bounda		Low Population Zone		Control Room	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	7.6653E-07	2.5581E-08	2.0905E-07	6.9766E-09	9.1477E-08	2.8599E-09
0.083	1.1373E-03	3.7953E-05	3.1018E-04	1.0351E-05	3.9823E-03	1.2450E-04
0.400	2.3599E-02	7.8509E-04	6.4362E-03	2.1412E-04	5.2580E-02	1.6429E-03
0.700	6.4121E-02	2.1274E-03	1.7487E-02	5.8020E-04	1.5297E-01	4.7769E-03
1.000	1.1679E-01	3.8652E-03	3.1851E-02	1.0542E-03	3.0815E-01	9.6178E-03
1.300	1.7737E-01	5.8571E-03	4.8373E-02	1.5974E-03	5.0575E-01	1.5778E-02
1.600	2.4308E-01	8.0106E-03	6.6294E-02	2.1847E-03	7.3321E-01	2.2864E-02
1.900	3.1208E-01	1.0265E-02	8.5112E-02	2.7996E-03	9.8075E-01	3.0572E-02
2.000	3.3559E-01	1.1032E-02	9.1523E-02	3.0087E-03	1.0665E+00	3.3239E-02
2.300	3.4069E-01	1.1198E-02	9.2916E-02	3.0541E-03	1.2315E+00	3.8374E-02
2.600	3.4750E-01	1.1419E-02	9.4772E-02	3.1143E-03	1.2992E+00	4.0480E-02
2.900	3.5594E-01	1.1693E-02	9.7074E-02	3.1890E-03	1.3378E+00	4.1680E-02
3.200	3.6597E-01	1.2017E-02	9.9811E-02	3.2775E-03	1.3700E+00	4.2680E-02
3.500	3.7755E-01	1.2391E-02	1.0297E-01	3.3793E-03	1.4032E+00	4.3712E-02
3.800	3.9061E-01	1.2812E-02	1.0653E-01	3.4941E-03	1.4399E+00	4.4851E-02
4.100	4.0512E-01	1.3279E-02	1.1049E-01	3.6214E-03	1.4807E+00	4.6119E-02
4.400	4.2103E-01	1.3790E-02	1.1483E-01	3.7608E-03	1.5259E+00	4.7520E-02
4.700	4.3829E-01	1.4343E-02	1.1953E-01	3.9118E-03	1.5753E+00	4.9052E-02
5.000	4.5687E-01	1.4938E-02	1.2460E-01	4.0741E-03	1.6289E+00	5.0713E-02
5.300	4.7672E-01	1.5573E-02	1.3001E-01	4.2473E-03	1.6865E+00	5.2498E-02
5.600	4.9780E-01	1.6247E-02	1.3576E-01	4.4310E-03	1.7480E+00	5.4404E-02
5.900	5.2008E-01	1.6958E-02	1.4184E-01	4.6249E-03	1.8133E+00	5.6428E-02
6.200	5.4351E-01	1.7705E-02	1.4823E-01	4.8286E-03	1.8823E+00	5.8564E-02
6.500	5.6806E-01	1.8487E-02	1.5492E-01	5.0419E-03	1.9549E+00	6.0810E-02
6.800	5.9369E-01	1.9303E-02	1.6192E-01	5.2644E-03	2.0309E+00	6.3162E-02
7.100	6.2037E-01	2.0151E-02	1.6919E-01	5.4957E-03	2.1102E+00	6.5616E-02
7.400	6.4807E-01	2.1031E-02	1.7675E-01	5.7357E-03	2.1928E+00	6.8171E-02
7.700	6.7676E-01	2.1941E-02	1.8457E-01	5.9840E-03	2.2785E+00	7.0821E-02
8.000	7.0639E-01	2.2881E-02	1.9265E-01	6.2403E-03	2.3672E+00	7.3565E-02
8.300	7.2891E-01	2.3595E-02	1.9336E-01	6.2634E-03	2.4346E+00	7.5649E-02
8.600	7.5223E-01	2.4333E-02	1.9410E-01	6.2873E-03	2.4784E+00	7.7003E-02
8.900	7.7633E-01	2.5096E-02	1.9486E-01	6.3120E-03	2.5150E+00	7.8135E-02
9.200	8.0119E-01	2.5882E-02	1.9565E-01	6.3374E-03	2.5500E+00	7.9214E-02
9.500	8.2680E-01	2.6692E-02	1.9646E-01	6.3636E-03	2.5850E+00	8.0298E-02
9.800	8.5313E-01	2.7524E-02	1.9729E-01	6.3905E-03	2.6208E+00	8.1403E-02
10.100	8.8017E-01	2.8377E-02	1.9815E-01	6.4181E-03	2.6575E+00	8.2536E-02
10.400	9.0790E-01	2.9252E-02	1.9902E-01	6.4463E-03	2.6951E+00	8.3698E-02
24.000	2.6702E+00	8.4402E-02	2.5474E-01	8.2185E-03	5.1187E+00	1.5830E-01
45.500	5.7791E+00	1.8070E-01	2.7716E-01	8.9169E-03	6.9433E+00	2.1421E-01

```
  96.000 8.4848E+00 2.6401E-01 2.9666E-01 9.5201E-03 8.5338E+00 2.6280E-01
 720.000 8.4848E+00 2.6401E-01 2.9666E-01 9.5201E-03 8.5360E+00 2.6287E-01

#####################################################################
                        Worst Two-Hour Doses
#####################################################################

Exclusion Area Boundary
   Time    Whole Body     Thyroid         TEDE
   (hr)      (rem)         (rem)          (rem)
    0.0    5.9208E-04    3.3559E-01    1.1032E-02
```

Attachment 13.5
RADTRAD Output File PMSINPLI01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:36:48
 #######################################################################

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

 Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078 R1\PMSINPLI01.psf
 Inventory file       = g:\radtrad 3.03\defaults\pimsliq_iodine_def.txt
 Release file         = g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
 Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt
```

```
     #####    ####   #####    #  #     #  #####   #    #  #####
     #    #  #       #        #  ##    #  #    #  #    #    #
     #    #  #       #        #  # #   #  #    #  #    #    #
     #####    ####   ####     #  #  #  #  #####   #    #    #
     #            #  #        #  #   # #  #       #    #    #
     #            #  #        #  #    ##  #       #    #    #
     #        ####   #        #  #     #  #        ####     #
```

```
 Radtrad 3.03 4/15/2001
 PINGP 1 & 2 MSLB Accident AST Analysis - Pre-accident  Iodine Spike with SG Liquid
Iodine Released  From Intact  SG  With Tube Uncovered for 2 Hours
 Nuclide Inventory File:
 g:\radtrad 3.03\defaults\pimsliq_iodine_def.txt
 Plant Power Level:
  1.8520E+03
 Compartments:
   3
 Compartment 1:
 Intact SG
   3
  1.7210E+03
   0
   0
   0
   0
   0
 Compartment 2:
 Environment
   2
  0.0000E+00
   0
   0
   0
   0
   0
 Compartment 3:
```

```
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Pathways:
  3
Pathway 1:
Intact SG to Environment
  1
  2
  2
Pathway 2:
Environment to Control Room
  2
  3
  2
Pathway 3:
Control Room to Environment
  3
  2
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  3
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
```

```
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  3
Pathway 1:
  0
  0
  0
  0
  0
  1
  5
  0.0000E+00   3.9420E+01   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   2.3610E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   1.7340E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   1.3980E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.5500E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  2
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  2
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  3
```

```
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   3.0700E-02
  2.0000E+00   2.4900E-02
  8.0000E+00   1.1200E-02
  2.4000E+01   7.7800E-03
  9.6000E+01   6.1700E-03
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o4
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:36:48
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   3

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Intact SG
Compartment volume =   1.7210E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Intact SG to Environment

Compartment number  2
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Intact SG to Environment
   Inlet Pathway Number   3: Control Room to Environment
   Exit Pathway Number    2: Environment to Control Room

Compartment number  3
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  3
   Inlet Pathway Number   2: Environment to Control Room
   Exit Pathway Number    3: Control Room to Environment

Total number of pathways =   3
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:36:48
#######################################################################

#######################################################################
                    Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	1.0000E+00	0.0000E+00	0.0000E+00	4.077E-05
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
I-131	2	2.253E-03	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	2.474E-03	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	3.428E-03	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	5.142E-04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	1.944E-03	2.380E+04	8.294E-14	8.460E-09	3.320E-10

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01
Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: Intact SG

Compartment number 2: Environment

Compartment number 3: Control Room

Compartment Filter Data

Time (hr) Flow Rate Filter Efficiencies (%)

	(cfm)	Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: Intact SG to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9420E+01	0.0000E+00	0.0000E+00	0.0000E+00
2.0000E+00	2.3610E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	1.7340E+00	0.0000E+00	0.0000E+00	0.0000E+00
2.4000E+01	1.3980E+00	0.0000E+00	0.0000E+00	0.0000E+00
4.5500E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	6.4900E-04
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Low Population Zone is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	1.7700E-04
8.0000E+00	3.9900E-05

```
  2.4000E+01          7.1200E-06
  9.6000E+01          1.0400E-06
  7.2000E+02          0.0000E+00

Location Breathing Rate Data
 Time (hr)         Breathing Rate (m^3 * sec^-1)
  0.0000E+00                3.5000E-04
  8.0000E+00                1.8000E-04
  2.4000E+01                2.3000E-04
  7.2000E+02                0.0000E+00
Location Control Room'    is in compartment   3

Location X/Q Data
 Time (hr)         X/Q (s * m^-3)
  0.0000E+00          3.0700E-02
  2.0000E+00          2.4900E-02
  8.0000E+00          1.1200E-02
  2.4000E+01          7.7800E-03
  9.6000E+01          6.1700E-03
  7.2000E+02          0.0000E+00

Location Breathing Rate Data
 Time (hr)         Breathing Rate (m^3 * sec^-1)
  0.0000E+00                3.5000E-04
  7.2000E+02                0.0000E+00

Location Occupancy Factor Data
 Time (hr)         Occupancy Factor
  0.0000E+00            1.0000E+00
  2.4000E+01            6.0000E-01
  9.6000E+01            4.0000E-01
  7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
  0.0000E+00       1.0000E-01
  2.0000E+00       5.0000E-01
  8.0000E+00       1.0000E+00
  2.4000E+01       2.0000E+00
  9.6000E+01       4.0000E+00
  7.2000E+02       0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:36:48
#######################################################################

     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #

#######################################################################
           Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.1040E-06	3.2497E-03	1.0845E-04
Accumulated dose (rem)	7.1040E-06	3.2497E-03	1.0845E-04

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9374E-06	8.8628E-04	2.9577E-05
Accumulated dose (rem)	1.9374E-06	8.8628E-04	2.9577E-05

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2581E-08	4.2114E-04	1.3166E-05
Accumulated dose (rem)	3.2581E-08	4.2114E-04	1.3166E-05

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
I-131	2.9791E-04	2.4030E-12	1.1047E+13	1.0140E+08
I-132	3.2678E-04	3.1658E-14	1.4443E+11	1.1126E+08
I-133	4.5323E-04	4.0009E-13	1.8116E+12	1.5427E+08
I-134	6.7799E-05	2.5415E-15	1.1422E+10	2.3099E+07
I-135	2.5696E-04	7.3168E-14	3.2639E+11	8.7469E+07
Xe-131m	2.3355E-11	2.7883E-19	1.2818E+06	1.2038E+00
Xe-133	7.1091E-09	3.7980E-17	1.7197E+08	3.6644E+02
Xe-133m	5.0949E-10	1.1355E-18	5.1413E+06	2.6262E+01
Xe-135	4.8924E-08	1.9158E-17	8.5460E+07	2.5216E+03
Xe-135m	3.0757E-07	3.3765E-18	1.5062E+07	1.5812E+04

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	2.7891E+08	0.0000E+00

```
Elemental I (atoms)     1.2940E+13  0.0000E+00
Organic I (atoms)       4.0021E+11  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          2.2048E-13
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    2.6112E-13
Total I (Ci)                                    1.4027E-03

                        Deposition Recirculating
Time (h) =    0.0036     Surfaces     Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00

Environment to Control Room Transport Group Inventory:

                          Pathway
Time (h) =    0.0036     Filtered   Transported
Noble gases (atoms)     0.0000E+00  3.6350E+07
Elemental I (atoms)     0.0000E+00  1.2971E+13
Organic I (atoms)       0.0000E+00  4.0117E+11
Aerosols (kg)           0.0000E+00  0.0000E+00

Control Room to Environment Transport Group Inventory:

                          Pathway
Time (h) =    0.0036     Filtered   Transported
Noble gases (atoms)     1.2791E+05  0.0000E+00
Elemental I (atoms)     3.0415E+10  0.0000E+00
Organic I (atoms)       9.4067E+08  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) =    0.0833    Whole Body   Thyroid       TEDE
Delta dose (rem)         2.9752E-04  1.3617E-01  4.5442E-03
Accumulated dose (rem)   3.0463E-04  1.3942E-01  4.6526E-03

Low Population Zone Doses:

Time (h) =    0.0833    Whole Body   Thyroid       TEDE
Delta dose (rem)         8.1143E-05  3.7138E-02  1.2393E-03
Accumulated dose (rem)   8.3080E-05  3.8024E-02  1.2689E-03

Control Room Doses:

Time (h) =    0.0833    Whole Body   Thyroid       TEDE
Delta dose (rem)         3.7632E-05  4.8668E-01  1.5215E-02
Accumulated dose (rem)   3.7665E-05  4.8710E-01  1.5228E-02

Control Room Compartment Nuclide Inventory:

Time (h) =    0.0833       Ci           kg          Atoms       Decay
I-131                   1.1821E-02  9.5350E-11  4.3833E+14  1.2561E+11
I-132                   1.2662E-02  1.2267E-12  5.5966E+12  1.3616E+11
I-133                   1.7941E-02  1.5838E-11  7.1713E+13  1.9087E+11
I-134                   2.5267E-03  9.4715E-14  4.2566E+11  2.7710E+10
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I-135	1.0114E-02	2.8800E-12	1.2847E+13	1.0791E+11
Xe-131m	2.6023E-08	3.1069E-16	1.4282E+09	9.2152E+03
Xe-133	7.9118E-06	4.2268E-14	1.9139E+11	2.8047E+06
Xe-133m	5.6701E-07	1.2637E-15	5.7218E+09	2.0094E+05
Xe-135	5.4336E-05	2.1277E-14	9.4914E+10	1.9246E+07
Xe-135m	3.3947E-04	3.7267E-15	1.6624E+10	1.0916E+08

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	3.1007E+11	0.0000E+00	
Elemental I (atoms)	5.1304E+14	0.0000E+00	
Organic I (atoms)	1.5867E+13	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		8.7419E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.0343E-11
Total I (Ci)			5.5066E-02

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.0990E+10
Elemental I (atoms)	0.0000E+00	5.5650E+14
Organic I (atoms)	0.0000E+00	1.7211E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	8.6761E+08	0.0000E+00
Elemental I (atoms)	4.2946E+13	0.0000E+00
Organic I (atoms)	1.3282E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1126E-03	1.0835E+00	3.5857E-02
Accumulated dose (rem)	2.4172E-03	1.2229E+00	4.0509E-02

Low Population Zone Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.7617E-04	2.9550E-01	9.7791E-03
Accumulated dose (rem)	6.5925E-04	3.3352E-01	1.1048E-02

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE

Delta dose (rem)	5.0526E-04	7.2042E+00	2.2488E-01
Accumulated dose (rem)	5.4293E-04	7.6913E+00	2.4011E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 2.0000	Ci	kg	Atoms	Decay
I-131	7.0272E-04	5.6682E-12	2.6057E+13	1.0110E+12
I-132	4.2538E-04	4.1210E-14	1.8801E+11	9.4695E+11
I-133	1.0075E-03	8.8936E-13	4.0270E+12	1.5128E+12
I-134	3.3228E-05	1.2456E-15	5.5979E+09	1.5727E+11
I-135	4.9517E-04	1.4100E-13	6.2897E+11	8.2466E+11
Xe-131m	3.2263E-07	3.8518E-15	1.7707E+10	5.7846E+07
Xe-133	9.6205E-05	5.1397E-13	2.3272E+12	1.7364E+10
Xe-133m	6.8180E-06	1.5195E-14	6.8801E+10	1.2364E+09
Xe-135	6.7416E-04	2.6399E-13	1.1776E+12	1.2441E+11
Xe-135m	2.3911E-04	2.6250E-15	1.1710E+10	1.6218E+11

Control Room Transport Group Inventory:

Time (h) = 2.0000	Atmosphere	Sump	
Noble gases (atoms)	3.6030E+12	0.0000E+00	
Elemental I (atoms)	2.9979E+13	0.0000E+00	
Organic I (atoms)	9.2720E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		5.1105E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		5.9272E-13
Total I (Ci)			2.6640E-03

Time (h) = 2.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.0368E+15
Organic I (atoms)	0.0000E+00	3.2065E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 2.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.8405E+12
Elemental I (atoms)	0.0000E+00	1.2050E+15
Organic I (atoms)	0.0000E+00	3.7268E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 2.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.4427E+12	0.0000E+00
Elemental I (atoms)	1.3389E+14	0.0000E+00
Organic I (atoms)	4.1409E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5153E-05	3.1181E-02	1.0008E-03
Accumulated dose (rem)	2.4524E-03	1.2541E+00	4.1510E-02

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.5872E-06	8.5038E-03	2.7294E-04
Accumulated dose (rem)	6.6883E-04	3.4203E-01	1.1321E-02

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.9960E-05	2.8547E-01	8.8764E-03
Accumulated dose (rem)	5.6289E-04	7.9768E+00	2.4899E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
I-131	1.2950E-05	1.0446E-13	4.8020E+11	1.0452E+12
I-132	1.3132E-06	1.2722E-16	5.8042E+08	9.6257E+11
I-133	1.5533E-05	1.3712E-14	6.2087E+10	1.5600E+12
I-134	5.4461E-09	2.0415E-19	9.1749E+05	1.5823E+11
I-135	4.9701E-06	1.4152E-15	6.3131E+09	8.4611E+11
Xe-131m	8.0019E-08	9.5532E-16	4.3917E+09	1.8892E+08
Xe-133	2.2990E-05	1.2282E-13	5.5613E+11	5.6039E+10
Xe-133m	1.5617E-06	3.4805E-15	1.5759E+10	3.9307E+09
Xe-135	1.0614E-04	4.1562E-14	1.8540E+11	3.5817E+11
Xe-135m	1.8031E-06	1.9795E-17	8.8301E+07	1.7692E+11

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump
Noble gases (atoms)	7.6177E+11	0.0000E+00
Elemental I (atoms)	5.3271E+11	0.0000E+00
Organic I (atoms)	1.6476E+10	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	9.0352E-15
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.0116E-14
Total I (Ci)		3.4772E-05

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.0777E+15
Organic I (atoms)	0.0000E+00	3.3329E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.2848E+12
Elemental I (atoms)	0.0000E+00	1.2201E+15
Organic I (atoms)	0.0000E+00	3.7737E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported

Noble gases (atoms)	4.5247E+12	0.0000E+00
Elemental I (atoms)	1.3748E+14	0.0000E+00
Organic I (atoms)	4.2519E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7023E-05	2.7695E-02	8.6977E-04
Accumulated dose (rem)	2.4694E-03	1.2818E+00	4.2380E-02

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0466E-06	8.7565E-04	2.8009E-05
Accumulated dose (rem)	6.6988E-04	3.4290E-01	1.1349E-02

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.2130E-06	4.1491E-02	1.2799E-03
Accumulated dose (rem)	5.6510E-04	8.0183E+00	2.5027E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
I-131	1.5260E-06	1.2309E-14	5.6585E+10	1.0510E+12
I-132	1.3196E-09	1.2785E-19	5.8326E+05	9.6275E+11
I-133	1.1375E-06	1.0041E-15	4.5465E+09	1.5658E+12
I-135	1.1586E-07	3.2991E-17	1.4717E+08	8.4741E+11
Xe-131m	1.3068E-08	1.5602E-16	7.1723E+08	2.4473E+08
Xe-133	2.9082E-06	1.5537E-14	7.0350E+10	7.0957E+10
Xe-133m	1.8471E-07	4.1166E-16	1.8639E+09	4.9187E+09
Xe-135	4.3394E-06	1.6992E-15	7.5800E+09	4.0811E+11
Xe-135m	6.6238E-08	7.2715E-19	3.2437E+06	1.7755E+11

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump
Noble gases (atoms)	8.0514E+10	0.0000E+00
Elemental I (atoms)	5.9441E+10	0.0000E+00
Organic I (atoms)	1.8384E+09	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	9.8989E-16
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.0596E-15
Total I (Ci)		2.7806E-06

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.0837E+15
Organic I (atoms)	0.0000E+00	3.3517E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported

Noble gases (atoms)	0.0000E+00	3.7090E+12
Elemental I (atoms)	0.0000E+00	1.2263E+15
Organic I (atoms)	0.0000E+00	3.7926E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.5724E+12	0.0000E+00
Elemental I (atoms)	1.3801E+14	0.0000E+00
Organic I (atoms)	4.2683E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5483E-06	9.6904E-03	3.0045E-04
Accumulated dose (rem)	2.4730E-03	1.2915E+00	4.2680E-02

Low Population Zone Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.8927E-08	6.9861E-05	2.1794E-06
Accumulated dose (rem)	6.6992E-04	3.4297E-01	1.1351E-02

Control Room Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3376E-07	5.8865E-03	1.8050E-04
Accumulated dose (rem)	5.6524E-04	8.0242E+00	2.5045E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 45.5000	Ci	kg	Atoms	Decay
I-131	2.7652E-07	2.2304E-15	1.0253E+10	1.0524E+12
I-133	1.0876E-07	9.6012E-17	4.3474E+08	1.5666E+12
I-135	2.3796E-09	6.7758E-19	3.0226E+06	8.4747E+11
Xe-131m	4.6113E-09	5.5053E-17	2.5308E+08	2.6375E+08
Xe-133	7.4969E-07	4.0052E-15	1.8135E+10	7.4657E+10
Xe-133m	4.2939E-08	9.5696E-17	4.3331E+08	5.1448E+09
Xe-135	2.4461E-07	9.5786E-17	4.2729E+08	4.1139E+11
Xe-135m	1.3284E-09	1.4583E-20	6.5054E+04	1.7759E+11

Control Room Transport Group Inventory:

Time (h) = 45.5000	Atmosphere	Sump	
Noble gases (atoms)	1.9249E+10	0.0000E+00	
Elemental I (atoms)	1.0370E+10	0.0000E+00	
Organic I (atoms)	3.2074E+08	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.6973E-16
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.7612E-16
Total I (Ci)			3.8766E-07

Time (h) = 45.5000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00

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Elemental I (atoms)     0.0000E+00  1.0851E+15
Organic I (atoms)       0.0000E+00  3.3560E+13
Aerosols (kg)           0.0000E+00  0.0000E+00

Environment to Control Room Transport Group Inventory:

                          Pathway
Time (h) =  45.5000      Filtered   Transported
Noble gases (atoms)     0.0000E+00  3.8800E+12
Elemental I (atoms)     0.0000E+00  1.2278E+15
Organic I (atoms)       0.0000E+00  3.7973E+13
Aerosols (kg)           0.0000E+00  0.0000E+00

Control Room to Environment Transport Group Inventory:

                          Pathway
Time (h) =  45.5000      Filtered   Transported
Noble gases (atoms)     5.7986E+12  0.0000E+00
Elemental I (atoms)     1.3813E+14  0.0000E+00
Organic I (atoms)       4.2721E+12  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) =  96.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   2.4730E-03  1.2915E+00  4.2680E-02

Low Population Zone Doses:

Time (h) =  96.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   6.6992E-04  3.4297E-01  1.1351E-02

Control Room Doses:

Time (h) =  96.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         2.5280E-09  5.2073E-05  1.5946E-06
Accumulated dose (rem)   5.6524E-04  8.0242E+00  2.5045E-01

Control Room Compartment Nuclide Inventory:

Time (h) =  96.0000        Ci           kg          Atoms       Decay

Control Room Transport Group Inventory:
Time (h) =  96.0000     Atmosphere     Sump
Noble gases (atoms)     5.2364E+03  0.0000E+00
Elemental I (atoms)     1.2129E-70  0.0000E+00
Organic I (atoms)       3.7513E-72  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          1.9521E-96
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    1.9691E-96
Total I (Ci)                                    3.6336E-87

                        Deposition Recirculating
Time (h) =  96.0000      Surfaces     Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
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Elemental I (atoms)     0.0000E+00  1.0851E+15
Organic I (atoms)       0.0000E+00  3.3561E+13
Aerosols (kg)           0.0000E+00  0.0000E+00

Environment to Control Room Transport Group Inventory:

                          Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     0.0000E+00  3.8800E+12
Elemental I (atoms)     0.0000E+00  1.2278E+15
Organic I (atoms)       0.0000E+00  3.7973E+13
Aerosols (kg)           0.0000E+00  0.0000E+00

Control Room to Environment Transport Group Inventory:

                          Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     5.8175E+12  0.0000E+00
Elemental I (atoms)     1.3813E+14  0.0000E+00
Organic I (atoms)       4.2722E+12  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   2.4730E-03  1.2915E+00  4.2680E-02

Low Population Zone Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   6.6992E-04  3.4297E-01  1.1351E-02

Control Room Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         1.3105E-16  5.6007E-85  1.3105E-16
Accumulated dose (rem)   5.6524E-04  8.0242E+00  2.5045E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000        Ci          kg          Atoms       Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000     Atmosphere     Sump
Noble gases (atoms)     5.1568E-78  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                        Deposition Recirculating
Time (h) = 720.0000      Surfaces     Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
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Elemental I (atoms)	0.0000E+00	1.0851E+15
Organic I (atoms)	0.0000E+00	3.3561E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.8800E+12
Elemental I (atoms)	0.0000E+00	1.2278E+15
Organic I (atoms)	0.0000E+00	3.7973E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.8175E+12	0.0000E+00
Elemental I (atoms)	1.3813E+14	0.0000E+00
Organic I (atoms)	4.2722E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

840

##
I-131 Summary
##

Time (hr)	Intact SG I-131 (Curies)	Environment I-131 (Curies)	Control Room I-131 (Curies)
0.000	6.4367E-01	2.4575E-04	7.1188E-06
0.004	4.1622E+00	1.0305E-02	2.9791E-04
0.083	3.7293E+00	4.4200E-01	1.1821E-02
0.400	2.4105E+00	1.7571E+00	6.9823E-03
0.700	1.5944E+00	2.5710E+00	4.4135E-03
1.000	1.0545E+00	3.1093E+00	2.8506E-03
1.300	6.9748E-01	3.4654E+00	1.8624E-03
1.600	4.6133E-01	3.7009E+00	1.2241E-03
1.900	3.0513E-01	3.8566E+00	8.0707E-04
2.000	2.6585E-01	3.8958E+00	7.0272E-04
2.300	2.5909E-01	3.9023E+00	2.4939E-04
2.600	2.5250E-01	3.9086E+00	9.7097E-05
2.900	2.4607E-01	3.9148E+00	4.5711E-05
3.200	2.3981E-01	3.9208E+00	2.8153E-05
3.500	2.3371E-01	3.9266E+00	2.1942E-05
3.800	2.2776E-01	3.9323E+00	1.9542E-05
4.100	2.2197E-01	3.9378E+00	1.8428E-05
4.400	2.1632E-01	3.9433E+00	1.7752E-05
4.700	2.1082E-01	3.9485E+00	1.7231E-05
5.000	2.0545E-01	3.9537E+00	1.6769E-05
5.300	2.0023E-01	3.9587E+00	1.6335E-05
5.600	1.9513E-01	3.9636E+00	1.5917E-05
5.900	1.9017E-01	3.9683E+00	1.5511E-05
6.200	1.8533E-01	3.9729E+00	1.5116E-05
6.500	1.8062E-01	3.9775E+00	1.4731E-05
6.800	1.7602E-01	3.9819E+00	1.4356E-05
7.100	1.7154E-01	3.9862E+00	1.3991E-05

7.400	1.6718E-01	3.9903E+00	1.3635E-05
7.700	1.6292E-01	3.9944E+00	1.3288E-05
8.000	1.5878E-01	3.9984E+00	1.2950E-05
8.300	1.5576E-01	4.0012E+00	7.0864E-06
8.600	1.5279E-01	4.0040E+00	5.0688E-06
8.900	1.4989E-01	4.0068E+00	4.3413E-06
9.200	1.4703E-01	4.0095E+00	4.0472E-06
9.500	1.4423E-01	4.0121E+00	3.8993E-06
9.800	1.4149E-01	4.0147E+00	3.8013E-06
10.100	1.3880E-01	4.0172E+00	3.7210E-06
10.400	1.3616E-01	4.0197E+00	3.6475E-06
24.000	5.6985E-02	4.0944E+00	1.5260E-06
45.500	1.8498E-02	4.1301E+00	2.7652E-07
96.000	1.5429E-02	4.1301E+00	3.3406E-87
720.000	1.6401E-03	4.1301E+00	0.0000E+00

##

Cumulative Dose Summary

##

	Exclusion Area Bounda		Low Population Zone		Control Room	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	3.2497E-03	1.0845E-04	8.8628E-04	2.9577E-05	4.2114E-04	1.3166E-05
0.083	1.3942E-01	4.6526E-03	3.8024E-02	1.2689E-03	4.8710E-01	1.5228E-02
0.400	5.5358E-01	1.8436E-02	1.5098E-01	5.0280E-03	3.4089E+00	1.0652E-01
0.700	8.0917E-01	2.6905E-02	2.2068E-01	7.3376E-03	5.0939E+00	1.5913E-01
1.000	9.7777E-01	3.2469E-02	2.6666E-01	8.8551E-03	6.1675E+00	1.9263E-01
1.300	1.0890E+00	3.6126E-02	2.9700E-01	9.8526E-03	6.8632E+00	2.1432E-01
1.600	1.1624E+00	3.8531E-02	3.1701E-01	1.0508E-02	7.3179E+00	2.2848E-01
1.900	1.2108E+00	4.0113E-02	3.3021E-01	1.0940E-02	7.6165E+00	2.3778E-01
2.000	1.2229E+00	4.0509E-02	3.3352E-01	1.1048E-02	7.6913E+00	2.4011E-01
2.300	1.2249E+00	4.0575E-02	3.3407E-01	1.1066E-02	7.8220E+00	2.4418E-01
2.600	1.2269E+00	4.0638E-02	3.3460E-01	1.1083E-02	7.8697E+00	2.4566E-01
2.900	1.2288E+00	4.0699E-02	3.3512E-01	1.1100E-02	7.8896E+00	2.4628E-01
3.200	1.2306E+00	4.0759E-02	3.3562E-01	1.1116E-02	7.9001E+00	2.4661E-01
3.500	1.2324E+00	4.0817E-02	3.3611E-01	1.1132E-02	7.9073E+00	2.4683E-01
3.800	1.2342E+00	4.0873E-02	3.3659E-01	1.1147E-02	7.9134E+00	2.4702E-01
4.100	1.2359E+00	4.0928E-02	3.3705E-01	1.1162E-02	7.9189E+00	2.4719E-01
4.400	1.2375E+00	4.0981E-02	3.3750E-01	1.1177E-02	7.9242E+00	2.4736E-01
4.700	1.2391E+00	4.1032E-02	3.3794E-01	1.1191E-02	7.9293E+00	2.4751E-01
5.000	1.2407E+00	4.1082E-02	3.3836E-01	1.1204E-02	7.9343E+00	2.4767E-01
5.300	1.2422E+00	4.1131E-02	3.3878E-01	1.1217E-02	7.9391E+00	2.4782E-01
5.600	1.2437E+00	4.1178E-02	3.3918E-01	1.1230E-02	7.9437E+00	2.4796E-01
5.900	1.2451E+00	4.1224E-02	3.3957E-01	1.1243E-02	7.9483E+00	2.4810E-01
6.200	1.2465E+00	4.1268E-02	3.3995E-01	1.1255E-02	7.9527E+00	2.4824E-01
6.500	1.2478E+00	4.1311E-02	3.4032E-01	1.1267E-02	7.9570E+00	2.4837E-01
6.800	1.2492E+00	4.1353E-02	3.4068E-01	1.1278E-02	7.9612E+00	2.4850E-01
7.100	1.2505E+00	4.1394E-02	3.4103E-01	1.1289E-02	7.9652E+00	2.4863E-01
7.400	1.2517E+00	4.1434E-02	3.4137E-01	1.1300E-02	7.9692E+00	2.4875E-01
7.700	1.2529E+00	4.1472E-02	3.4171E-01	1.1311E-02	7.9730E+00	2.4887E-01
8.000	1.2541E+00	4.1510E-02	3.4203E-01	1.1321E-02	7.9768E+00	2.4899E-01
8.300	1.2549E+00	4.1537E-02	3.4205E-01	1.1322E-02	7.9795E+00	2.4907E-01
8.600	1.2558E+00	4.1563E-02	3.4208E-01	1.1323E-02	7.9812E+00	2.4912E-01
8.900	1.2566E+00	4.1589E-02	3.4211E-01	1.1323E-02	7.9825E+00	2.4916E-01
9.200	1.2574E+00	4.1614E-02	3.4213E-01	1.1324E-02	7.9837E+00	2.4920E-01

9.500	1.2582E+00	4.1639E-02	3.4216E-01	1.1325E-02	7.9848E+00	2.4923E-01
9.800	1.2589E+00	4.1663E-02	3.4218E-01	1.1326E-02	7.9859E+00	2.4927E-01
10.100	1.2597E+00	4.1686E-02	3.4220E-01	1.1327E-02	7.9870E+00	2.4930E-01
10.400	1.2604E+00	4.1709E-02	3.4223E-01	1.1327E-02	7.9880E+00	2.4933E-01
24.000	1.2818E+00	4.2380E-02	3.4290E-01	1.1349E-02	8.0183E+00	2.5027E-01
45.500	1.2915E+00	4.2680E-02	3.4297E-01	1.1351E-02	8.0242E+00	2.5045E-01
96.000	1.2915E+00	4.2680E-02	3.4297E-01	1.1351E-02	8.0242E+00	2.5045E-01
720.000	1.2915E+00	4.2680E-02	3.4297E-01	1.1351E-02	8.0242E+00	2.5045E-01

```
#######################################################################
                        Worst Two-Hour Doses
#######################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	2.4172E-03	1.2229E+00	4.0509E-02

Attachment 13.6
RADTRAD Output File PMSINPNG01.o0

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:45:30
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078 R1\PMSINPNG01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimspre_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_ng_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt



    #####    ####   #####    #  #     #  #####   #    #  #####
    #    #  #       #        #  ##    #  #    #  #    #    #
    #    #  #       #        #  # #   #  #    #  #    #    #
    #####    ####   ####     #  #  #  #  #####   #    #    #
    #            #  #        #  #   # #  #       #    #    #
    #            #  #        #  #    ##  #       #    #    #
    #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Pre-accident Iodine Spike with  Noble Gas
Release From Intact SG
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimspre_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  3
Compartment 1:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
Compartment 2:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 3:
```

```
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Pathways:
  3
Pathway 1:
RCS to Environment
  1
  2
  2
Pathway 2:
Environment to Control Room
  2
  3
  2
Pathway 3:
Control Room to Environment
  3
  2
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_ng_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  3
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
```

```
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  3
Pathway 1:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.8800E-02   0.0000E+00   0.0000E+00   0.0000E+00
  4.5500E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
```

```
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  2
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  2
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  3
  0
  1
  2
```

```
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   3.0700E-02
  2.0000E+00   2.4900E-02
  8.0000E+00   1.1200E-02
  2.4000E+01   7.7800E-03
  9.6000E+01   6.1700E-03
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o5
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:45:30
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments  =   3

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: RCS to Environment

Compartment number  2
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  2
   Inlet Pathway Number   1: RCS to Environment
   Inlet Pathway Number   3: Control Room to Environment
   Exit Pathway Number    2: Environment to Control Room

Compartment number  3
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  3
   Inlet Pathway Number   2: Environment to Control Room
   Exit Pathway Number    3: Control Room to Environment

Total number of pathways =   3
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:45:30
#######################################################################

#######################################################################
                    Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	1.0000E+00	0.0000E+00	0.0000E+00	4.811E+00
IODINE	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Kr-83m	1	3.487E-02	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	9.695E-01	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	1.414E-01	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	9.162E-02	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	2.571E-01	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Xe-131m	1	1.823E-01	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	2.313E+01	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	3.247E-01	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	7.329E-01	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	4.465E-02	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	5.417E-02	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01

Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: RCS

Compartment number 2: Environment

Compartment number 3: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: RCS to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8800E-02	0.0000E+00	0.0000E+00	0.0000E+00
4.5500E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary is in compartment 2

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	6.4900E-04
7.2000E+02	0.0000E+00

```
Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  7.2000E+02                 0.0000E+00
Location Low Population Zone     is in compartment   2

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           1.7700E-04
  8.0000E+00           3.9900E-05
  2.4000E+01           7.1200E-06
  9.6000E+01           1.0400E-06
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  8.0000E+00                 1.8000E-04
  2.4000E+01                 2.3000E-04
  7.2000E+02                 0.0000E+00
Location Control Room     is in compartment   3

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           3.0700E-02
  2.0000E+00           2.4900E-02
  8.0000E+00           1.1200E-02
  2.4000E+01           7.7800E-03
  9.6000E+01           6.1700E-03
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  7.2000E+02                 0.0000E+00

Location Occupancy Factor Data
 Time (hr)          Occupancy Factor
  0.0000E+00            1.0000E+00
  2.4000E+01            6.0000E-01
  9.6000E+01            4.0000E-01
  7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
      0.0000E+00       1.0000E-01
      2.0000E+00       5.0000E-01
      8.0000E+00       1.0000E+00
      2.4000E+01       2.0000E+00
      9.6000E+01       4.0000E+00
      7.2000E+02       0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:45:30
#######################################################################

     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #

#######################################################################
            Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3746E-07	2.4466E-13	1.3746E-07
Accumulated dose (rem)	1.3746E-07	2.4466E-13	1.3746E-07

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7488E-08	6.6724E-14	3.7489E-08
Accumulated dose (rem)	3.7488E-08	6.6724E-14	3.7489E-08

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.3034E-10	4.0659E-14	6.3093E-10
Accumulated dose (rem)	6.3034E-10	4.0659E-14	6.3093E-10

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
Kr-83m	7.1560E-07	3.4684E-17	2.5165E+08	2.4367E+05
Kr-85	1.9923E-05	5.0781E-11	3.5978E+14	6.7808E+06
Kr-85m	2.9041E-06	3.5289E-16	2.5002E+09	9.8861E+05
Kr-87	1.8791E-06	6.6339E-17	4.5920E+08	6.3999E+05
Kr-88	5.2787E-06	4.2098E-16	2.8809E+09	1.7972E+06
Rb-88	3.6200E-08	3.0157E-19	2.0637E+06	1.8629E+03
Xe-131m	3.7462E-06	4.4725E-14	2.0560E+11	1.2750E+06
Xe-133	4.7531E-04	2.5393E-12	1.1498E+13	1.6177E+08
Xe-133m	6.6722E-06	1.4870E-14	6.7330E+10	2.2709E+06
Xe-135	1.5059E-05	5.8968E-15	2.6305E+10	5.1256E+06
Xe-135m	9.1849E-07	1.0083E-17	4.4979E+07	3.1363E+05
Xe-138	1.1015E-06	1.1455E-17	4.9989E+07	3.7631E+05
Cs-138	4.1944E-09	9.9124E-20	4.3256E+05	2.1693E+02

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump	
Noble gases (atoms)	3.7158E+14	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	4.0069E-19	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.7245E+14
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	5.2351E-20

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	8.7306E+11	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.8402E-22	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.0874E-06	7.7735E-11	6.0886E-06
Accumulated dose (rem)	6.2249E-06	7.7979E-11	6.2260E-06

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.6602E-06	2.1200E-11	1.6605E-06
Accumulated dose (rem)	1.6977E-06	2.1267E-11	1.6980E-06

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.6913E-07	2.7835E-10	7.7316E-07
Accumulated dose (rem)	7.6976E-07	2.7839E-10	7.7379E-07

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
Kr-83m	2.9126E-05	1.4117E-15	1.0243E+10	3.1416E+08

Kr-85	8.3575E-04	2.1302E-09	1.5092E+16	8.8791E+09
Kr-85m	1.2033E-04	1.4622E-14	1.0359E+11	1.2863E+09
Kr-87	7.5475E-05	2.6645E-15	1.8444E+10	8.1954E+08
Kr-88	2.1717E-04	1.7319E-14	1.1852E+11	2.3299E+09
Rb-88	4.2017E-05	3.5003E-16	2.3954E+09	1.3780E+07
Xe-131m	1.5712E-04	1.8758E-12	8.6231E+12	1.6694E+09
Xe-133	1.9930E-02	1.0647E-10	4.8211E+14	2.1179E+11
Xe-133m	2.7960E-04	6.2312E-13	2.8215E+12	2.9721E+09
Xe-135	6.2810E-04	2.4595E-13	1.0972E+12	6.6911E+09
Xe-135m	3.1114E-05	3.4157E-16	1.5237E+09	3.6916E+08
Xe-138	3.6569E-05	3.8031E-16	1.6596E+09	4.3775E+08
Cs-138	4.3897E-06	1.0374E-16	4.5271E+08	1.6621E+06

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	1.5587E+16	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	4.5377E-16	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.6864E+16
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.6685E-17

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	1.2772E+15	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.2912E-18	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.5080E-04	4.7363E-07	4.5841E-04
Accumulated dose (rem)	4.5702E-04	4.7371E-07	4.6463E-04

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE

Delta dose (rem)	1.2295E-04	1.2917E-07	1.2502E-04
Accumulated dose (rem)	1.2464E-04	1.2919E-07	1.2672E-04

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0877E-04	5.1753E-06	4.9306E-04
Accumulated dose (rem)	4.0954E-04	5.1756E-06	4.9383E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Kr-83m	7.4781E-06	3.6245E-16	2.6298E+09	3.1358E+10
Kr-85	4.3037E-03	1.0969E-08	7.7717E+16	3.5756E+12
Kr-85m	1.8206E-04	2.2123E-14	1.5674E+11	2.7109E+11
Kr-87	5.1945E-06	1.8338E-16	1.2694E+09	5.3304E+10
Kr-88	1.6198E-04	1.2917E-14	8.8399E+10	3.5512E+11
Rb-88	9.5684E-05	7.9711E-16	5.4549E+09	1.4148E+11
Xe-131m	7.9373E-04	9.4761E-12	4.3562E+13	6.6493E+11
Xe-133	9.8316E-02	5.2524E-10	2.3783E+15	8.3216E+13
Xe-133m	1.2970E-03	2.8905E-12	1.3088E+13	1.1277E+12
Xe-135	1.7712E-03	6.9357E-13	3.0939E+12	1.9348E+12
Cs-138	5.4224E-10	1.2814E-20	5.5921E+04	1.5081E+09

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump
Noble gases (atoms)	8.0155E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	7.9712E-16	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	4.0602E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.2708E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.3258E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.4683E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00

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Aerosols (kg)          3.4189E-15  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) =  24.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        5.7681E-04  1.1602E-07  5.7872E-04
Accumulated dose (rem)  1.0338E-03  5.8973E-07  1.0434E-03

Low Population Zone Doses:

Time (h) =  24.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        3.5462E-05  3.6685E-09  3.5522E-05
Accumulated dose (rem)  1.6010E-04  1.3286E-07  1.6224E-04

Control Room Doses:

Time (h) =  24.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        4.3673E-04  1.1965E-06  4.5647E-04
Accumulated dose (rem)  8.4627E-04  6.3721E-06  9.5030E-04

Control Room Compartment Nuclide Inventory:

Time (h) =  24.0000       Ci           kg          Atoms       Decay
Kr-83m                 8.4317E-09  4.0867E-19  2.9652E+06  3.3371E+10
Kr-85                  2.0791E-03  5.2992E-09  3.7544E+16  8.9324E+12
Kr-85m                 7.3993E-06  8.9911E-16  6.3701E+09  3.6721E+11
Kr-87                  4.0935E-10  1.4451E-20  1.0003E+05  5.4334E+10
Kr-88                  1.5761E-06  1.2569E-16  8.6017E+08  4.1703E+11
Rb-88                  4.2268E-06  3.5212E-17  2.4097E+08  1.6089E+11
Xe-131m                3.6888E-04  4.4040E-12  2.0245E+13  1.6361E+12
Xe-133                 4.3543E-02  2.3262E-10  1.0533E+15  2.0099E+14
Xe-133m                5.0734E-04  1.1307E-12  5.1196E+12  2.6002E+12
Xe-135                 2.5263E-04  9.8925E-14  4.4129E+11  3.2992E+12

Control Room Transport Group Inventory:
Time (h) =  24.0000    Atmosphere     Sump
Noble gases (atoms)    3.8624E+16  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          3.5212E-17  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                       Deposition Recirculating
Time (h) =  24.0000     Surfaces     Filter
Noble gases (atoms)    0.0000E+00  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          0.0000E+00  4.6792E-14

Environment to Control Room Transport Group Inventory:

                         Pathway
Time (h) =  24.0000     Filtered   Transported
Noble gases (atoms)    0.0000E+00  4.0714E+17
Elemental I (atoms)    0.0000E+00  0.0000E+00
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Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.4589E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	3.6829E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	3.9400E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.3118E-04	4.6053E-09	6.3126E-04
Accumulated dose (rem)	1.6650E-03	5.9434E-07	1.6746E-03

Low Population Zone Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.9245E-06	3.3201E-11	6.9251E-06
Accumulated dose (rem)	1.6703E-04	1.3290E-07	1.6917E-04

Control Room Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7304E-04	1.9881E-08	1.7336E-04
Accumulated dose (rem)	1.0193E-03	6.3920E-06	1.1237E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 45.5000	Ci	kg	Atoms	Decay
Kr-85	1.4245E-03	3.6307E-09	2.5723E+16	1.3271E+13
Kr-85m	1.8212E-07	2.2130E-17	1.5679E+08	3.7202E+11
Kr-88	5.6821E-09	4.5314E-19	3.1010E+06	4.1772E+11
Rb-88	8.2649E-09	6.8852E-20	4.7118E+05	1.6097E+11
Xe-131m	2.3992E-04	2.8644E-12	1.3168E+13	2.3869E+12
Xe-133	2.6540E-02	1.4179E-10	6.4200E+14	2.8693E+14
Xe-133m	2.6176E-04	5.8336E-13	2.6414E+12	3.5274E+12
Xe-135	3.3598E-05	1.3157E-14	5.8690E+10	3.5677E+12

Control Room Transport Group Inventory:

Time (h) = 45.5000	Atmosphere	Sump
Noble gases (atoms)	2.6381E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	6.8852E-20	0.0000E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 45.5000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00

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Aerosols (kg)          0.0000E+00  4.6845E-14

Environment to Control Room Transport Group Inventory:

                         Pathway
Time (h) =  45.5000     Filtered   Transported
Noble gases (atoms)    0.0000E+00  5.7404E+17
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          0.0000E+00  1.4626E-14

Control Room to Environment Transport Group Inventory:

                         Pathway
Time (h) =  45.5000     Filtered   Transported
Noble gases (atoms)    5.4735E+17  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          3.9445E-15  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) =  96.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)  1.6650E-03  5.9434E-07  1.6746E-03

Low Population Zone Doses:

Time (h) =  96.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)  1.6703E-04  1.3290E-07  1.6917E-04

Control Room Doses:

Time (h) =  96.0000    Whole Body   Thyroid       TEDE
Delta dose (rem)        2.3278E-05  3.0051E-11  2.3279E-05
Accumulated dose (rem)  1.0426E-03  6.3920E-06  1.1469E-03

Control Room Compartment Nuclide Inventory:

Time (h) =  96.0000       Ci          kg         Atoms      Decay
Kr-85                  5.1884E-10  1.3224E-15  9.3693E+09  1.3833E+13
Xe-131m                7.7338E-11  9.2332E-19  4.2445E+06  2.4808E+12
Xe-133                 7.3396E-09  3.9211E-17  1.7754E+08  2.9722E+14
Xe-133m                4.8972E-11  1.0914E-19  4.9418E+05  3.6262E+12

Control Room Transport Group Inventory:
Time (h) =  96.0000    Atmosphere     Sump
Noble gases (atoms)    9.5516E+09  0.0000E+00
Elemental I (atoms)    0.0000E+00  0.0000E+00
Organic I (atoms)      0.0000E+00  0.0000E+00
Aerosols (kg)          2.0332E-31  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                       Deposition Recirculating
```

```
Time (h) =  96.0000      Surfaces      Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  4.6845E-14

Environment to Control Room Transport Group Inventory:

                          Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     0.0000E+00  5.7404E+17
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  1.4626E-14

Control Room to Environment Transport Group Inventory:

                          Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     5.7371E+17  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           3.9445E-15  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   1.6650E-03  5.9434E-07  1.6746E-03

Low Population Zone Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   1.6703E-04  1.3290E-07  1.6917E-04

Control Room Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         4.2581E-12  4.4162E-23  4.2581E-12
Accumulated dose (rem)   1.0426E-03  6.3920E-06  1.1469E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000       Ci            kg          Atoms       Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000     Atmosphere     Sump
Noble gases (atoms)     2.5924E-70  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           4.0744-177  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                        Deposition Recirculating
```

Time (h) = 720.0000	Surfaces	Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	4.6845E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.7404E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.4626E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.7371E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	3.9445E-15	0.0000E+00

840

```
#####################################################################
                          I-131 Summary
#####################################################################
```

Time (hr)	RCS I-131 (Curies)	Environment I-131 (Curies)	Control Room I-131 (Curies)
0.000	0.0000E+00	0.0000E+00	0.0000E+00
0.004	0.0000E+00	0.0000E+00	0.0000E+00
0.083	0.0000E+00	0.0000E+00	0.0000E+00
0.400	0.0000E+00	0.0000E+00	0.0000E+00
0.700	0.0000E+00	0.0000E+00	0.0000E+00
1.000	0.0000E+00	0.0000E+00	0.0000E+00
1.300	0.0000E+00	0.0000E+00	0.0000E+00
1.600	0.0000E+00	0.0000E+00	0.0000E+00
1.900	0.0000E+00	0.0000E+00	0.0000E+00
2.200	0.0000E+00	0.0000E+00	0.0000E+00
2.500	0.0000E+00	0.0000E+00	0.0000E+00
2.800	0.0000E+00	0.0000E+00	0.0000E+00
3.100	0.0000E+00	0.0000E+00	0.0000E+00
3.400	0.0000E+00	0.0000E+00	0.0000E+00
3.700	0.0000E+00	0.0000E+00	0.0000E+00
4.000	0.0000E+00	0.0000E+00	0.0000E+00
4.300	0.0000E+00	0.0000E+00	0.0000E+00
4.600	0.0000E+00	0.0000E+00	0.0000E+00
4.900	0.0000E+00	0.0000E+00	0.0000E+00
5.200	0.0000E+00	0.0000E+00	0.0000E+00
5.500	0.0000E+00	0.0000E+00	0.0000E+00
5.800	0.0000E+00	0.0000E+00	0.0000E+00
6.100	0.0000E+00	0.0000E+00	0.0000E+00
6.400	0.0000E+00	0.0000E+00	0.0000E+00
6.700	0.0000E+00	0.0000E+00	0.0000E+00

7.000	0.0000E+00	0.0000E+00	0.0000E+00
7.300	0.0000E+00	0.0000E+00	0.0000E+00
7.600	0.0000E+00	0.0000E+00	0.0000E+00
7.900	0.0000E+00	0.0000E+00	0.0000E+00
8.000	0.0000E+00	0.0000E+00	0.0000E+00
8.300	0.0000E+00	0.0000E+00	0.0000E+00
8.600	0.0000E+00	0.0000E+00	0.0000E+00
8.900	0.0000E+00	0.0000E+00	0.0000E+00
9.200	0.0000E+00	0.0000E+00	0.0000E+00
9.500	0.0000E+00	0.0000E+00	0.0000E+00
9.800	0.0000E+00	0.0000E+00	0.0000E+00
10.100	0.0000E+00	0.0000E+00	0.0000E+00
10.400	0.0000E+00	0.0000E+00	0.0000E+00
24.000	0.0000E+00	0.0000E+00	0.0000E+00
45.500	0.0000E+00	0.0000E+00	0.0000E+00
96.000	0.0000E+00	0.0000E+00	0.0000E+00
720.000	0.0000E+00	0.0000E+00	0.0000E+00

##

Cumulative Dose Summary

##

	Exclusion Area Bounda		Low Population Zone		Control Room	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	2.4466E-13	1.3746E-07	6.6724E-14	3.7489E-08	4.0659E-14	6.3093E-10
0.083	7.7979E-11	6.2260E-06	2.1267E-11	1.6980E-06	2.7839E-10	7.7379E-07
0.400	1.7321E-08	3.0933E-05	4.7238E-09	8.4363E-06	1.1519E-07	9.9732E-06
0.700	4.6811E-08	5.4357E-05	1.2767E-08	1.4825E-05	3.2525E-07	2.2645E-05
1.000	8.0155E-08	7.7269E-05	2.1860E-08	2.1073E-05	5.8103E-07	3.7962E-05
1.300	1.1354E-07	9.9478E-05	3.0965E-08	2.7130E-05	8.5926E-07	5.5244E-05
1.600	1.4542E-07	1.2094E-04	3.9660E-08	3.2984E-05	1.1484E-06	7.4039E-05
1.900	1.7527E-07	1.4167E-04	4.7800E-08	3.8638E-05	1.4417E-06	9.4017E-05
2.200	2.0298E-07	1.6172E-04	5.5358E-08	4.4104E-05	1.7311E-06	1.1474E-04
2.500	2.2864E-07	1.8112E-04	6.2355E-08	4.9396E-05	2.0067E-06	1.3556E-04
2.800	2.5237E-07	1.9993E-04	6.8829E-08	5.4526E-05	2.2708E-06	1.5642E-04
3.100	2.7434E-07	2.1819E-04	7.4820E-08	5.9506E-05	2.5238E-06	1.7727E-04
3.400	2.9468E-07	2.3594E-04	8.0368E-08	6.4348E-05	2.7655E-06	1.9806E-04
3.700	3.1353E-07	2.5322E-04	8.5509E-08	6.9061E-05	2.9957E-06	2.1874E-04
4.000	3.3102E-07	2.7007E-04	9.0277E-08	7.3656E-05	3.2145E-06	2.3929E-04
4.300	3.4724E-07	2.8651E-04	9.4701E-08	7.8139E-05	3.4219E-06	2.5967E-04
4.600	3.6229E-07	3.0257E-04	9.8806E-08	8.2520E-05	3.6182E-06	2.7986E-04
4.900	3.7627E-07	3.1828E-04	1.0262E-07	8.6804E-05	3.8036E-06	2.9986E-04
5.200	3.8925E-07	3.3366E-04	1.0616E-07	9.0999E-05	3.9784E-06	3.1964E-04
5.500	4.0130E-07	3.4873E-04	1.0945E-07	9.5109E-05	4.1431E-06	3.3921E-04
5.800	4.1251E-07	3.6352E-04	1.1250E-07	9.9141E-05	4.2981E-06	3.5857E-04
6.100	4.2291E-07	3.7803E-04	1.1534E-07	1.0310E-04	4.4436E-06	3.7769E-04
6.400	4.3258E-07	3.9229E-04	1.1798E-07	1.0699E-04	4.5802E-06	3.9660E-04
6.700	4.4157E-07	4.0631E-04	1.2043E-07	1.1081E-04	4.7083E-06	4.1529E-04
7.000	4.4992E-07	4.2010E-04	1.2270E-07	1.1457E-04	4.8284E-06	4.3376E-04
7.300	4.5767E-07	4.3369E-04	1.2482E-07	1.1828E-04	4.9408E-06	4.5202E-04
7.600	4.6488E-07	4.4707E-04	1.2679E-07	1.2193E-04	5.0460E-06	4.7008E-04
7.900	4.7158E-07	4.6027E-04	1.2861E-07	1.2553E-04	5.1443E-06	4.8793E-04
8.000	4.7371E-07	4.6463E-04	1.2919E-07	1.2672E-04	5.1756E-06	4.9383E-04
8.300	4.7979E-07	4.7760E-04	1.2939E-07	1.2751E-04	5.2614E-06	5.1095E-04
8.600	4.8543E-07	4.9040E-04	1.2956E-07	1.2830E-04	5.3365E-06	5.2705E-04

8.900	4.9068E-07	5.0305E-04	1.2973E-07	1.2907E-04	5.4032E-06	5.4225E-04
9.200	4.9556E-07	5.1556E-04	1.2988E-07	1.2984E-04	5.4629E-06	5.5665E-04
9.500	5.0009E-07	5.2792E-04	1.3003E-07	1.3060E-04	5.5164E-06	5.7032E-04
9.800	5.0430E-07	5.4015E-04	1.3016E-07	1.3135E-04	5.5644E-06	5.8333E-04
10.100	5.0821E-07	5.5226E-04	1.3028E-07	1.3209E-04	5.6076E-06	5.9574E-04
10.400	5.1185E-07	5.6426E-04	1.3040E-07	1.3282E-04	5.6465E-06	6.0761E-04
24.000	5.8973E-07	1.0434E-03	1.3286E-07	1.6224E-04	6.3721E-06	9.5030E-04
45.500	5.9434E-07	1.6746E-03	1.3290E-07	1.6917E-04	6.3920E-06	1.1237E-03
96.000	5.9434E-07	1.6746E-03	1.3290E-07	1.6917E-04	6.3920E-06	1.1469E-03
720.000	5.9434E-07	1.6746E-03	1.3290E-07	1.6917E-04	6.3920E-06	1.1469E-03

```
#####################################################################
                        Worst Two-Hour Doses
#####################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
0.0	1.4549E-04	1.8450E-07	1.4835E-04

Attachment 13.7
RADTRAD Output File PMSFCI01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  2:51:59
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078\PMSFCI01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimsconc_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt



    #####    ####   #####    #  #     #  #####   #    #  #####
    #    #  #       #        #  ##    #  #    #  #    #    #
    #    #  #       #        #  # #   #  #    #  #    #    #
    #####    ####   ####     #  #  #  #  #####   #    #    #
    #            #  #        #  #   # #  #       #    #    #
    #            #  #        #  #    ##  #       #    #    #
    #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Concurrent Iodine Spike with Iodine Release
From Faulted SG During & Following Dryout
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimsconc_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  5
Compartment 1:
Fuel
  3
 1.0000E+03
  0
  0
  0
  0
  0
Compartment 2:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
Compartment 3:
Environment
  2
```

```
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 4:
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Compartment 5:
Faulted SG
  3
 1.7160E+03
  0
  0
  0
  0
  0
Pathways:
  6
Pathway 1:
Fuel to RCS
  1
  2
  2
Pathway 2:
RCS to Environment
  2
  3
  2
Pathway 3:
Environment to Control Room
  3
  4
  2
Pathway 4:
Control Room to Environment
  4
  3
  2
Pathway 5:
RCS to  Faulted SG
  2
  5
  2
Pathway 6:
Faulted SG to  Environment
  5
  3
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:
```

```
Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  5
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
```

```
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  6
Pathway 1:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   9.6000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
```

```
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 6:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  1.6700E-01   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
```

```
  3
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  3
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   4.7900E-03
  2.0000E+00   3.6000E-03
  8.0000E+00   1.6000E-03
  2.4000E+01   1.2100E-03
  9.6000E+01   9.5500E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o0
```

```
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  2:51:59
#######################################################################
#######################################################################
                        Plant Description
#######################################################################
Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   5

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Fuel
Compartment volume =   1.0000E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Fuel to RCS

Compartment number  2
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Fuel to RCS
   Exit Pathway Number    2: RCS to Environment
   Exit Pathway Number    5: RCS to  Faulted SG

Compartment number  3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  3
   Inlet Pathway Number   2: RCS to Environment
   Inlet Pathway Number   4: Control Room to Environment
   Inlet Pathway Number   6: Faulted SG to  Environment
   Exit Pathway Number    3: Environment to Control Room

Compartment number  4
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   3: Environment to Control Room
   Exit Pathway Number    4: Control Room to Environment

Compartment number  5
Name: Faulted SG
Compartment volume =   1.7160E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  5
   Inlet Pathway Number   5: RCS to  Faulted SG
   Exit Pathway Number    6: Faulted SG to  Environment

Total number of pathways =   6
```

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#########################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  2:51:59
#########################################################################

#########################################################################
                      Scenario Description
#########################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	1.0000E+00	0.0000E+00	0.0000E+00	5.452E-01
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
I-131	2	2.867E+01	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	7.675E+01	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	4.989E+01	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	3.141E+01	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	3.683E+01	2.380E+04	8.294E-14	8.460E-09	3.320E-10

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01
Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: Fuel

Compartment number 2: RCS

Compartment number 3: Environment

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

Compartment number 5: Faulted SG

PATHWAY DATA

Pathway number 1: Fuel to RCS

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	9.6000E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: RCS to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8100E-01	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7.5000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: RCS to Faulted SG

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic

```
  0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00
  1.6700E-01    1.8100E-01    0.0000E+00    0.0000E+00    0.0000E+00
  7.5000E+01    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00

Pathway number  6: Faulted SG to  Environment

     Pathway Filter: Removal Data

       Time (hr)      Flow Rate          Filter Efficiencies (%)
                       (cfm)        Aerosol     Elemental     Organic
       0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00
       1.6700E-01    1.8100E-01    0.0000E+00    0.0000E+00    0.0000E+00
       7.5000E+01    0.0000E+00    0.0000E+00    0.0000E+00    0.0000E+00

LOCATION DATA
     Location Exclusion Area Boundary     is in compartment   3

     Location X/Q Data
      Time (hr)          X/Q (s * m^-3)
       0.0000E+00          6.4900E-04
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)          Breathing Rate (m^3 * sec^-1)
       0.0000E+00                 3.5000E-04
       7.2000E+02                 0.0000E+00
     Location Low Population Zone     is in compartment   3

     Location X/Q Data
      Time (hr)          X/Q (s * m^-3)
       0.0000E+00          1.7700E-04
       8.0000E+00          3.9900E-05
       2.4000E+01          7.1200E-06
       9.6000E+01          1.0400E-06
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)          Breathing Rate (m^3 * sec^-1)
       0.0000E+00                 3.5000E-04
       8.0000E+00                 1.8000E-04
       2.4000E+01                 2.3000E-04
       7.2000E+02                 0.0000E+00
     Location Control Room     is in compartment   4

     Location X/Q Data
      Time (hr)          X/Q (s * m^-3)
       0.0000E+00          4.7900E-03
       2.0000E+00          3.6000E-03
       8.0000E+00          1.6000E-03
       2.4000E+01          1.2100E-03
       9.6000E+01          9.5500E-04
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)          Breathing Rate (m^3 * sec^-1)
       0.0000E+00                 3.5000E-04
       7.2000E+02                 0.0000E+00

     Location Occupancy Factor Data
      Time (hr)          Occupancy Factor
```

```
  0.0000E+00          1.0000E+00
  2.4000E+01          6.0000E-01
  9.6000E+01          4.0000E-01
  7.2000E+02          0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
  0.0000E+00         1.0000E-01
  2.0000E+00         5.0000E-01
  8.0000E+00         1.0000E+00
  2.4000E+01         2.0000E+00
  9.6000E+01         4.0000E+00
  7.2000E+02         0.0000E+00
```

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#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  2:51:59
#######################################################################
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 ####   #    #  #####  #####   #    #  #####
#    #  #    #    #    #    #  #    #    #
#    #  #    #    #    #    #  #    #    #
#    #  #    #    #    #####   #    #    #
#    #  #    #    #    #       #    #    #
#    #  #    #    #    #       #    #    #
 ####    ####     #    #        ####     #
```

```
#######################################################################
           Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0113E-07	4.4704E-05	1.6115E-06
Accumulated dose (rem)	2.0113E-07	4.4704E-05	1.6115E-06

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.4854E-08	1.2192E-05	4.3950E-07
Accumulated dose (rem)	5.4854E-08	1.2192E-05	4.3950E-07

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3253E-10	8.3237E-07	2.6393E-08
Accumulated dose (rem)	1.3253E-10	8.3237E-07	2.6393E-08

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
I-131	6.1176E-07	4.9346E-15	2.2684E+10	2.0431E+05
I-132	1.6359E-06	1.5849E-16	7.2306E+08	5.4656E+05
I-133	1.0644E-06	9.3965E-16	4.2546E+09	3.5551E+05
I-134	6.6833E-07	2.5053E-17	1.1259E+08	2.2343E+05
I-135	7.8559E-07	2.2370E-16	9.9788E+08	2.6240E+05
Xe-133	1.7513E-11	9.3561E-20	4.2364E+05	1.1206E+00
Xe-133m	1.2551E-12	2.7972E-21	1.2665E+04	8.0308E-02
Xe-135	1.5690E-10	6.1438E-20	2.7407E+05	1.0038E+01
Xe-135m	9.8604E-10	1.0825E-20	4.8287E+04	6.2940E+01

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	7.6142E+05	0.0000E+00
Elemental I (atoms)	2.7909E+10	0.0000E+00
Organic I (atoms)	8.6318E+08	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc) I-131 (Thyroid) 4.7349E-16

Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 5.9440E-16
Total I (Ci) 4.7661E-06

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.4193E+05
Elemental I (atoms)	0.0000E+00	2.7960E+10
Organic I (atoms)	0.0000E+00	8.6475E+08
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	3.0250E+02	0.0000E+00
Elemental I (atoms)	5.2936E+07	0.0000E+00
Organic I (atoms)	1.6372E+06	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.0420E-04	6.7666E-02	2.4390E-03
Accumulated dose (rem)	3.0440E-04	6.7711E-02	2.4406E-03

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.2964E-05	1.8454E-02	6.6518E-04
Accumulated dose (rem)	8.3019E-05	1.8467E-02	6.6562E-04

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.8868E-06	3.7001E-02	1.1732E-03
Accumulated dose (rem)	5.8869E-06	3.7001E-02	1.1733E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
I-131	8.8038E-04	7.1013E-12	3.2645E+13	9.3477E+09
I-132	2.2991E-03	2.2273E-13	1.0161E+12	2.4703E+10
I-133	1.5282E-03	1.3490E-12	6.1084E+12	1.6245E+10
I-134	9.0331E-04	3.3861E-14	1.5218E+11	9.8984E+09
I-135	1.1215E-03	3.1933E-13	1.4245E+12	1.1956E+10
Xe-131m	1.9382E-09	2.3140E-17	1.0638E+08	6.8736E+02
Xe-133	6.7395E-07	3.6005E-15	1.6303E+10	2.3926E+05
Xe-133m	4.8299E-08	1.0764E-16	4.8739E+08	1.7142E+04
Xe-135	6.0252E-06	2.3594E-15	1.0525E+10	2.1372E+06
Xe-135m	3.7642E-05	4.1323E-16	1.8434E+09	1.2122E+07

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	2.9265E+10	0.0000E+00	
Elemental I (atoms)	4.0106E+13	0.0000E+00	
Organic I (atoms)	1.2404E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		6.8067E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.5268E-13
Total I (Ci)			6.7324E-03

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.0326E+09
Elemental I (atoms)	0.0000E+00	4.2349E+13
Organic I (atoms)	0.0000E+00	1.3098E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	5.2291E+07	0.0000E+00
Elemental I (atoms)	2.1400E+12	0.0000E+00
Organic I (atoms)	6.6186E+10	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.9834E-04	2.0573E-01	7.3856E-03
Accumulated dose (rem)	1.2027E-03	2.7344E-01	9.8262E-03

Low Population Zone Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4500E-04	5.6109E-02	2.0142E-03
Accumulated dose (rem)	3.2802E-04	7.4576E-02	2.6799E-03

Control Room Doses:

Time (h) = 0.1670	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2809E-05	8.2850E-02	2.6253E-03
Accumulated dose (rem)	1.8696E-05	1.1985E-01	3.7985E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 0.1670	Ci	kg	Atoms	Decay
I-131	1.0201E-03	8.2282E-12	3.7825E+13	2.0430E+10
I-132	2.5983E-03	2.5172E-13	1.1484E+12	5.3278E+10
I-133	1.7663E-03	1.5592E-12	7.0601E+12	3.5458E+10
I-134	9.7993E-04	3.6733E-14	1.6509E+11	2.0895E+10

I-135	1.2884E-03	3.6689E-13	1.6366E+12	2.6011E+10
Xe-131m	5.1861E-09	6.1915E-17	2.8463E+08	3.5281E+04
Xe-133	1.8010E-06	9.6217E-15	4.3566E+10	1.2264E+07
Xe-133m	1.2902E-07	2.8753E-16	1.3019E+09	8.7862E+05
Xe-135	1.6353E-05	6.4034E-15	2.8565E+10	1.0985E+08
Xe-135m	8.7751E-05	9.6331E-16	4.2972E+09	6.1237E+08

Control Room Transport Group Inventory:

Time (h) = 0.1670	Atmosphere	Sump	
Noble gases (atoms)	7.8015E+10	0.0000E+00	
Elemental I (atoms)	4.6401E+13	0.0000E+00	
Organic I (atoms)	1.4351E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		7.8782E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		9.8477E-13
Total I (Ci)			7.6531E-03

Time (h) = 0.1670	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.1868E+13
Organic I (atoms)	0.0000E+00	3.6707E+11
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.1670	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.7533E+10
Elemental I (atoms)	0.0000E+00	6.1642E+13
Organic I (atoms)	0.0000E+00	1.9064E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.1670	Pathway Filtered	Transported
Noble gases (atoms)	1.0530E+09	0.0000E+00
Elemental I (atoms)	3.1811E+12	0.0000E+00
Organic I (atoms)	9.8384E+10	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.6461E-03	4.3458E+00	1.4168E-01
Accumulated dose (rem)	7.8488E-03	4.6192E+00	1.5151E-01

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8126E-03	1.1852E+00	3.8640E-02
Accumulated dose (rem)	2.1406E-03	1.2598E+00	4.1320E-02

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4932E-04	2.1063E+00	6.5714E-02
Accumulated dose (rem)	1.6801E-04	2.2261E+00	6.9513E-02

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
I-131	5.4815E-04	4.4215E-12	2.0326E+13	2.9762E+11
I-132	1.3551E-04	1.3128E-14	5.9893E+10	2.6564E+11
I-133	7.5194E-04	6.6378E-13	3.0056E+12	4.5088E+11
I-134	1.1066E-06	4.1481E-17	1.8642E+08	5.4153E+10
I-135	3.1320E-04	8.9183E-14	3.9783E+11	2.4456E+11
Xe-131m	7.0543E-07	8.4219E-15	3.8716E+10	1.9726E+08
Xe-133	2.1948E-04	1.1726E-12	5.3093E+12	6.2860E+10
Xe-133m	1.5153E-05	3.3770E-14	1.5291E+11	4.3749E+09
Xe-135	1.3156E-03	5.1516E-13	2.2980E+12	4.2646E+11
Xe-135m	1.0886E-04	1.1951E-15	5.3309E+09	7.0572E+10

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	7.8043E+12	0.0000E+00	
Elemental I (atoms)	2.3075E+13	0.0000E+00	
Organic I (atoms)	7.1367E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		3.9348E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.4930E-13
Total I (Ci)			1.7499E-03

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	3.1486E+14
Organic I (atoms)	0.0000E+00	9.7381E+12
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2614E+13
Elemental I (atoms)	0.0000E+00	3.6904E+14
Organic I (atoms)	0.0000E+00	1.1414E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.0186E+12	0.0000E+00
Elemental I (atoms)	2.9760E+13	0.0000E+00
Organic I (atoms)	9.2040E+11	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6890E-02	4.0070E+01	1.2616E+00
Accumulated dose (rem)	3.4739E-02	4.4689E+01	1.4131E+00

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.6532E-03	1.2669E+00	4.0691E-02
Accumulated dose (rem)	3.7938E-03	2.5267E+00	8.2011E-02

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.8411E-04	7.9018E+00	2.4377E-01
Accumulated dose (rem)	4.5213E-04	1.0128E+01	3.1329E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
I-131	7.8413E-04	6.3250E-12	2.9076E+13	1.4541E+12
I-132	1.6531E-06	1.6015E-16	7.3065E+08	3.0801E+11
I-133	6.6846E-04	5.9009E-13	2.6719E+12	1.6645E+12
I-135	8.8635E-05	2.5239E-14	1.1259E+11	5.3025E+11
Xe-131m	4.8009E-06	5.7316E-14	2.6349E+11	5.1037E+09
Xe-133	1.1934E-03	6.3757E-12	2.8868E+13	1.3790E+12
Xe-133m	7.6346E-05	1.7015E-13	7.7041E+11	9.0959E+10
Xe-135	2.3209E-03	9.0883E-13	4.0542E+12	4.4109E+12
Xe-135m	5.0165E-05	5.5070E-16	2.4566E+09	2.2273E+11

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	3.3959E+13	0.0000E+00	
Elemental I (atoms)	3.0905E+13	0.0000E+00	
Organic I (atoms)	9.5584E+11	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		5.1719E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		5.5882E-13
Total I (Ci)			1.5429E-03

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.4657E+15
Organic I (atoms)	0.0000E+00	4.5331E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2752E+14
Elemental I (atoms)	0.0000E+00	1.6313E+15
Organic I (atoms)	0.0000E+00	5.0453E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	8.9982E+13	0.0000E+00
Elemental I (atoms)	1.3071E+14	0.0000E+00
Organic I (atoms)	4.0426E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.8679E-02	2.9165E+02	9.0072E+00
Accumulated dose (rem)	1.2342E-01	3.3634E+02	1.0420E+01

Low Population Zone Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.7287E-04	2.1026E+00	6.5270E-02
Accumulated dose (rem)	4.7666E-03	4.6293E+00	1.4728E-01

Control Room Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0918E-04	2.6236E+01	8.0270E-01
Accumulated dose (rem)	8.6130E-04	3.6363E+01	1.1160E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 75.0000	Ci	kg	Atoms	Decay
I-131	1.3258E-03	1.0694E-11	4.9162E+13	8.4444E+12
I-133	2.4810E-04	2.1901E-13	9.9168E+11	4.4645E+12
I-135	8.5633E-07	2.4384E-16	1.0877E+09	6.4677E+11
Xe-131m	3.1870E-05	3.8048E-13	1.7491E+12	1.1834E+11
Xe-133	4.0481E-03	2.1627E-11	9.7924E+13	1.9662E+13
Xe-133m	1.9647E-04	4.3785E-13	1.9825E+12	1.0924E+12
Xe-135	2.1152E-04	8.2827E-14	3.6948E+11	1.1143E+13
Xe-135m	4.8616E-07	5.3371E-18	2.3808E+07	3.0182E+11

Control Room Transport Group Inventory:

Time (h) = 75.0000	Atmosphere	Sump	
Noble gases (atoms)	1.0203E+14	0.0000E+00	
Elemental I (atoms)	4.8650E+13	0.0000E+00	
Organic I (atoms)	1.5046E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		7.8741E-13
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		8.0185E-13
Total I (Ci)			1.5748E-03

Time (h) = 75.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	8.0181E+15
Organic I (atoms)	0.0000E+00	2.4798E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2452E+15
Elemental I (atoms)	0.0000E+00	8.7914E+15
Organic I (atoms)	0.0000E+00	2.7190E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.1174E+15	0.0000E+00
Elemental I (atoms)	7.0548E+14	0.0000E+00
Organic I (atoms)	2.1819E+13	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.2342E-01	3.3634E+02	1.0420E+01

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.7666E-03	4.6293E+00	1.4728E-01

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.4826E-06	3.3886E-01	1.0345E-02
Accumulated dose (rem)	8.6879E-04	3.6702E+01	1.1263E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Xe-131m	6.3663E-08	7.6005E-16	3.4940E+09	1.3066E+11
Xe-133	7.6193E-06	4.0705E-14	1.8431E+11	2.1211E+13
Xe-133m	3.1299E-07	6.9754E-16	3.1584E+09	1.1657E+12
Xe-135	8.9651E-08	3.5106E-17	1.5660E+08	1.1209E+13

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	1.9112E+11	0.0000E+00	
Elemental I (atoms)	2.8176E-20	0.0000E+00	
Organic I (atoms)	8.7143E-22	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		4.5381E-46
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		4.5832E-46
Total I (Ci)			8.5273E-37

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	8.0296E+15
Organic I (atoms)	0.0000E+00	2.4834E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2452E+15
Elemental I (atoms)	0.0000E+00	8.7914E+15
Organic I (atoms)	0.0000E+00	2.7190E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.2176E+15	0.0000E+00
Elemental I (atoms)	7.0649E+14	0.0000E+00
Organic I (atoms)	2.1850E+13	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.2342E-01	3.3634E+02	1.0420E+01

Low Population Zone Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.7666E-03	4.6293E+00	1.4728E-01

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.8514E-09	1.3020E-34	4.8514E-09
Accumulated dose (rem)	8.6879E-04	3.6702E+01	1.1263E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000	Ci	kg	Atoms	Decay

Control Room Transport Group Inventory:

Time (h) = 720.0000	Atmosphere	Sump	
Noble gases (atoms)	1.9100E-70	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 720.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	8.0296E+15
Organic I (atoms)	0.0000E+00	2.4834E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.2452E+15
Elemental I (atoms)	0.0000E+00	8.7914E+15
Organic I (atoms)	0.0000E+00	2.7190E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.2178E+15	0.0000E+00
Elemental I (atoms)	7.0649E+14	0.0000E+00
Organic I (atoms)	2.1850E+13	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

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#####################################################################
                          I-131 Summary
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Time (hr)	Fuel I-131 (Curies)	RCS I-131 (Curies)	Environment I-131 (Curies)
0.000	8.1926E+03	1.3109E+00	4.9838E-07
0.004	5.3041E+04	5.5012E+01	1.3555E-04
0.083	5.0647E+04	2.4340E+03	2.0526E-01
0.167	4.8248E+04	4.8158E+03	8.2973E-01
0.500	3.9780E+04	1.3215E+04	8.3531E-01
0.800	3.3431E+04	1.9496E+04	8.5615E-01
1.100	2.8095E+04	2.4761E+04	8.9959E-01
1.400	2.3611E+04	2.9172E+04	9.7172E-01
1.700	1.9843E+04	3.2864E+04	1.0776E+00
2.000	1.6676E+04	3.5953E+04	1.2215E+00
2.300	1.4014E+04	3.8535E+04	1.4069E+00
2.600	1.1778E+04	4.0691E+04	1.6367E+00
2.900	9.8980E+03	4.2488E+04	1.9133E+00
3.200	8.3183E+03	4.3985E+04	2.2386E+00
3.500	6.9907E+03	4.5229E+04	2.6142E+00
3.800	5.8750E+03	4.6260E+04	3.0416E+00
4.100	4.9373E+03	4.7113E+04	3.5216E+00
4.400	4.1493E+03	4.7816E+04	4.0552E+00
4.700	3.4871E+03	4.8392E+04	4.6430E+00
5.000	2.9306E+03	4.8863E+04	5.2856E+00
5.300	2.4628E+03	4.9245E+04	5.9833E+00
5.600	2.0698E+03	4.9552E+04	6.7364E+00
5.900	1.7394E+03	4.9796E+04	7.5450E+00
6.200	1.4618E+03	4.9987E+04	8.4094E+00
6.500	1.2285E+03	5.0134E+04	9.3296E+00
6.800	1.0324E+03	5.0244E+04	1.0306E+01
7.100	8.6766E+02	5.0323E+04	1.1337E+01
7.400	7.2919E+02	5.0375E+04	1.2425E+01
7.700	6.1281E+02	5.0405E+04	1.3568E+01
8.000	5.1500E+02	5.0417E+04	1.4766E+01
8.300	5.1445E+02	5.0332E+04	1.6020E+01
8.600	5.1389E+02	5.0247E+04	1.7329E+01
8.900	5.1334E+02	5.0162E+04	1.8692E+01
9.200	5.1279E+02	5.0077E+04	2.0110E+01
9.500	5.1224E+02	4.9992E+04	2.1582E+01
9.800	5.1168E+02	4.9907E+04	2.3108E+01
10.100	5.1113E+02	4.9823E+04	2.4688E+01
10.400	5.1058E+02	4.9739E+04	2.6322E+01
24.000	4.8624E+02	4.6063E+04	1.5225E+02
75.000	4.0484E+02	3.4540E+04	1.2609E+03
96.000	3.7543E+02	3.2030E+04	1.2609E+03
720.000	3.9907E+01	3.4047E+03	1.2609E+03

Time (hr)	Control Room I-131 (Curies)	Faulted SG I-131 (Curies)
0.000	2.2527E-09	0.0000E+00
0.004	6.1176E-07	0.0000E+00
0.083	8.8038E-04	0.0000E+00
0.167	1.0201E-03	0.0000E+00
0.500	3.0587E-04	6.2477E+00
0.800	1.1182E-04	1.6345E+01
1.100	5.6355E-05	2.9953E+01
1.400	4.9806E-05	4.6488E+01
1.700	6.1713E-05	6.5459E+01

2.000	8.1517E-05	8.6454E+01
2.300	8.5995E-05	1.0912E+02
2.600	1.0133E-04	1.3318E+02
2.900	1.2104E-04	1.5838E+02
3.200	1.4281E-04	1.8451E+02
3.500	1.6575E-04	2.1141E+02
3.800	1.8950E-04	2.3892E+02
4.100	2.1382E-04	2.6693E+02
4.400	2.3860E-04	2.9533E+02
4.700	2.6374E-04	3.2404E+02
5.000	2.8914E-04	3.5299E+02
5.300	3.1476E-04	3.8211E+02
5.600	3.4053E-04	4.1135E+02
5.900	3.6641E-04	4.4068E+02
6.200	3.9236E-04	4.7006E+02
6.500	4.1835E-04	4.9945E+02
6.800	4.4436E-04	5.2883E+02
7.100	4.7036E-04	5.5818E+02
7.400	4.9634E-04	5.8749E+02
7.700	5.2227E-04	6.1673E+02
8.000	5.4815E-04	6.4590E+02
8.300	3.5716E-04	6.7496E+02
8.600	3.0072E-04	7.0388E+02
8.900	2.8935E-04	7.3266E+02
9.200	2.9305E-04	7.6130E+02
9.500	3.0176E-04	7.8981E+02
9.800	3.1212E-04	8.1818E+02
10.100	3.2299E-04	8.4642E+02
10.400	3.3399E-04	8.7451E+02
24.000	7.8413E-04	2.0135E+03
75.000	1.3258E-03	4.4632E+03
96.000	7.7500E-37	4.1389E+03
720.000	0.0000E+00	4.3995E+02

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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)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	4.4704E-05	1.6115E-06	1.2192E-05	4.3950E-07	8.3237E-07	2.6393E-08
0.083	6.7711E-02	2.4406E-03	1.8467E-02	6.6562E-04	3.7001E-02	1.1733E-03
0.167	2.7344E-01	9.8262E-03	7.4576E-02	2.6799E-03	1.1985E-01	3.7985E-03
0.500	2.7528E-01	9.8913E-03	7.5075E-02	2.6976E-03	3.2876E-01	1.0411E-02
0.800	2.8210E-01	1.0131E-02	7.6935E-02	2.7631E-03	3.8918E-01	1.2320E-02
1.100	2.9626E-01	1.0625E-02	8.0799E-02	2.8977E-03	4.1369E-01	1.3093E-02
1.400	3.1971E-01	1.1435E-02	8.7193E-02	3.1187E-03	4.2958E-01	1.3593E-02
1.700	3.5401E-01	1.2612E-02	9.6548E-02	3.4396E-03	4.4663E-01	1.4129E-02
2.000	4.0047E-01	1.4194E-02	1.0922E-01	3.8711E-03	4.6867E-01	1.4821E-02
2.300	4.6013E-01	1.6214E-02	1.2549E-01	4.4220E-03	4.9412E-01	1.5620E-02
2.600	5.3385E-01	1.8696E-02	1.4559E-01	5.0990E-03	5.2277E-01	1.6518E-02
2.900	6.2230E-01	2.1660E-02	1.6972E-01	5.9073E-03	5.5678E-01	1.7583E-02
3.200	7.2604E-01	2.5121E-02	1.9801E-01	6.8511E-03	5.9706E-01	1.8843E-02
3.500	8.4550E-01	2.9089E-02	2.3059E-01	7.9334E-03	6.4405E-01	2.0311E-02
3.800	9.8100E-01	3.3574E-02	2.6754E-01	9.1566E-03	6.9801E-01	2.1997E-02
4.100	1.1328E+00	3.8581E-02	3.0894E-01	1.0522E-02	7.5910E-01	2.3904E-02
4.400	1.3011E+00	4.4115E-02	3.5484E-01	1.2031E-02	8.2746E-01	2.6036E-02
4.700	1.4859E+00	5.0177E-02	4.0526E-01	1.3685E-02	9.0315E-01	2.8396E-02

5.000	1.6875E+00	5.6769E-02	4.6023E-01	1.5482E-02	9.8625E-01	3.0985E-02
5.300	1.9058E+00	6.3890E-02	5.1977E-01	1.7425E-02	1.0768E+00	3.3804E-02
5.600	2.1409E+00	7.1541E-02	5.8388E-01	1.9511E-02	1.1748E+00	3.6855E-02
5.900	2.3927E+00	7.9719E-02	6.5255E-01	2.1742E-02	1.2802E+00	4.0136E-02
6.200	2.6612E+00	8.8422E-02	7.2578E-01	2.4115E-02	1.3932E+00	4.3647E-02
6.500	2.9463E+00	9.7648E-02	8.0355E-01	2.6631E-02	1.5135E+00	4.7389E-02
6.800	3.2481E+00	1.0739E-01	8.8584E-01	2.9289E-02	1.6413E+00	5.1360E-02
7.100	3.5663E+00	1.1766E-01	9.7264E-01	3.2088E-02	1.7765E+00	5.5559E-02
7.400	3.9010E+00	1.2843E-01	1.0639E+00	3.5027E-02	1.9191E+00	5.9985E-02
7.700	4.2520E+00	1.3972E-01	1.1596E+00	3.8104E-02	2.0690E+00	6.4637E-02
8.000	4.6192E+00	1.5151E-01	1.2598E+00	4.1320E-02	2.2261E+00	6.9513E-02
8.300	5.0025E+00	1.6380E-01	1.2719E+00	4.1721E-02	2.3541E+00	7.3482E-02
8.600	5.4018E+00	1.7659E-01	1.2845E+00	4.2138E-02	2.4487E+00	7.6416E-02
8.900	5.8170E+00	1.8987E-01	1.2977E+00	4.2571E-02	2.5342E+00	7.9069E-02
9.200	6.2478E+00	2.0364E-01	1.3113E+00	4.3019E-02	2.6188E+00	8.1691E-02
9.500	6.6943E+00	2.1789E-01	1.3254E+00	4.3483E-02	2.7052E+00	8.4368E-02
9.800	7.1562E+00	2.3262E-01	1.3400E+00	4.3962E-02	2.7942E+00	8.7125E-02
10.100	7.6333E+00	2.4782E-01	1.3551E+00	4.4456E-02	2.8861E+00	8.9971E-02
10.400	8.1257E+00	2.6350E-01	1.3707E+00	4.4965E-02	2.9810E+00	9.2909E-02
24.000	4.4689E+01	1.4131E+00	2.5267E+00	8.2011E-02	1.0128E+01	3.1329E-01
75.000	3.3634E+02	1.0420E+01	4.6293E+00	1.4728E-01	3.6363E+01	1.1160E+00
96.000	3.3634E+02	1.0420E+01	4.6293E+00	1.4728E-01	3.6702E+01	1.1263E+00
720.000	3.3634E+02	1.0420E+01	4.6293E+00	1.4728E-01	3.6702E+01	1.1263E+00

```
#####################################################################
                        Worst Two-Hour Doses
#####################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
24.0	3.4776E-03	1.1437E+01	3.5323E-01

Attachment 13.8
RADTRAD Output File PMSFCNG01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:00:12
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078\PMSFCNG01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimsconc_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_ng_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt


    #####    ####   #####    #  #     #  #####   #    #  #####
    #    #  #       #        #  ##    #  #    #  #    #    #
    #    #  #       #        #  # #   #  #    #  #    #    #
    #####    ####   ####     #  #  #  #  #####   #    #    #
    #            #  #        #  #   # #  #       #    #    #
    #            #  #        #  #    ##  #       #    #    #
    #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Concurrent Iodine Spike with Noble Gas Release
From Faulted SG During and Following Dryout
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimsconc_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  4
Compartment 1:
Fuel
  3
 1.0000E+03
  0
  0
  0
  0
  0
Compartment 2:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
Compartment 3:
Environment
  2
 0.0000E+00
  0
  0
```

```
  0
  0
  0
Compartment 4:
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Pathways:
  4
Pathway 1:
Fuel to RCS
  1
  2
  2
Pathway 2:
RCS to Environment
  2
  3
  2
Pathway 3:
Environment to Control Room
  3
  4
  2
Pathway 4:
Control Room to Environment
  4
  3
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_ng_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  4
Compartment 1:
  0
  1
  0
```

```
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  4
Pathway 1:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   9.6000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
```

```
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.8100E-01   0.0000E+00   0.0000E+00   0.0000E+00
  7.5000E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  3
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
```

```
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  3
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   4.7900E-03
  2.0000E+00   3.6000E-03
  8.0000E+00   1.6000E-03
  2.4000E+01   1.2100E-03
  9.6000E+01   9.5500E-04
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o1
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:00:12
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   4

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Fuel
Compartment volume =   1.0000E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Fuel to RCS

Compartment number  2
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Fuel to RCS
   Exit Pathway Number    2: RCS to Environment

Compartment number  3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  3
   Inlet Pathway Number   2: RCS to Environment
   Inlet Pathway Number   4: Control Room to Environment
   Exit Pathway Number    3: Environment to Control Room

Compartment number  4
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   3: Environment to Control Room
   Exit Pathway Number    4: Control Room to Environment

Total number of pathways =   4
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:00:12
#######################################################################

#######################################################################
                      Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	1.0000E+00	0.0000E+00	0.0000E+00	4.811E+00
IODINE	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Kr-83m	1	3.487E-02	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	9.695E-01	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	1.414E-01	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	9.162E-02	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	2.571E-01	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Xe-131m	1	1.823E-01	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	2.313E+01	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	3.247E-01	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	7.329E-01	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	4.465E-02	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	5.417E-02	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol	=	0.0000E+00
Elemental	=	9.7000E-01
Organic	=	3.0000E-02

COMPARTMENT DATA

Compartment number 1: Fuel

Compartment number 2: RCS

Compartment number 3: Environment

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: Fuel to RCS

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	9.6000E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: RCS to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8100E-01	0.0000E+00	0.0000E+00	0.0000E+00
7.5000E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary is in compartment 3

```
Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           6.4900E-04
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  7.2000E+02                 0.0000E+00
Location Low Population Zone     is in compartment   3

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           1.7700E-04
  8.0000E+00           3.9900E-05
  2.4000E+01           7.1200E-06
  9.6000E+01           1.0400E-06
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  8.0000E+00                 1.8000E-04
  2.4000E+01                 2.3000E-04
  7.2000E+02                 0.0000E+00
Location Control Room     is in compartment   4

Location X/Q Data
 Time (hr)          X/Q (s * m^-3)
  0.0000E+00           4.7900E-03
  2.0000E+00           3.6000E-03
  8.0000E+00           1.6000E-03
  2.4000E+01           1.2100E-03
  9.6000E+01           9.5500E-04
  7.2000E+02           0.0000E+00

Location Breathing Rate Data
 Time (hr)          Breathing Rate (m^3 * sec^-1)
  0.0000E+00                 3.5000E-04
  7.2000E+02                 0.0000E+00

Location Occupancy Factor Data
 Time (hr)          Occupancy Factor
  0.0000E+00            1.0000E+00
  2.4000E+01            6.0000E-01
  9.6000E+01            4.0000E-01
  7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
Time             Time step
 0.0000E+00       1.0000E-01
 2.0000E+00       5.0000E-01
 8.0000E+00       1.0000E+00
 2.4000E+01       2.0000E+00
 9.6000E+01       4.0000E+00
 7.2000E+02       0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/02/2009  at  3:00:12
#######################################################################


     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #


#######################################################################
            Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.1615E-10	2.4405E-15	9.1618E-10
Accumulated dose (rem)	9.1615E-10	2.4405E-15	9.1618E-10

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4986E-10	6.6558E-16	2.4987E-10
Accumulated dose (rem)	2.4986E-10	6.6558E-16	2.4987E-10

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.0366E-13	4.7804E-17	6.0435E-13
Accumulated dose (rem)	6.0366E-13	4.7804E-17	6.0435E-13

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
Kr-83m	7.4305E-10	3.6014E-20	2.6131E+05	2.4828E+02
Kr-85	2.0687E-08	5.2729E-14	3.7358E+11	6.9090E+03
Kr-85m	3.0156E-09	3.6643E-19	2.5961E+06	1.0073E+03
Kr-87	1.9512E-09	6.8884E-20	4.7682E+05	6.5209E+02
Kr-88	5.4813E-09	4.3713E-19	2.9914E+06	1.8311E+03
Xe-131m	3.8899E-09	4.6441E-17	2.1349E+08	1.2991E+03
Xe-133	4.9355E-07	2.6367E-15	1.1939E+10	1.6483E+05
Xe-133m	6.9284E-09	1.5441E-17	6.9915E+07	2.3139E+03
Xe-135	1.5661E-08	6.1327E-18	2.7357E+07	5.2308E+03
Xe-135m	1.1089E-09	1.2173E-20	5.4301E+04	3.7124E+02
Xe-138	1.1437E-09	1.1895E-20	5.1907E+04	3.8339E+02

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	3.8584E+11	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00

Aerosols (kg)	4.3631E-22	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.8652E+11
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	8.1478E-23

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	7.3177E+08	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.7365E-25	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3888E-06	1.7728E-11	1.3891E-06
Accumulated dose (rem)	1.3897E-06	1.7731E-11	1.3900E-06

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.7876E-07	4.8350E-12	3.7883E-07
Accumulated dose (rem)	3.7901E-07	4.8356E-12	3.7908E-07

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6876E-08	9.6948E-12	2.7016E-08
Accumulated dose (rem)	2.6876E-08	9.6948E-12	2.7016E-08

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
Kr-83m	1.0378E-06	5.0302E-17	3.6497E+08	1.1186E+07
Kr-85	2.9780E-05	7.5904E-11	5.3777E+14	3.1615E+08
Kr-85m	4.2877E-06	5.2102E-16	3.6913E+09	4.5801E+07
Kr-87	2.6893E-06	9.4944E-17	6.5720E+08	2.9180E+07
Kr-88	7.7383E-06	6.1713E-16	4.2232E+09	8.2956E+07
Rb-88	1.4972E-06	1.2473E-17	8.5357E+07	4.9170E+05
Xe-131m	5.5985E-06	6.6839E-14	3.0726E+11	5.9441E+07
Xe-133	7.1016E-04	3.7940E-12	1.7179E+13	7.5409E+09
Xe-133m	9.9632E-06	2.2204E-14	1.0054E+11	1.0583E+08

Xe-135	2.2441E-05	8.7877E-15	3.9200E+10	2.3887E+08
Xe-135m	1.4053E-06	1.5427E-17	6.8820E+07	1.6660E+07
Xe-138	1.3030E-06	1.3551E-17	5.9136E+07	1.5585E+07
Cs-138	1.5642E-07	3.6967E-18	1.6132E+07	5.9310E+04

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	5.5541E+14	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	1.6170E-17	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.8546E+14
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	5.9192E-19

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	2.9585E+13	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.9975E-20	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2419E-03	3.2244E-06	3.2942E-03
Accumulated dose (rem)	3.2433E-03	3.2245E-06	3.2956E-03

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.8415E-04	8.7940E-07	8.9842E-04
Accumulated dose (rem)	8.8453E-04	8.7940E-07	8.9880E-04

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.4830E-04	3.9951E-06	4.1379E-04
Accumulated dose (rem)	3.4833E-04	3.9951E-06	4.1382E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Kr-83m	9.1155E-06	4.4181E-16	3.2056E+09	2.0593E+10
Kr-85	5.2460E-03	1.3371E-08	9.4734E+16	3.2105E+12
Kr-85m	2.2192E-04	2.6967E-14	1.9106E+11	2.1714E+11
Kr-87	6.3319E-06	2.2354E-16	1.5473E+09	2.9931E+10
Kr-88	1.9744E-04	1.5746E-14	1.0775E+11	2.6370E+11
Rb-88	1.1750E-04	9.7888E-16	6.6988E+09	1.1241E+11
Xe-131m	9.6753E-04	1.1551E-11	5.3101E+13	5.9609E+11
Xe-133	1.1984E-01	6.4026E-10	2.8990E+15	7.4453E+13
Xe-133m	1.5811E-03	3.5236E-12	1.5955E+13	1.0038E+12
Xe-135	2.1657E-03	8.4807E-13	3.7831E+12	1.6523E+12
Cs-138	7.3783E-10	1.7437E-20	7.6092E+04	6.3230E+08

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	9.7706E+16	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	9.7890E-16	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	3.1330E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.2822E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.2902E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.3044E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.6372E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.3618E-03	1.0831E-06	5.3796E-03
Accumulated dose (rem)	8.6050E-03	4.3075E-06	8.6752E-03

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.2964E-04	3.4245E-08	3.3020E-04
Accumulated dose (rem)	1.2142E-03	9.1364E-07	1.2290E-03

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.6250E-04	1.5286E-06	5.8772E-04
Accumulated dose (rem)	9.1084E-04	5.5237E-06	1.0015E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
Kr-83m	1.1074E-08	5.3673E-19	3.8943E+06	2.3116E+10
Kr-85	2.7306E-03	6.9598E-09	4.9309E+16	1.0126E+13
Kr-85m	9.7178E-06	1.1809E-15	8.3662E+09	3.3935E+11
Kr-87	5.3762E-10	1.8980E-20	1.3138E+05	3.1214E+10
Kr-88	2.0700E-06	1.6508E-16	1.1297E+09	3.4184E+11
Rb-88	5.5511E-06	4.6244E-17	3.1646E+08	1.3686E+11
Xe-131m	4.8448E-04	5.7840E-12	2.6589E+13	1.8495E+12
Xe-133	5.7188E-02	3.0552E-10	1.3834E+15	2.2641E+14
Xe-133m	6.6635E-04	1.4851E-12	6.7242E+12	2.9023E+12
Xe-135	3.3282E-04	1.3033E-13	5.8138E+11	3.4056E+12

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	5.0726E+16	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	4.6244E-17	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	3.9146E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.6711E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.4677E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	4.1614E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	3.2952E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1958E-02	4.2048E-08	1.1959E-02
Accumulated dose (rem)	2.0563E-02	4.3496E-06	2.0634E-02

Low Population Zone Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3119E-04	3.0314E-10	1.3120E-04
Accumulated dose (rem)	1.3454E-03	9.1395E-07	1.3602E-03

Control Room Doses:

Time (h) = 75.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.8964E-04	2.7071E-08	4.9009E-04
Accumulated dose (rem)	1.4005E-03	5.5508E-06	1.4916E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 75.0000	Ci	kg	Atoms	Decay
Kr-85	1.8438E-03	4.6996E-09	3.3296E+16	2.3586E+13
Kr-85m	2.4564E-09	2.9848E-19	2.1147E+06	3.4615E+11
Xe-131m	2.8917E-04	3.4523E-12	1.5870E+13	4.1010E+12
Xe-133	2.9252E-02	1.5627E-10	7.0760E+14	4.7376E+14
Xe-133m	2.2960E-04	5.1169E-13	2.3169E+12	5.3218E+12
Xe-135	4.6015E-06	1.8019E-15	8.0379E+09	3.8477E+12

Control Room Transport Group Inventory:

Time (h) = 75.0000	Atmosphere	Sump	
Noble gases (atoms)	3.4022E+16	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	1.2272E-22	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 75.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	3.9221E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.0023E+18
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.4729E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 75.0000	Pathway Filtered	Transported
Noble gases (atoms)	9.6771E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	3.3014E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	2.0563E-02	4.3496E-06	2.0634E-02

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.3454E-03	9.1395E-07	1.3602E-03

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5434E-05	3.9758E-14	2.5434E-05
Accumulated dose (rem)	1.4259E-03	5.5508E-06	1.5171E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Kr-85	3.8750E-06	9.8769E-12	6.9976E+13	2.4304E+13
Xe-131m	5.7761E-07	6.8960E-15	3.1701E+10	4.2128E+12
Xe-133	5.4817E-05	2.9286E-13	1.3260E+12	4.8495E+14
Xe-133m	3.6577E-07	8.1517E-16	3.6910E+09	5.4074E+12
Xe-135	1.9502E-09	7.6366E-19	3.4066E+06	3.8491E+12

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	7.1338E+13	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	1.5186E-27	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	3.9221E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.0023E+18
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.4729E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.0016E+18	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	3.3014E-15	0.0000E+00

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Exclusion Area Boundary Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   2.0563E-02  4.3496E-06  2.0634E-02

Low Population Zone Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   1.3454E-03  9.1395E-07  1.3602E-03

Control Room Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         3.1802E-08  3.2983E-19  3.1802E-08
Accumulated dose (rem)   1.4259E-03  5.5508E-06  1.5171E-03

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000       Ci           kg         Atoms      Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000     Atmosphere     Sump
Noble gases (atoms)     1.9362E-66  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           3.0431-173  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                        Deposition Recirculating
Time (h) = 720.0000      Surfaces     Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  3.9221E-14

Environment to Control Room Transport Group Inventory:

                          Pathway
Time (h) = 720.0000      Filtered   Transported
Noble gases (atoms)     0.0000E+00  1.0023E+18
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  1.4729E-14

Control Room to Environment Transport Group Inventory:

                          Pathway
Time (h) = 720.0000      Filtered   Transported
Noble gases (atoms)     1.0017E+18  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           3.3014E-15  0.0000E+00

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I-131 Summary

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Time (hr)	Fuel I-131 (Curies)	RCS I-131 (Curies)	Environment I-131 (Curies)
0.000	0.0000E+00	0.0000E+00	0.0000E+00
0.004	0.0000E+00	0.0000E+00	0.0000E+00
0.083	0.0000E+00	0.0000E+00	0.0000E+00
0.400	0.0000E+00	0.0000E+00	0.0000E+00
0.700	0.0000E+00	0.0000E+00	0.0000E+00
1.000	0.0000E+00	0.0000E+00	0.0000E+00
1.300	0.0000E+00	0.0000E+00	0.0000E+00
1.600	0.0000E+00	0.0000E+00	0.0000E+00
1.900	0.0000E+00	0.0000E+00	0.0000E+00
2.200	0.0000E+00	0.0000E+00	0.0000E+00
2.500	0.0000E+00	0.0000E+00	0.0000E+00
2.800	0.0000E+00	0.0000E+00	0.0000E+00
3.100	0.0000E+00	0.0000E+00	0.0000E+00
3.400	0.0000E+00	0.0000E+00	0.0000E+00
3.700	0.0000E+00	0.0000E+00	0.0000E+00
4.000	0.0000E+00	0.0000E+00	0.0000E+00
4.300	0.0000E+00	0.0000E+00	0.0000E+00
4.600	0.0000E+00	0.0000E+00	0.0000E+00
4.900	0.0000E+00	0.0000E+00	0.0000E+00
5.200	0.0000E+00	0.0000E+00	0.0000E+00
5.500	0.0000E+00	0.0000E+00	0.0000E+00
5.800	0.0000E+00	0.0000E+00	0.0000E+00
6.100	0.0000E+00	0.0000E+00	0.0000E+00
6.400	0.0000E+00	0.0000E+00	0.0000E+00
6.700	0.0000E+00	0.0000E+00	0.0000E+00
7.000	0.0000E+00	0.0000E+00	0.0000E+00
7.300	0.0000E+00	0.0000E+00	0.0000E+00
7.600	0.0000E+00	0.0000E+00	0.0000E+00
7.900	0.0000E+00	0.0000E+00	0.0000E+00
8.000	0.0000E+00	0.0000E+00	0.0000E+00
8.300	0.0000E+00	0.0000E+00	0.0000E+00
8.600	0.0000E+00	0.0000E+00	0.0000E+00
8.900	0.0000E+00	0.0000E+00	0.0000E+00
9.200	0.0000E+00	0.0000E+00	0.0000E+00
9.500	0.0000E+00	0.0000E+00	0.0000E+00
9.800	0.0000E+00	0.0000E+00	0.0000E+00
10.100	0.0000E+00	0.0000E+00	0.0000E+00
10.400	0.0000E+00	0.0000E+00	0.0000E+00
24.000	0.0000E+00	0.0000E+00	0.0000E+00
75.000	0.0000E+00	0.0000E+00	0.0000E+00
96.000	0.0000E+00	0.0000E+00	0.0000E+00
720.000	0.0000E+00	0.0000E+00	0.0000E+00

Time (hr)	Control Room I-131 (Curies)
0.000	0.0000E+00
0.004	0.0000E+00
0.083	0.0000E+00
0.400	0.0000E+00
0.700	0.0000E+00
1.000	0.0000E+00
1.300	0.0000E+00
1.600	0.0000E+00
1.900	0.0000E+00
2.200	0.0000E+00

2.500	0.0000E+00
2.800	0.0000E+00
3.100	0.0000E+00
3.400	0.0000E+00
3.700	0.0000E+00
4.000	0.0000E+00
4.300	0.0000E+00
4.600	0.0000E+00
4.900	0.0000E+00
5.200	0.0000E+00
5.500	0.0000E+00
5.800	0.0000E+00
6.100	0.0000E+00
6.400	0.0000E+00
6.700	0.0000E+00
7.000	0.0000E+00
7.300	0.0000E+00
7.600	0.0000E+00
7.900	0.0000E+00
8.000	0.0000E+00
8.300	0.0000E+00
8.600	0.0000E+00
8.900	0.0000E+00
9.200	0.0000E+00
9.500	0.0000E+00
9.800	0.0000E+00
10.100	0.0000E+00
10.400	0.0000E+00
24.000	0.0000E+00
75.000	0.0000E+00
96.000	0.0000E+00
720.000	0.0000E+00

##
Cumulative Dose Summary
##

	Exclusion Area Bounda		Low Population Zone		Control Room	
Time	Thyroid	TEDE	Thyroid	TEDE	Thyroid	TEDE
(hr)	(rem)	(rem)	(rem)	(rem)	(rem)	(rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	2.4405E-15	9.1618E-10	6.6558E-16	2.4987E-10	4.7804E-17	6.0435E-13
0.083	1.7731E-11	1.3900E-06	4.8356E-12	3.7908E-07	9.6948E-12	2.7016E-08
0.400	2.3698E-08	3.1906E-05	6.4631E-09	8.7016E-06	8.4774E-09	6.4091E-07
0.700	1.0091E-07	9.2769E-05	2.7520E-08	2.5301E-05	4.3283E-08	2.5536E-06
1.000	2.2474E-07	1.7780E-04	6.1293E-08	4.8491E-05	1.1382E-07	6.3641E-06
1.300	3.7981E-07	2.8102E-04	1.0359E-07	7.6641E-05	2.1995E-07	1.2334E-05
1.600	5.5297E-07	3.9765E-04	1.5081E-07	1.0845E-04	3.5792E-07	2.0539E-05
1.900	7.3481E-07	5.2404E-04	2.0040E-07	1.4292E-04	5.2317E-07	3.0952E-05
2.200	9.1906E-07	6.5737E-04	2.5065E-07	1.7928E-04	7.0609E-07	4.3245E-05
2.500	1.1016E-06	7.9550E-04	3.0044E-07	2.1695E-04	8.9230E-07	5.6650E-05
2.800	1.2798E-06	9.3678E-04	3.4904E-07	2.5549E-04	1.0837E-06	7.1132E-05
3.100	1.4519E-06	1.0799E-03	3.9598E-07	2.9453E-04	1.2792E-06	8.6628E-05
3.400	1.6170E-06	1.2240E-03	4.4099E-07	3.3383E-04	1.4770E-06	1.0305E-04
3.700	1.7743E-06	1.3683E-03	4.8389E-07	3.7318E-04	1.6753E-06	1.2030E-04
4.000	1.9235E-06	1.5122E-03	5.2460E-07	4.1242E-04	1.8725E-06	1.3829E-04
4.300	2.0646E-06	1.6553E-03	5.6308E-07	4.5144E-04	2.0673E-06	1.5693E-04
4.600	2.1977E-06	1.7973E-03	5.9936E-07	4.9017E-04	2.2585E-06	1.7613E-04
4.900	2.3227E-06	1.9379E-03	6.3347E-07	5.2852E-04	2.4451E-06	1.9582E-04
5.200	2.4401E-06	2.0771E-03	6.6549E-07	5.6647E-04	2.6263E-06	2.1592E-04

5.500	2.5501E-06	2.2146E-03	6.9549E-07	6.0398E-04	2.8016E-06	2.3637E-04
5.800	2.6530E-06	2.3505E-03	7.2355E-07	6.4103E-04	2.9704E-06	2.5711E-04
6.100	2.7492E-06	2.4846E-03	7.4978E-07	6.7762E-04	3.1324E-06	2.7808E-04
6.400	2.8390E-06	2.6171E-03	7.7427E-07	7.1375E-04	3.2875E-06	2.9925E-04
6.700	2.9228E-06	2.7478E-03	7.9712E-07	7.4941E-04	3.4354E-06	3.2056E-04
7.000	3.0009E-06	2.8769E-03	8.1841E-07	7.8461E-04	3.5762E-06	3.4199E-04
7.300	3.0736E-06	3.0044E-03	8.3826E-07	8.1937E-04	3.7100E-06	3.6349E-04
7.600	3.1414E-06	3.1302E-03	8.5674E-07	8.5369E-04	3.8367E-06	3.8504E-04
7.900	3.2044E-06	3.2545E-03	8.7394E-07	8.8759E-04	3.9566E-06	4.0662E-04
8.000	3.2245E-06	3.2956E-03	8.7940E-07	8.9880E-04	3.9951E-06	4.1382E-04
8.300	3.2817E-06	3.4178E-03	8.8121E-07	9.0629E-04	4.1006E-06	4.3475E-04
8.600	3.3349E-06	3.5384E-03	8.8289E-07	9.1368E-04	4.1931E-06	4.5451E-04
8.900	3.3843E-06	3.6575E-03	8.8445E-07	9.2097E-04	4.2757E-06	4.7326E-04
9.200	3.4301E-06	3.7751E-03	8.8590E-07	9.2818E-04	4.3498E-06	4.9108E-04
9.500	3.4727E-06	3.8914E-03	8.8725E-07	9.3531E-04	4.4165E-06	5.0808E-04
9.800	3.5123E-06	4.0064E-03	8.8850E-07	9.4236E-04	4.4766E-06	5.2432E-04
10.100	3.5491E-06	4.1202E-03	8.8966E-07	9.4934E-04	4.5309E-06	5.3988E-04
10.400	3.5832E-06	4.2327E-03	8.9074E-07	9.5624E-04	4.5800E-06	5.5481E-04
24.000	4.3075E-06	8.6752E-03	9.1364E-07	1.2290E-03	5.5237E-06	1.0015E-03
75.000	4.3496E-06	2.0634E-02	9.1395E-07	1.3602E-03	5.5508E-06	1.4916E-03
96.000	4.3496E-06	2.0634E-02	9.1395E-07	1.3602E-03	5.5508E-06	1.5171E-03
720.000	4.3496E-06	2.0634E-02	9.1395E-07	1.3602E-03	5.5508E-06	1.5171E-03

```
#####################################################################
                        Worst Two-Hour Doses
#####################################################################
```

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
2.6	9.3768E-04	1.0366E-06	9.5468E-04

Attachment 13.9
RADTRAD Output File PMSINCI01.o0

```
#######################################################################
    RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:53:11
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078 R1\PMSINCI01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimsconc_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt


     #####    ####   #####    #  #     #  #####   #    #  #####
     #    #  #       #        #  ##    #  #    #  #    #    #
     #    #  #       #        #  # #   #  #    #  #    #    #
     #####    ####   ####     #  #  #  #  #####   #    #    #
     #            #  #        #  #   # #  #       #    #    #
     #            #  #        #  #    ##  #       #    #    #
     #        ####   #        #  #     #  #        ####     #


Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Concurrent Iodine Spike with  Iodine
Release From Intact SG  With Tube Uncovered for 2 Hours
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimsconc_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  5
Compartment 1:
Fuel
  3
 1.0000E+03
  0
  0
  0
  0
  0
Compartment 2:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
Compartment 3:
Environment
  2
 0.0000E+00
```

```
  0
  0
  0
  0
  0
Compartment 4:
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Compartment 5:
Intact SG
  3
 1.7210E+03
  0
  0
  0
  0
  0
Pathways:
  5
Pathway 1:
Fuel to RCS
  1
  2
  2
Pathway 2:
RCS to Intact SG
  2
  5
  2
Pathway 3:
Environment to Control Room
  3
  4
  2
Pathway 4:
Control Room to Environment
  4
  3
  2
Pathway 5:
Intact SG to Environment
  5
  3
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
```

```
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_iodine_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
  0
  0
  0
Compartments:
  5
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
```

```
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Compartment 5:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Pathways:
  5
Pathway 1:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   9.6000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.8800E-02   0.0000E+00   0.0000E+00   0.0000E+00
  4.5500E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
```

```
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 5:
  0
  0
  0
  0
  0
  1
  5
  0.0000E+00   3.9420E+01   0.0000E+00   0.0000E+00   0.0000E+00
  2.0000E+00   2.3610E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   1.7340E+00   0.0000E+00   0.0000E+00   0.0000E+00
  2.4000E+01   1.3980E+00   0.0000E+00   0.0000E+00   0.0000E+00
  4.5500E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  3
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
```

```
Location 2:
Low Population Zone
  3
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   3.0700E-02
  2.0000E+00   2.4900E-02
  8.0000E+00   1.1200E-02
  2.4000E+01   7.7800E-03
  9.6000E+01   6.1700E-03
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o6
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:53:11
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   5

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Fuel
Compartment volume =   1.0000E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Fuel to RCS

Compartment number  2
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Fuel to RCS
   Exit Pathway Number    2: RCS to Intact SG

Compartment number  3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  3
   Inlet Pathway Number   4: Control Room to Environment
   Inlet Pathway Number   5: Intact SG to Environment
   Exit Pathway Number    3: Environment to Control Room

Compartment number  4
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   3: Environment to Control Room
   Exit Pathway Number    4: Control Room to Environment

Compartment number  5
Name: Intact SG
Compartment volume =   1.7210E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  5
```

```
   Inlet Pathway Number    2: RCS to Intact SG
   Exit Pathway Number     5: Intact SG to Environment

Total number of pathways =   5
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:53:11
#######################################################################

#######################################################################
                      Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	1.0000E+00	0.0000E+00	0.0000E+00	5.452E-01
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
I-131	2	2.867E+01	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	7.675E+01	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	4.989E+01	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	3.141E+01	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	3.683E+01	2.380E+04	8.294E-14	8.460E-09	3.320E-10

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01
Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: Fuel

Compartment number 2: RCS

Compartment number 3: Environment

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

Compartment number 5: Intact SG

PATHWAY DATA

Pathway number 1: Fuel to RCS

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	9.6000E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: RCS to Intact SG

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	1.8800E-02	0.0000E+00	0.0000E+00	0.0000E+00
4.5500E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: Intact SG to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.9420E+01	0.0000E+00	0.0000E+00	0.0000E+00
2.0000E+00	2.3610E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	1.7340E+00	0.0000E+00	0.0000E+00	0.0000E+00
2.4000E+01	1.3980E+00	0.0000E+00	0.0000E+00	0.0000E+00
4.5500E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

LOCATION DATA

Location Exclusion Area Boundary is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	6.4900E-04
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Low Population Zone is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	1.7700E-04
8.0000E+00	3.9900E-05
2.4000E+01	7.1200E-06
9.6000E+01	1.0400E-06
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
8.0000E+00	1.8000E-04
2.4000E+01	2.3000E-04
7.2000E+02	0.0000E+00

Location Control Room is in compartment 4

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	3.0700E-02
2.0000E+00	2.4900E-02
8.0000E+00	1.1200E-02
2.4000E+01	7.7800E-03
9.6000E+01	6.1700E-03
7.2000E+02	0.0000E+00

Location Breathing Rate Data

Time (hr)	Breathing Rate (m^3 * sec^-1)
0.0000E+00	3.5000E-04
7.2000E+02	0.0000E+00

Location Occupancy Factor Data

Time (hr)	Occupancy Factor

```
  0.0000E+00          1.0000E+00
  2.4000E+01          6.0000E-01
  9.6000E+01          4.0000E-01
  7.2000E+02          0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
  0.0000E+00         1.0000E-01
  2.0000E+00         5.0000E-01
  8.0000E+00         1.0000E+00
  2.4000E+01         2.0000E+00
  9.6000E+01         4.0000E+00
  7.2000E+02         0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:53:11
#######################################################################

     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #

#######################################################################
            Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5817E-11	5.7381E-09	2.0685E-10
Accumulated dose (rem)	2.5817E-11	5.7381E-09	2.0685E-10

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	7.0409E-12	1.5649E-09	5.6414E-11
Accumulated dose (rem)	7.0409E-12	1.5649E-09	5.6414E-11

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0631E-13	6.6765E-10	2.1171E-11
Accumulated dose (rem)	1.0631E-13	6.6765E-10	2.1171E-11

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
I-131	5.0346E-10	4.0610E-18	1.8668E+07	1.6727E+02
I-132	1.3463E-09	1.3043E-19	5.9505E+05	4.4746E+02
I-133	8.7600E-10	7.7329E-19	3.5014E+06	2.9105E+02
I-134	5.5001E-10	2.0618E-20	9.2659E+04	1.8291E+02
I-135	6.4651E-10	1.8409E-19	8.2122E+05	2.1482E+02

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	6.4870E+02	0.0000E+00
Elemental I (atoms)	2.2968E+07	0.0000E+00
Organic I (atoms)	7.1036E+05	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	3.8966E-19
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	4.8917E-19
Total I (Ci)		3.9223E-09

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00

Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.4151E+02
Elemental I (atoms)	0.0000E+00	2.3002E+07
Organic I (atoms)	0.0000E+00	7.1141E+05
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	2.5210E-01	0.0000E+00
Elemental I (atoms)	3.9592E+04	0.0000E+00
Organic I (atoms)	1.2245E+03	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1529E-06	2.5645E-04	9.2438E-06
Accumulated dose (rem)	1.1529E-06	2.5646E-04	9.2440E-06

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.1443E-07	6.9942E-05	2.5210E-06
Accumulated dose (rem)	3.1444E-07	6.9944E-05	2.5211E-06

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4467E-07	9.0930E-04	2.8832E-05
Accumulated dose (rem)	1.4467E-07	9.0930E-04	2.8832E-05

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
I-131	2.1650E-05	1.7463E-13	8.0280E+11	2.2987E+08
I-132	5.6538E-05	5.4774E-15	2.4989E+10	6.0748E+08
I-133	3.7581E-05	3.3175E-14	1.5022E+11	3.9950E+08
I-134	2.2214E-05	8.3272E-16	3.7423E+09	2.4342E+08
I-135	2.7579E-05	7.8530E-15	3.5031E+10	2.9400E+08
Xe-131m	4.7667E-11	5.6909E-19	2.6161E+06	1.6929E+01
Xe-133	1.6575E-08	8.8548E-17	4.0094E+08	5.8929E+03
Xe-133m	1.1878E-09	2.6472E-18	1.1987E+07	4.2220E+02
Xe-135	1.4818E-07	5.8024E-17	2.5884E+08	5.2639E+04
Xe-135m	9.2574E-07	1.0163E-17	4.5334E+07	2.9856E+05

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump
Noble gases (atoms)	7.1971E+08	0.0000E+00
Elemental I (atoms)	9.8628E+11	0.0000E+00

Organic I (atoms)	3.0503E+10	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.6739E-14
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.0969E-14
Total I (Ci)			1.6556E-04

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.5119E+07
Elemental I (atoms)	0.0000E+00	1.0280E+12
Organic I (atoms)	0.0000E+00	3.1795E+10
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	1.2566E+06	0.0000E+00
Elemental I (atoms)	5.1425E+10	0.0000E+00
Organic I (atoms)	1.5905E+09	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.0566E-03	1.6303E+00	5.6177E-02
Accumulated dose (rem)	5.0578E-03	1.6305E+00	5.6187E-02

Low Population Zone Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3791E-03	4.4462E-01	1.5321E-02
Accumulated dose (rem)	1.3794E-03	4.4469E-01	1.5324E-02

Control Room Doses:

Time (h) = 2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.0070E-04	4.5875E+00	1.4432E-01
Accumulated dose (rem)	5.0084E-04	4.5884E+00	1.4435E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 2.0000	Ci	kg	Atoms	Decay
I-131	5.7354E-03	4.6262E-11	2.1267E+14	6.2834E+11
I-132	8.4638E-03	8.1997E-13	3.7409E+12	1.0984E+12
I-133	9.4042E-03	8.3017E-12	3.7589E+13	1.0472E+12
I-134	1.3019E-03	4.8801E-14	2.1932E+11	2.3083E+11
I-135	6.0169E-03	1.7133E-12	7.6428E+12	6.9712E+11

Xe-131m	8.0498E-07	9.6104E-15	4.4180E+10	5.5657E+07
Xe-133	2.7238E-04	1.4552E-12	6.5890E+12	1.8935E+10
Xe-133m	1.9349E-05	4.3122E-14	1.9525E+11	1.3476E+09
Xe-135	2.4555E-03	9.6153E-13	4.2893E+12	1.7315E+11
Xe-135m	1.8887E-03	2.0734E-14	9.2489E+10	1.9161E+11

Control Room Transport Group Inventory:

Time (h) = 2.0000	Atmosphere	Sump	
Noble gases (atoms)	1.1210E+13	0.0000E+00	
Elemental I (atoms)	2.5401E+14	0.0000E+00	
Organic I (atoms)	7.8559E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		4.3350E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		5.2279E-12
Total I (Ci)			3.0922E-02

Time (h) = 2.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	6.6114E+14
Organic I (atoms)	0.0000E+00	2.0448E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 2.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.1248E+13
Elemental I (atoms)	0.0000E+00	9.7679E+14
Organic I (atoms)	0.0000E+00	3.0210E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 2.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.5958E+12	0.0000E+00
Elemental I (atoms)	5.8046E+13	0.0000E+00
Organic I (atoms)	1.7953E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.3191E-03	4.2987E+00	1.3984E-01
Accumulated dose (rem)	1.1377E-02	5.9292E+00	1.9603E-01

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7234E-03	1.1724E+00	3.8139E-02
Accumulated dose (rem)	3.1028E-03	1.6171E+00	5.3462E-02

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.5880E-04	1.3855E+01	4.3150E-01

Accumulated dose (rem) 1.3596E-03 1.8444E+01 5.7585E-01

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
I-131	3.8691E-03	3.1209E-11	1.4347E+14	2.4664E+12
I-132	9.5650E-04	9.2665E-14	4.2276E+11	2.1815E+12
I-133	5.3076E-03	4.6854E-12	2.1215E+13	3.7611E+12
I-134	7.8108E-06	2.9279E-16	1.3159E+09	2.9872E+11
I-135	2.2107E-03	6.2951E-13	2.8081E+12	2.0622E+12
Xe-131m	5.1487E-06	6.1469E-14	2.8258E+11	1.6942E+09
Xe-133	1.6044E-03	8.5714E-12	3.8811E+13	5.4474E+11
Xe-133m	1.1072E-04	2.4674E-13	1.1172E+12	3.7954E+10
Xe-135	9.6179E-03	3.7662E-12	1.6801E+13	3.8173E+12
Xe-135m	7.7058E-04	8.4593E-15	3.7736E+10	6.9941E+11

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump	
Noble gases (atoms)	5.7049E+13	0.0000E+00	
Elemental I (atoms)	1.6288E+14	0.0000E+00	
Organic I (atoms)	5.0375E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.7774E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		3.1714E-12
Total I (Ci)			1.2352E-02

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	2.6534E+15
Organic I (atoms)	0.0000E+00	8.2063E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.9685E+13
Elemental I (atoms)	0.0000E+00	3.0597E+15
Organic I (atoms)	0.0000E+00	9.4629E+13
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	4.4119E+13	0.0000E+00
Elemental I (atoms)	2.3280E+14	0.0000E+00
Organic I (atoms)	7.2001E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8010E-02	2.6433E+01	8.3262E-01
Accumulated dose (rem)	2.9386E-02	3.2362E+01	1.0287E+00

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1072E-03	8.3576E-01	2.6864E-02
Accumulated dose (rem)	4.2100E-03	2.4528E+00	8.0326E-02

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3820E-03	3.6944E+01	1.1400E+00
Accumulated dose (rem)	2.7417E-03	5.5387E+01	1.7158E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
I-131	3.2235E-03	2.6001E-11	1.1953E+14	7.8164E+12
I-132	6.7958E-06	6.5837E-16	3.0036E+09	2.4008E+12
I-133	2.7480E-03	2.4258E-12	1.0984E+13	9.4416E+12
I-135	3.6437E-04	1.0376E-13	4.6284E+11	3.4394E+12
Xe-131m	2.0576E-05	2.4565E-13	1.1293E+12	2.5141E+10
Xe-133	5.1221E-03	2.7364E-11	1.2390E+14	6.8890E+12
Xe-133m	3.2754E-04	7.2996E-13	3.3052E+12	4.5598E+11
Xe-135	9.9606E-03	3.9004E-12	1.7399E+13	2.3754E+13
Xe-135m	2.0658E-04	2.2678E-15	1.0116E+10	1.4261E+12

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	1.4575E+14	0.0000E+00	
Elemental I (atoms)	1.2705E+14	0.0000E+00	
Organic I (atoms)	3.9294E+12	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		2.1261E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		2.2973E-12
Total I (Ci)			6.3427E-03

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	8.0317E+15
Organic I (atoms)	0.0000E+00	2.4840E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	6.2373E+14
Elemental I (atoms)	0.0000E+00	8.8862E+15
Organic I (atoms)	0.0000E+00	2.7483E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	4.6028E+14	0.0000E+00
Elemental I (atoms)	7.0458E+14	0.0000E+00

Organic I (atoms)	2.1791E+13	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.6439E-02	4.2703E+01	1.3253E+00
Accumulated dose (rem)	4.5826E-02	7.5065E+01	2.3540E+00

Low Population Zone Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.8035E-04	3.0786E-01	9.6167E-03
Accumulated dose (rem)	4.3904E-03	2.7607E+00	8.9942E-02

Control Room Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.6673E-04	2.5055E+01	7.6857E-01
Accumulated dose (rem)	3.3084E-03	8.0442E+01	2.4844E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 45.5000	Ci	kg	Atoms	Decay
I-131	2.4406E-03	1.9687E-11	9.0500E+13	1.4174E+13
I-132	8.5306E-09	8.2643E-19	3.7704E+06	2.4027E+12
I-133	1.0979E-03	9.6920E-13	4.3885E+12	1.3389E+13
I-135	3.1269E-05	8.9039E-15	3.9719E+10	3.7183E+12
Xe-131m	3.3922E-05	4.0499E-13	1.8617E+12	9.4407E+10
Xe-133	6.2555E-03	3.3419E-11	1.5132E+14	2.1458E+13
Xe-133m	3.5908E-04	8.0027E-13	3.6235E+12	1.3373E+12
Xe-135	2.6572E-03	1.0405E-12	4.6416E+12	3.7605E+13
Xe-135m	1.7325E-05	1.9019E-16	8.4841E+08	1.6179E+12

Control Room Transport Group Inventory:

Time (h) = 45.5000	Atmosphere	Sump
Noble gases (atoms)	1.6145E+14	0.0000E+00
Elemental I (atoms)	9.2081E+13	0.0000E+00
Organic I (atoms)	2.8479E+12	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	1.5115E-12
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	1.5762E-12
Total I (Ci)		3.5698E-03

Time (h) = 45.5000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.4144E+16
Organic I (atoms)	0.0000E+00	4.3744E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 45.5000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.5202E+15
Elemental I (atoms)	0.0000E+00	1.5552E+16

Organic I (atoms)	0.0000E+00	4.8098E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 45.5000	Pathway Filtered	Transported
Noble gases (atoms)	1.3169E+15	0.0000E+00
Elemental I (atoms)	1.2407E+15	0.0000E+00
Organic I (atoms)	3.8373E+13	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.5826E-02	7.5065E+01	2.3540E+00

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	4.3904E-03	2.7607E+00	8.9942E-02

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5016E-05	4.6371E-01	1.4210E-02
Accumulated dose (rem)	3.3334E-03	8.0906E+01	2.4986E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Xe-131m	1.0937E-11	1.3057E-19	6.0024E+05	1.0769E+11
Xe-133	1.7491E-09	9.3442E-18	4.2310E+07	2.3884E+13
Xe-133m	6.7189E-11	1.4974E-19	6.7801E+05	1.4729E+12
Xe-135	2.0592E-11	8.0637E-21	3.5971E+04	3.8439E+13

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump	
Noble gases (atoms)	4.3624E+07	0.0000E+00	
Elemental I (atoms)	1.0720E-66	0.0000E+00	
Organic I (atoms)	3.3155E-68	0.0000E+00	
Aerosols (kg)	0.0000E+00	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		1.7266E-92
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		1.7437E-92
Total I (Ci)			3.2443E-83

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	1.4212E+16
Organic I (atoms)	0.0000E+00	4.3954E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

```
                          Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     0.0000E+00  1.5202E+15
Elemental I (atoms)     0.0000E+00  1.5552E+16
Organic I (atoms)       0.0000E+00  4.8098E+14
Aerosols (kg)           0.0000E+00  0.0000E+00

Control Room to Environment Transport Group Inventory:

                          Pathway
Time (h) =  96.0000      Filtered   Transported
Noble gases (atoms)     1.4750E+15  0.0000E+00
Elemental I (atoms)     1.2467E+15  0.0000E+00
Organic I (atoms)       3.8557E+13  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   4.5826E-02  7.5065E+01  2.3540E+00

Low Population Zone Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         0.0000E+00  0.0000E+00  0.0000E+00
Accumulated dose (rem)   4.3904E-03  2.7607E+00  8.9942E-02

Control Room Doses:

Time (h) = 720.0000     Whole Body   Thyroid       TEDE
Delta dose (rem)         1.1109E-12  4.9536E-81  1.1109E-12
Accumulated dose (rem)   3.3334E-03  8.0906E+01  2.4986E+00

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000        Ci            kg          Atoms       Decay

Control Room Transport Group Inventory:
Time (h) = 720.0000     Atmosphere     Sump
Noble gases (atoms)     4.2541E-74  0.0000E+00
Elemental I (atoms)     0.0000E+00  0.0000E+00
Organic I (atoms)       0.0000E+00  0.0000E+00
Aerosols (kg)           0.0000E+00  0.0000E+00
Dose Effective (Ci/cc) I-131 (Thyroid)          0.0000E+00
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)    0.0000E+00
Total I (Ci)                                    0.0000E+00

                        Deposition Recirculating
Time (h) = 720.0000      Surfaces     Filter
Noble gases (atoms)     0.0000E+00  0.0000E+00
Elemental I (atoms)     0.0000E+00  1.4212E+16
Organic I (atoms)       0.0000E+00  4.3954E+14
Aerosols (kg)           0.0000E+00  0.0000E+00

Environment to Control Room Transport Group Inventory:
```

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.5202E+15
Elemental I (atoms)	0.0000E+00	1.5552E+16
Organic I (atoms)	0.0000E+00	4.8098E+14
Aerosols (kg)	0.0000E+00	0.0000E+00

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	1.4750E+15	0.0000E+00
Elemental I (atoms)	1.2467E+15	0.0000E+00
Organic I (atoms)	3.8557E+13	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

840

```
#####################################################################
                          I-131 Summary
#####################################################################
```

Time (hr)	Fuel I-131 (Curies)	RCS I-131 (Curies)	Environment I-131 (Curies)
0.000	8.1926E+03	1.3109E+00	9.8795E-12
0.004	5.3041E+04	5.5012E+01	1.7399E-08
0.083	5.0647E+04	2.4342E+03	7.7742E-04
0.400	4.2153E+04	1.0867E+04	7.7962E-02
0.700	3.5426E+04	1.7536E+04	3.6644E-01
1.000	2.9772E+04	2.3132E+04	9.3862E-01
1.300	2.5020E+04	2.7825E+04	1.8189E+00
1.600	2.1027E+04	3.1759E+04	3.0039E+00
1.900	1.7671E+04	3.5056E+04	4.4752E+00
2.000	1.6676E+04	3.6032E+04	5.0248E+00
2.300	1.4014E+04	3.8634E+04	5.1538E+00
2.600	1.1778E+04	4.0811E+04	5.3396E+00
2.900	9.8980E+03	4.2632E+04	5.5843E+00
3.200	8.3183E+03	4.4152E+04	5.8892E+00
3.500	6.9907E+03	4.5420E+04	6.2552E+00
3.800	5.8750E+03	4.6477E+04	6.6826E+00
4.100	4.9373E+03	4.7355E+04	7.1717E+00
4.400	4.1493E+03	4.8084E+04	7.7221E+00
4.700	3.4871E+03	4.8687E+04	8.3334E+00
5.000	2.9306E+03	4.9184E+04	9.0051E+00
5.300	2.4628E+03	4.9592E+04	9.7364E+00
5.600	2.0698E+03	4.9926E+04	1.0526E+01
5.900	1.7394E+03	5.0197E+04	1.1374E+01
6.200	1.4618E+03	5.0416E+04	1.2279E+01
6.500	1.2285E+03	5.0590E+04	1.3239E+01
6.800	1.0324E+03	5.0727E+04	1.4253E+01
7.100	8.6766E+02	5.0833E+04	1.5321E+01
7.400	7.2919E+02	5.0912E+04	1.6441E+01
7.700	6.1281E+02	5.0970E+04	1.7611E+01
8.000	5.1500E+02	5.1009E+04	1.8832E+01
8.300	5.1445E+02	5.0950E+04	1.9767E+01
8.600	5.1389E+02	5.0892E+04	2.0742E+01
8.900	5.1334E+02	5.0834E+04	2.1758E+01

9.200	5.1279E+02	5.0776E+04	2.2813E+01
9.500	5.1224E+02	5.0718E+04	2.3906E+01
9.800	5.1168E+02	5.0660E+04	2.5036E+01
10.100	5.1113E+02	5.0603E+04	2.6203E+01
10.400	5.1058E+02	5.0545E+04	2.7406E+01
24.000	4.8624E+02	4.7996E+04	1.0938E+02
45.500	4.5010E+02	4.4225E+04	2.6613E+02
96.000	3.7543E+02	3.6888E+04	2.6613E+02
720.000	3.9907E+01	3.9211E+03	2.6613E+02

Time (hr)	Control Room I-131 (Curies)	Intact SG I-131 (Curies)
0.000	2.8622E-13	5.1755E-08
0.004	5.0346E-10	1.4061E-05
0.083	2.1650E-05	2.0543E-02
0.400	2.4737E-04	4.0102E-01
0.700	9.0709E-04	1.0264E+00
1.000	1.8884E-03	1.7587E+00
1.300	3.0336E-03	2.5102E+00
1.600	4.2202E-03	3.2314E+00
1.900	5.3692E-03	3.8962E+00
2.000	5.7354E-03	4.1030E+00
2.300	2.2094E-03	6.3591E+00
2.600	1.1502E-03	8.7082E+00
2.900	9.2170E-04	1.1123E+01
3.200	9.7445E-04	1.3582E+01
3.500	1.1232E-03	1.6067E+01
3.800	1.3049E-03	1.8561E+01
4.100	1.4979E-03	2.1052E+01
4.400	1.6941E-03	2.3531E+01
4.700	1.8905E-03	2.5989E+01
5.000	2.0856E-03	2.8419E+01
5.300	2.2786E-03	3.0815E+01
5.600	2.4690E-03	3.3174E+01
5.900	2.6565E-03	3.5492E+01
6.200	2.8407E-03	3.7766E+01
6.500	3.0214E-03	3.9995E+01
6.800	3.1985E-03	4.2177E+01
7.100	3.3719E-03	4.4310E+01
7.400	3.5415E-03	4.6396E+01
7.700	3.7073E-03	4.8433E+01
8.000	3.8691E-03	5.0421E+01
8.300	2.2022E-03	5.2691E+01
8.600	1.6827E-03	5.4915E+01
8.900	1.5470E-03	5.7092E+01
9.200	1.5391E-03	5.9225E+01
9.500	1.5733E-03	6.1313E+01
9.800	1.6209E-03	6.3358E+01
10.100	1.6721E-03	6.5360E+01
10.400	1.7239E-03	6.7321E+01
24.000	3.2235E-03	1.2319E+02
45.500	2.4406E-03	1.6586E+02
96.000	2.9485E-83	1.3834E+02
720.000	0.0000E+00	1.4705E+01

##

Cumulative Dose Summary

##

Time (hr)	Exclusion Area Bounda Thyroid (rem)	TEDE (rem)	Low Population Zone Thyroid (rem)	TEDE (rem)	Control Room Thyroid (rem)	TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	5.7381E-09	2.0685E-10	1.5649E-09	5.6414E-11	6.6765E-10	2.1171E-11
0.083	2.5646E-04	9.2440E-06	6.9944E-05	2.5211E-06	9.0930E-04	2.8832E-05
0.400	2.5640E-02	9.1504E-04	6.9927E-03	2.4956E-04	3.3803E-02	1.0701E-03
0.700	1.2018E-01	4.2535E-03	3.2776E-02	1.1600E-03	2.0573E-01	6.5026E-03
1.000	3.0702E-01	1.0786E-02	8.3732E-02	2.9417E-03	6.3755E-01	2.0125E-02
1.300	5.9345E-01	2.0713E-02	1.6185E-01	5.6490E-03	1.4027E+00	4.4229E-02
1.600	9.7773E-01	3.3925E-02	2.6665E-01	9.2524E-03	2.5299E+00	7.9686E-02
1.900	1.4533E+00	5.0160E-02	3.9634E-01	1.3680E-02	4.0164E+00	1.2639E-01
2.000	1.6305E+00	5.6187E-02	4.4469E-01	1.5324E-02	4.5884E+00	1.4435E-01
2.300	1.6720E+00	5.7591E-02	4.5601E-01	1.5707E-02	5.7232E+00	1.7995E-01
2.600	1.7316E+00	5.9599E-02	4.7227E-01	1.6254E-02	6.2094E+00	1.9519E-01
2.900	1.8099E+00	6.2221E-02	4.9361E-01	1.6969E-02	6.5167E+00	2.0481E-01
3.200	1.9072E+00	6.5464E-02	5.2013E-01	1.7854E-02	6.8029E+00	2.1377E-01
3.500	2.0235E+00	6.9330E-02	5.5187E-01	1.8908E-02	7.1213E+00	2.2372E-01
3.800	2.1591E+00	7.3817E-02	5.8884E-01	2.0132E-02	7.4898E+00	2.3523E-01
4.100	2.3137E+00	7.8917E-02	6.3101E-01	2.1523E-02	7.9143E+00	2.4848E-01
4.400	2.4873E+00	8.4625E-02	6.7835E-01	2.3080E-02	8.3966E+00	2.6353E-01
4.700	2.6796E+00	9.0930E-02	7.3079E-01	2.4799E-02	8.9368E+00	2.8037E-01
5.000	2.8903E+00	9.7821E-02	7.8826E-01	2.6678E-02	9.5345E+00	2.9899E-01
5.300	3.1191E+00	1.0529E-01	8.5066E-01	2.8714E-02	1.0189E+01	3.1937E-01
5.600	3.3657E+00	1.1331E-01	9.1791E-01	3.0903E-02	1.0899E+01	3.4148E-01
5.900	3.6296E+00	1.2188E-01	9.8990E-01	3.3241E-02	1.1664E+01	3.6527E-01
6.200	3.9106E+00	1.3099E-01	1.0665E+00	3.5725E-02	1.2482E+01	3.9071E-01
6.500	4.2081E+00	1.4062E-01	1.1477E+00	3.8350E-02	1.3352E+01	4.1777E-01
6.800	4.5217E+00	1.5075E-01	1.2332E+00	4.1113E-02	1.4274E+01	4.4640E-01
7.100	4.8511E+00	1.6137E-01	1.3230E+00	4.4009E-02	1.5245E+01	4.7657E-01
7.400	5.1957E+00	1.7246E-01	1.4170E+00	4.7035E-02	1.6265E+01	5.0822E-01
7.700	5.5552E+00	1.8402E-01	1.5151E+00	5.0188E-02	1.7331E+01	5.4133E-01
8.000	5.9292E+00	1.9603E-01	1.6171E+00	5.3462E-02	1.8444E+01	5.7585E-01
8.300	6.2151E+00	2.0519E-01	1.6261E+00	5.3761E-02	1.9293E+01	6.0220E-01
8.600	6.5128E+00	2.1473E-01	1.6355E+00	5.4072E-02	1.9848E+01	6.1940E-01
8.900	6.8220E+00	2.2462E-01	1.6453E+00	5.4395E-02	2.0314E+01	6.3387E-01
9.200	7.1424E+00	2.3486E-01	1.6554E+00	5.4728E-02	2.0762E+01	6.4775E-01
9.500	7.4738E+00	2.4544E-01	1.6659E+00	5.5072E-02	2.1214E+01	6.6175E-01
9.800	7.8159E+00	2.5635E-01	1.6767E+00	5.5427E-02	2.1677E+01	6.7610E-01
10.100	8.1684E+00	2.6758E-01	1.6879E+00	5.5792E-02	2.2153E+01	6.9086E-01
10.400	8.5310E+00	2.7913E-01	1.6993E+00	5.6167E-02	2.2644E+01	7.0605E-01
24.000	3.2362E+01	1.0287E+00	2.4528E+00	8.0326E-02	5.5387E+01	1.7158E+00
45.500	7.5065E+01	2.3540E+00	2.7607E+00	8.9942E-02	8.0442E+01	2.4844E+00
96.000	7.5065E+01	2.3540E+00	2.7607E+00	8.9942E-02	8.0906E+01	2.4986E+00
720.000	7.5065E+01	2.3540E+00	2.7607E+00	8.9942E-02	8.0906E+01	2.4986E+00

##

Worst Two-Hour Doses

##

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
24.0	1.5293E-03	3.9723E+00	1.2329E-01

Attachment 13.10
RADTRAD Output File PMSINCNG01.o0

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:58:00
#######################################################################

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

Plant file           = G:\Radtrad 3.03\Input\PI\GEN-PI-078 R1\PMSINCNG01.psf
Inventory file       = g:\radtrad 3.03\defaults\pimsconc_def.txt
Release file         = g:\radtrad 3.03\defaults\pingp_ng_rft.txt
Dose Conversion file = g:\radtrad 3.03\defaults\pingp_fg11&12.txt
```

```
#####    ####   #####    #  #     #  #####   #    #  #####
#    #  #       #        #  ##    #  #    #  #    #    #
#    #  #       #        #  # #   #  #    #  #    #    #
#####    ####   ####     #  #  #  #  #####   #    #    #
#            #  #        #  #   # #  #       #    #    #
#            #  #        #  #    ##  #       #    #    #
#        ####   #        #  #     #  #        ####     #
```

```
Radtrad 3.03 4/15/2001
PINGP 1 & 2 MSLB Accident AST Analysis - Concurrent Iodine Spike with  Noble Gas
Release From Intact SG
Nuclide Inventory File:
g:\radtrad 3.03\defaults\pimsconc_def.txt
Plant Power Level:
 1.8520E+03
Compartments:
  4
Compartment 1:
Fuel
  3
 1.0000E+03
  0
  0
  0
  0
  0
Compartment 2:
RCS
  3
 5.2900E+03
  0
  0
  0
  0
  0
```

```
Compartment 3:
Environment
  2
 0.0000E+00
  0
  0
  0
  0
  0
Compartment 4:
Control Room
  1
 6.1315E+04
  0
  0
  1
  0
  0
Pathways:
  4
Pathway 1:
Fuel to RCS
  1
  2
  2
Pathway 2:
Environment to Control Room
  3
  4
  2
Pathway 3:
Control Room to Environment
  4
  3
  2
Pathway 4:
RCS to  Environment
  2
  3
  2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
  1
  1   1.0000E+00
g:\radtrad 3.03\defaults\pingp_fg11&12.txt
g:\radtrad 3.03\defaults\pingp_ng_rft.txt
  0.0000E+00
  1
  0.0000E+00   9.7000E-01   3.0000E-02   1.0000E+00
Overlying Pool:
  0
  0.0000E+00
  0
```

```
  0
  0
  0
Compartments:
  4
Compartment 1:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 2:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 3:
  0
  1
  0
  0
  0
  0
  0
  0
  0
Compartment 4:
  1
  1
  0
  0
  0
  0
  1
  3.6000E+03
  3
  0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   9.9000E+01   9.5000E+01   9.5000E+01
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
Pathways:
  4
Pathway 1:
  0
  0
  0
  0
```

```
  0
  1
  2
  0.0000E+00   9.6000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  8.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 2:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 3:
  0
  0
  0
  0
  0
  1
  3
  0.0000E+00   2.0000E+03   0.0000E+00   0.0000E+00   0.0000E+00
  8.3300E-02   3.0000E+02   0.0000E+00   0.0000E+00   0.0000E+00
  7.2000E+02   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
  0
  0
  0
  0
Pathway 4:
  0
  0
  0
  0
  0
  1
  2
  0.0000E+00   1.8800E-02   0.0000E+00   0.0000E+00   0.0000E+00
  4.5500E+01   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
  0
  0
```

```
  0
  0
  0
  0
Dose Locations:
  3
Location 1:
Exclusion Area Boundary
  3
  1
  2
  0.0000E+00   6.4900E-04
  7.2000E+02   0.0000E+00
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  0
Location 2:
Low Population Zone
  3
  1
  5
  0.0000E+00   1.7700E-04
  8.0000E+00   3.9900E-05
  2.4000E+01   7.1200E-06
  9.6000E+01   1.0400E-06
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   3.5000E-04
  8.0000E+00   1.8000E-04
  2.4000E+01   2.3000E-04
  7.2000E+02   0.0000E+00
  0
Location 3:
Control Room
  4
  0
  1
  2
  0.0000E+00   3.5000E-04
  7.2000E+02   0.0000E+00
  1
  4
  0.0000E+00   1.0000E+00
  2.4000E+01   6.0000E-01
  9.6000E+01   4.0000E-01
  7.2000E+02   0.0000E+00
Effective Volume Location:
  1
  6
  0.0000E+00   3.0700E-02
  2.0000E+00   2.4900E-02
  8.0000E+00   1.1200E-02
  2.4000E+01   7.7800E-03
  9.6000E+01   6.1700E-03
```

```
  7.2000E+02   0.0000E+00
Simulation Parameters:
  6
  0.0000E+00   1.0000E-01
  2.0000E+00   5.0000E-01
  8.0000E+00   1.0000E+00
  2.4000E+01   2.0000E+00
  9.6000E+01   4.0000E+00
  7.2000E+02   0.0000E+00
Output Filename:
G:\Radtrad 3.o7
  1
  1
  1
  0
  0
End of Scenario File
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:58:00
#######################################################################

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

Number of Nuclides =  60

Inventory Power =   1.0000E+00 MWth
Plant Power Level =   1.8520E+03 MWth

Number of compartments    =   4

Compartment information

Compartment number  1  (Source term fraction =   1.0000E+00
)
Name: Fuel
Compartment volume =   1.0000E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  1
   Exit Pathway Number    1: Fuel to RCS

Compartment number  2
Name: RCS
Compartment volume =   5.2900E+03 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment  2
   Inlet Pathway Number   1: Fuel to RCS
   Exit Pathway Number    4: RCS to  Environment

Compartment number  3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment  3
   Inlet Pathway Number   3: Control Room to Environment
   Inlet Pathway Number   4: RCS to  Environment
   Exit Pathway Number    2: Environment to Control Room

Compartment number  4
Name: Control Room
Compartment volume =   6.1315E+04 (Cubic feet)
Compartment type is Control Room
Removal devices within compartment:
     Filter(s)
Pathways into and out of compartment  4
   Inlet Pathway Number   2: Environment to Control Room
   Exit Pathway Number    3: Control Room to Environment

Total number of pathways =   4
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:58:00
#######################################################################

#######################################################################
                    Scenario Description
#######################################################################
```

Radioactive Decay is enabled
Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.003600 hr	0.0000 hrs	0.0000 hrs	(gm)
NOBLES	1.0000E+00	0.0000E+00	0.0000E+00	4.811E+00
IODINE	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CESIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
TELLURIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
STRONTIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
BARIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
RUTHENIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
CERIUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
LANTHANUM	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Inventory Power = 1852. MWt

Nuclide Name	Group	Specific Inventory (Ci/MWt)	half life (s)	Whole Body DCF (Sv-m3/Bq-s)	Inhaled Thyroid (Sv/Bq)	Inhaled Effective (Sv/Bq)
Kr-83m	1	3.487E-02	6.588E+03	1.500E-18	0.000E+00	0.000E+00
Kr-85	1	9.695E-01	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	1.414E-01	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	9.162E-02	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	2.571E-01	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Xe-131m	1	1.823E-01	1.028E+06	3.890E-16	0.000E+00	0.000E+00
Xe-133	1	2.313E+01	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-133m	1	3.247E-01	1.890E+05	1.370E-15	0.000E+00	0.000E+00
Xe-135	1	7.329E-01	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Xe-135m	1	4.465E-02	9.174E+02	2.040E-14	0.000E+00	0.000E+00
Xe-138	1	5.417E-02	8.502E+02	5.770E-14	0.000E+00	0.000E+00

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Kr-85m	Kr-85	0.21	none	0.00	none	0.00
Kr-87	Rb-87	1.00	none	0.00	none	0.00
Kr-88	Rb-88	1.00	none	0.00	none	0.00
I-131	Xe-131m	0.01	none	0.00	none	0.00
I-133	Xe-133m	0.03	Xe-133	0.97	none	0.00
I-135	Xe-135m	0.15	Xe-135	0.85	none	0.00
Xe-133m	Xe-133	1.00	none	0.00	none	0.00
Xe-135	Cs-135	1.00	none	0.00	none	0.00
Xe-135m	Xe-135	1.00	none	0.00	none	0.00
Xe-138	Cs-138	1.00	none	0.00	none	0.00

Iodine fractions
Aerosol = 0.0000E+00
Elemental = 9.7000E-01

Organic = 3.0000E-02

COMPARTMENT DATA

Compartment number 1: Fuel

Compartment number 2: RCS

Compartment number 3: Environment

Compartment number 4: Control Room

Compartment Filter Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.6000E+03	9.9000E+01	9.5000E+01	9.5000E+01
7.2000E+02	3.6000E+03	0.0000E+00	0.0000E+00	0.0000E+00

PATHWAY DATA

Pathway number 1: Fuel to RCS

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	9.6000E+00	0.0000E+00	0.0000E+00	0.0000E+00
8.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 2: Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 3: Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic
0.0000E+00	2.0000E+03	0.0000E+00	0.0000E+00	0.0000E+00
8.3300E-02	3.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
7.2000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: RCS to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%) Aerosol	Elemental	Organic

```
      0.0000E+00    1.8800E-02   0.0000E+00   0.0000E+00   0.0000E+00
      4.5500E+01    0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00

LOCATION DATA
     Location Exclusion Area Boundary     is in compartment   3

     Location X/Q Data
      Time (hr)         X/Q (s * m^-3)
       0.0000E+00          6.4900E-04
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)         Breathing Rate (m^3 * sec^-1)
       0.0000E+00                3.5000E-04
       7.2000E+02                0.0000E+00
     Location Low Population Zone     is in compartment   3

     Location X/Q Data
      Time (hr)         X/Q (s * m^-3)
       0.0000E+00          1.7700E-04
       8.0000E+00          3.9900E-05
       2.4000E+01          7.1200E-06
       9.6000E+01          1.0400E-06
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)         Breathing Rate (m^3 * sec^-1)
       0.0000E+00                3.5000E-04
       8.0000E+00                1.8000E-04
       2.4000E+01                2.3000E-04
       7.2000E+02                0.0000E+00
     Location Control Room     is in compartment   4

     Location X/Q Data
      Time (hr)         X/Q (s * m^-3)
       0.0000E+00          3.0700E-02
       2.0000E+00          2.4900E-02
       8.0000E+00          1.1200E-02
       2.4000E+01          7.7800E-03
       9.6000E+01          6.1700E-03
       7.2000E+02          0.0000E+00

     Location Breathing Rate Data
      Time (hr)         Breathing Rate (m^3 * sec^-1)
       0.0000E+00                3.5000E-04
       7.2000E+02                0.0000E+00

     Location Occupancy Factor Data
      Time (hr)         Occupancy Factor
       0.0000E+00            1.0000E+00
       2.4000E+01            6.0000E-01
       9.6000E+01            4.0000E-01
       7.2000E+02            0.0000E+00

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS
     Time            Time step
      0.0000E+00       1.0000E-01
```

```
2.0000E+00        5.0000E-01
8.0000E+00        1.0000E+00
2.4000E+01        2.0000E+00
9.6000E+01        4.0000E+00
7.2000E+02        0.0000E+00
```

```
#######################################################################
   RADTRAD Version 3.03 (Spring 2001) run on  6/22/2010  at  0:58:00
#######################################################################

     ####   #    #  #####  #####   #    #  #####
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #    #  #    #    #
    #    #  #    #    #    #####   #    #    #
    #    #  #    #    #    #       #    #    #
    #    #  #    #    #    #       #    #    #
     ####    ####     #    #        ####     #

#######################################################################
           Dose, Detailed model and Detailed Inventory Output
#######################################################################
```

Exclusion Area Boundary Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.5158E-11	2.5349E-16	9.5161E-11
Accumulated dose (rem)	9.5158E-11	2.5349E-16	9.5161E-11

Low Population Zone Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5952E-11	6.9133E-17	2.5953E-11
Accumulated dose (rem)	2.5952E-11	6.9133E-17	2.5953E-11

Control Room Doses:

Time (h) = 0.0036	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0186E-13	3.1823E-17	4.0232E-13
Accumulated dose (rem)	4.0186E-13	3.1823E-17	4.0232E-13

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0036	Ci	kg	Atoms	Decay
Kr-83m	4.9466E-10	2.3975E-20	1.7395E+05	1.6528E+02
Kr-85	1.3772E-08	3.5102E-14	2.4869E+11	4.5994E+03
Kr-85m	2.0075E-09	2.4394E-19	1.7283E+06	6.7057E+02
Kr-87	1.2989E-09	4.5857E-20	3.1742E+05	4.3410E+02
Kr-88	3.6489E-09	2.9100E-19	1.9914E+06	1.2190E+03
Xe-131m	2.5896E-09	3.0916E-17	1.4212E+08	8.6484E+02
Xe-133	3.2856E-07	1.7553E-15	7.9478E+09	1.0973E+05
Xe-133m	4.6123E-09	1.0279E-17	4.6543E+07	1.5404E+03
Xe-135	1.0426E-08	4.0826E-18	1.8212E+07	3.4822E+03
Xe-135m	7.3817E-10	8.1036E-21	3.6149E+04	2.4713E+02
Xe-138	7.6140E-10	7.9184E-21	3.4555E+04	2.5523E+02

Control Room Transport Group Inventory:

Time (h) = 0.0036	Atmosphere	Sump
Noble gases (atoms)	2.5685E+11	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.9045E-22	0.0000E+00

Dose Effective (Ci/cc) I-131 (Thyroid) 0.0000E+00

Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 0.0000E+00
Total I (Ci) 0.0000E+00

Time (h) = 0.0036	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.5731E+11
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	5.4240E-23

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0036	Pathway Filtered	Transported
Noble gases (atoms)	4.8715E+08	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.1560E-25	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.4426E-07	1.8415E-12	1.4428E-07
Accumulated dose (rem)	1.4435E-07	1.8417E-12	1.4438E-07

Low Population Zone Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.9343E-08	5.0222E-13	3.9350E-08
Accumulated dose (rem)	3.9369E-08	5.0229E-13	3.9376E-08

Control Room Doses:

Time (h) = 0.0833	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7892E-08	6.4542E-12	1.7985E-08
Accumulated dose (rem)	1.7893E-08	6.4542E-12	1.7986E-08

Control Room Compartment Nuclide Inventory:

Time (h) = 0.0833	Ci	kg	Atoms	Decay
Kr-83m	6.9092E-07	3.3488E-17	2.4297E+08	7.4468E+06
Kr-85	1.9826E-05	5.0532E-11	3.5801E+14	2.1047E+08
Kr-85m	2.8545E-06	3.4686E-16	2.4575E+09	3.0492E+07
Kr-87	1.7904E-06	6.3208E-17	4.3752E+08	1.9426E+07
Kr-88	5.1517E-06	4.1085E-16	2.8116E+09	5.5227E+07
Rb-88	9.9677E-07	8.3038E-18	5.6825E+07	3.2735E+05
Xe-131m	3.7272E-06	4.4498E-14	2.0456E+11	3.9572E+07
Xe-133	4.7278E-04	2.5258E-12	1.1437E+13	5.0203E+09

Xe-133m	6.6329E-06	1.4782E-14	6.6933E+10	7.0454E+07
Xe-135	1.4940E-05	5.8503E-15	2.6097E+10	1.5902E+08
Xe-135m	9.3558E-07	1.0271E-17	4.5816E+07	1.1091E+07
Xe-138	8.6748E-07	9.0216E-18	3.9369E+07	1.0376E+07
Cs-138	1.0414E-07	2.4610E-18	1.0740E+07	3.9485E+04

Control Room Transport Group Inventory:

Time (h) = 0.0833	Atmosphere	Sump	
Noble gases (atoms)	3.6976E+14	0.0000E+00	
Elemental I (atoms)	0.0000E+00	0.0000E+00	
Organic I (atoms)	0.0000E+00	0.0000E+00	
Aerosols (kg)	1.0765E-17	0.0000E+00	
Dose Effective (Ci/cc)	I-131 (Thyroid)		0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)		0.0000E+00
Total I (Ci)			0.0000E+00

Time (h) = 0.0833	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	0.0000E+00

Environment to Control Room Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.8977E+14
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	3.9406E-19

Control Room to Environment Transport Group Inventory:

Time (h) = 0.0833	Pathway Filtered	Transported
Noble gases (atoms)	1.9696E+13	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.9956E-20	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.3864E-04	3.3649E-07	3.4410E-04
Accumulated dose (rem)	3.3879E-04	3.3649E-07	3.4425E-04

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.2357E-05	9.1769E-08	9.3847E-05
Accumulated dose (rem)	9.2397E-05	9.1769E-08	9.3886E-05

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4611E-04	2.8038E-06	2.9208E-04

Accumulated dose (rem) 2.4613E-04 2.8039E-06 2.9210E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 8.0000	Ci	kg	Atoms	Decay
Kr-83m	6.5737E-06	3.1862E-16	2.3118E+09	1.4350E+10
Kr-85	3.7832E-03	9.6428E-09	6.8318E+16	2.2748E+12
Kr-85m	1.6004E-04	1.9447E-14	1.3778E+11	1.5291E+11
Kr-87	4.5663E-06	1.6121E-16	1.1159E+09	2.0689E+10
Kr-88	1.4239E-04	1.1355E-14	7.7708E+10	1.8495E+11
Rb-88	8.4784E-05	7.0631E-16	4.8335E+09	7.8963E+10
Xe-131m	6.9774E-04	8.3301E-12	3.8294E+13	4.2232E+11
Xe-133	8.6427E-02	4.6173E-10	2.0907E+15	5.2743E+13
Xe-133m	1.1402E-03	2.5411E-12	1.1506E+13	7.1087E+11
Xe-135	1.5618E-03	6.1160E-13	2.7282E+12	1.1674E+12
Cs-138	5.3604E-10	1.2668E-20	5.5281E+04	4.2736E+08

Control Room Transport Group Inventory:

Time (h) = 8.0000	Atmosphere	Sump
Noble gases (atoms)	7.0462E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	7.0632E-16	0.0000E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 8.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.1988E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.6292E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	9.1021E-15

Control Room to Environment Transport Group Inventory:

Time (h) = 8.0000	Pathway Filtered	Transported
Noble gases (atoms)	9.2400E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	1.8508E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.7139E-04	1.1491E-07	5.7328E-04
Accumulated dose (rem)	9.1018E-04	4.5139E-07	9.1753E-04

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.5129E-05	3.6331E-09	3.5188E-05
Accumulated dose (rem)	1.2753E-04	9.5402E-08	1.2907E-04

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.1401E-04	1.1192E-06	4.3247E-04
Accumulated dose (rem)	6.6014E-04	3.9230E-06	7.2457E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 24.0000	Ci	kg	Atoms	Decay
Kr-83m	8.3328E-09	4.0388E-19	2.9304E+06	1.6183E+10
Kr-85	2.0547E-03	5.2371E-09	3.7104E+16	7.3741E+12
Kr-85m	7.3124E-06	8.8856E-16	6.2953E+09	2.4227E+11
Kr-87	4.0454E-10	1.4282E-20	9.8859E+04	2.1619E+10
Kr-88	1.5576E-06	1.2422E-16	8.5007E+08	2.4190E+11
Rb-88	4.1773E-06	3.4800E-17	2.3814E+08	9.6759E+10
Xe-131m	3.6456E-04	4.3523E-12	2.0008E+13	1.3464E+12
Xe-133	4.3032E-02	2.2990E-10	1.0410E+15	1.6475E+14
Xe-133m	5.0141E-04	1.1175E-12	5.0598E+12	2.1097E+12
Xe-135	2.5044E-04	9.8069E-14	4.3747E+11	2.4543E+12

Control Room Transport Group Inventory:

Time (h) = 24.0000	Atmosphere	Sump
Noble gases (atoms)	3.8170E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	3.4800E-17	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 24.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.7684E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.4124E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.0420E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 24.0000	Pathway Filtered	Transported

Noble gases (atoms)	3.0289E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.3303E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.2516E-04	4.5609E-09	6.2523E-04
Accumulated dose (rem)	1.5353E-03	4.5596E-07	1.5428E-03

Low Population Zone Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.8584E-06	3.2881E-11	6.8589E-06
Accumulated dose (rem)	1.3438E-04	9.5435E-08	1.3593E-04

Control Room Doses:

Time (h) = 45.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.7130E-04	1.9666E-08	1.7163E-04
Accumulated dose (rem)	8.3144E-04	3.9427E-06	8.9620E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 45.5000	Ci	kg	Atoms	Decay
Kr-85	1.4107E-03	3.5957E-09	2.5475E+16	1.1669E+13
Kr-85m	1.8036E-07	2.1917E-17	1.5528E+08	2.4702E+11
Kr-88	5.6273E-09	4.4878E-19	3.0711E+06	2.4258E+11
Rb-88	8.1853E-09	6.8189E-20	4.6664E+05	9.6837E+10
Xe-131m	2.3761E-04	2.8368E-12	1.3041E+13	2.0897E+12
Xe-133	2.6284E-02	1.4042E-10	6.3582E+14	2.4984E+14
Xe-133m	2.5924E-04	5.7776E-13	2.6161E+12	3.0275E+12
Xe-135	3.3378E-05	1.3070E-14	5.8305E+10	2.7210E+12

Control Room Transport Group Inventory:

Time (h) = 45.5000	Atmosphere	Sump
Noble gases (atoms)	2.6127E+16	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	6.8189E-20	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 45.5000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.7737E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 45.5000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.0655E+17

Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.0457E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 45.5000	Pathway Filtered	Transported
Noble gases (atoms)	4.8014E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.3348E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.5353E-03	4.5596E-07	1.5428E-03

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.3438E-04	9.5435E-08	1.3593E-04

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.3055E-05	2.9762E-11	2.3055E-05
Accumulated dose (rem)	8.5450E-04	3.9427E-06	9.1925E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 96.0000	Ci	kg	Atoms	Decay
Kr-85	5.1384E-10	1.3097E-15	9.2790E+09	1.2225E+13
Xe-131m	7.6593E-11	9.1442E-19	4.2036E+06	2.1827E+12
Xe-133	7.2689E-09	3.8833E-17	1.7583E+08	2.6002E+14
Xe-133m	4.8502E-11	1.0809E-19	4.8944E+05	3.1254E+12

Control Room Transport Group Inventory:

Time (h) = 96.0000	Atmosphere	Sump
Noble gases (atoms)	9.4596E+09	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.0136E-31	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 96.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.7737E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.0655E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.0457E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 96.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.0625E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.3348E-15	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.5353E-03	4.5596E-07	1.5428E-03

Low Population Zone Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	1.3438E-04	9.5435E-08	1.3593E-04

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.2171E-12	4.3736E-23	4.2171E-12
Accumulated dose (rem)	8.5450E-04	3.9427E-06	9.1925E-04

Control Room Compartment Nuclide Inventory:

Time (h) = 720.0000	Ci	kg	Atoms	Decay

Control Room Transport Group Inventory:

Time (h) = 720.0000	Atmosphere	Sump
Noble gases (atoms)	2.5674E-70	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	4.0352-177	0.0000E+00
Dose Effective (Ci/cc)	I-131 (Thyroid)	0.0000E+00
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	0.0000E+00
Total I (Ci)		0.0000E+00

Time (h) = 720.0000	Deposition Surfaces	Recirculating Filter
Noble gases (atoms)	0.0000E+00	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	2.7737E-14

Environment to Control Room Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	5.0655E+17
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	0.0000E+00	1.0457E-14

Control Room to Environment Transport Group Inventory:

Time (h) = 720.0000	Pathway Filtered	Transported
Noble gases (atoms)	5.0625E+17	0.0000E+00
Elemental I (atoms)	0.0000E+00	0.0000E+00
Organic I (atoms)	0.0000E+00	0.0000E+00
Aerosols (kg)	2.3348E-15	0.0000E+00

840

##
I-131 Summary
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Time (hr)	Fuel I-131 (Curies)	RCS I-131 (Curies)	Environment I-131 (Curies)
0.000	0.0000E+00	0.0000E+00	0.0000E+00
0.004	0.0000E+00	0.0000E+00	0.0000E+00
0.083	0.0000E+00	0.0000E+00	0.0000E+00
0.400	0.0000E+00	0.0000E+00	0.0000E+00
0.700	0.0000E+00	0.0000E+00	0.0000E+00
1.000	0.0000E+00	0.0000E+00	0.0000E+00
1.300	0.0000E+00	0.0000E+00	0.0000E+00
1.600	0.0000E+00	0.0000E+00	0.0000E+00
1.900	0.0000E+00	0.0000E+00	0.0000E+00
2.200	0.0000E+00	0.0000E+00	0.0000E+00
2.500	0.0000E+00	0.0000E+00	0.0000E+00
2.800	0.0000E+00	0.0000E+00	0.0000E+00
3.100	0.0000E+00	0.0000E+00	0.0000E+00
3.400	0.0000E+00	0.0000E+00	0.0000E+00
3.700	0.0000E+00	0.0000E+00	0.0000E+00
4.000	0.0000E+00	0.0000E+00	0.0000E+00
4.300	0.0000E+00	0.0000E+00	0.0000E+00
4.600	0.0000E+00	0.0000E+00	0.0000E+00
4.900	0.0000E+00	0.0000E+00	0.0000E+00
5.200	0.0000E+00	0.0000E+00	0.0000E+00
5.500	0.0000E+00	0.0000E+00	0.0000E+00
5.800	0.0000E+00	0.0000E+00	0.0000E+00
6.100	0.0000E+00	0.0000E+00	0.0000E+00
6.400	0.0000E+00	0.0000E+00	0.0000E+00
6.700	0.0000E+00	0.0000E+00	0.0000E+00
7.000	0.0000E+00	0.0000E+00	0.0000E+00
7.300	0.0000E+00	0.0000E+00	0.0000E+00
7.600	0.0000E+00	0.0000E+00	0.0000E+00
7.900	0.0000E+00	0.0000E+00	0.0000E+00
8.000	0.0000E+00	0.0000E+00	0.0000E+00
8.300	0.0000E+00	0.0000E+00	0.0000E+00
8.600	0.0000E+00	0.0000E+00	0.0000E+00

8.900	0.0000E+00	0.0000E+00	0.0000E+00
9.200	0.0000E+00	0.0000E+00	0.0000E+00
9.500	0.0000E+00	0.0000E+00	0.0000E+00
9.800	0.0000E+00	0.0000E+00	0.0000E+00
10.100	0.0000E+00	0.0000E+00	0.0000E+00
10.400	0.0000E+00	0.0000E+00	0.0000E+00
24.000	0.0000E+00	0.0000E+00	0.0000E+00
45.500	0.0000E+00	0.0000E+00	0.0000E+00
96.000	0.0000E+00	0.0000E+00	0.0000E+00
720.000	0.0000E+00	0.0000E+00	0.0000E+00

Time (hr)	Control Room I-131 (Curies)
0.000	0.0000E+00
0.004	0.0000E+00
0.083	0.0000E+00
0.400	0.0000E+00
0.700	0.0000E+00
1.000	0.0000E+00
1.300	0.0000E+00
1.600	0.0000E+00
1.900	0.0000E+00
2.200	0.0000E+00
2.500	0.0000E+00
2.800	0.0000E+00
3.100	0.0000E+00
3.400	0.0000E+00
3.700	0.0000E+00
4.000	0.0000E+00
4.300	0.0000E+00
4.600	0.0000E+00
4.900	0.0000E+00
5.200	0.0000E+00
5.500	0.0000E+00
5.800	0.0000E+00
6.100	0.0000E+00
6.400	0.0000E+00
6.700	0.0000E+00
7.000	0.0000E+00
7.300	0.0000E+00
7.600	0.0000E+00
7.900	0.0000E+00
8.000	0.0000E+00
8.300	0.0000E+00
8.600	0.0000E+00
8.900	0.0000E+00
9.200	0.0000E+00
9.500	0.0000E+00
9.800	0.0000E+00
10.100	0.0000E+00
10.400	0.0000E+00
24.000	0.0000E+00
45.500	0.0000E+00
96.000	0.0000E+00
720.000	0.0000E+00

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Cumulative Dose Summary

Time (hr)	Exclusion Area Bounda Thyroid (rem)	Exclusion Area Bounda TEDE (rem)	Low Population Zone Thyroid (rem)	Low Population Zone TEDE (rem)	Control Room Thyroid (rem)	Control Room TEDE (rem)
0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.004	2.5349E-16	9.5161E-11	6.9133E-17	2.5953E-11	3.1823E-17	4.0232E-13
0.083	1.8417E-12	1.4438E-07	5.0229E-13	3.9376E-08	6.4542E-12	1.7986E-08
0.400	2.4621E-09	3.3148E-06	6.7150E-10	9.0404E-07	5.6444E-09	4.2672E-07
0.700	1.0486E-08	9.6399E-06	2.8599E-09	2.6291E-06	2.8823E-08	1.7005E-06
1.000	2.3359E-08	1.8479E-05	6.3707E-09	5.0398E-06	7.5809E-08	4.2385E-06
1.300	3.9485E-08	2.9213E-05	1.0769E-08	7.9671E-06	1.4652E-07	8.2155E-06
1.600	5.7497E-08	4.1346E-05	1.5681E-08	1.1276E-05	2.3846E-07	1.3683E-05
1.900	7.6420E-08	5.4498E-05	2.0842E-08	1.4863E-05	3.4862E-07	2.0624E-05
2.200	9.5601E-08	6.8378E-05	2.6073E-08	1.8649E-05	4.7139E-07	2.8858E-05
2.500	1.1461E-07	8.2763E-05	3.1258E-08	2.2572E-05	5.9880E-07	3.7976E-05
2.800	1.3318E-07	9.7482E-05	3.6321E-08	2.6586E-05	7.3120E-07	4.7938E-05
3.100	1.5112E-07	1.1240E-04	4.1214E-08	3.0656E-05	8.6741E-07	5.8686E-05
3.400	1.6833E-07	1.2743E-04	4.5907E-08	3.4753E-05	1.0060E-06	7.0149E-05
3.700	1.8473E-07	1.4248E-04	5.0382E-08	3.8858E-05	1.1456E-06	8.2254E-05
4.000	2.0031E-07	1.5749E-04	5.4630E-08	4.2953E-05	1.2849E-06	9.4931E-05
4.300	2.1504E-07	1.7243E-04	5.8648E-08	4.7028E-05	1.4229E-06	1.0811E-04
4.600	2.2894E-07	1.8727E-04	6.2438E-08	5.1072E-05	1.5588E-06	1.2173E-04
4.900	2.4201E-07	2.0196E-04	6.6003E-08	5.5081E-05	1.6917E-06	1.3573E-04
5.200	2.5429E-07	2.1651E-04	6.9350E-08	5.9049E-05	1.8210E-06	1.5005E-04
5.500	2.6579E-07	2.3090E-04	7.2488E-08	6.2972E-05	1.9462E-06	1.6465E-04
5.800	2.7656E-07	2.4512E-04	7.5426E-08	6.6851E-05	2.0670E-06	1.7948E-04
6.100	2.8663E-07	2.5917E-04	7.8172E-08	7.0682E-05	2.1832E-06	1.9450E-04
6.400	2.9604E-07	2.7305E-04	8.0738E-08	7.4467E-05	2.2944E-06	2.0967E-04
6.700	3.0482E-07	2.8675E-04	8.3133E-08	7.8205E-05	2.4007E-06	2.2497E-04
7.000	3.1301E-07	3.0029E-04	8.5366E-08	8.1897E-05	2.5020E-06	2.4037E-04
7.300	3.2064E-07	3.1366E-04	8.7448E-08	8.5544E-05	2.5983E-06	2.5584E-04
7.600	3.2776E-07	3.2687E-04	8.9388E-08	8.9147E-05	2.6896E-06	2.7136E-04
7.900	3.3438E-07	3.3993E-04	9.1195E-08	9.2708E-05	2.7761E-06	2.8691E-04
8.000	3.3649E-07	3.4425E-04	9.1769E-08	9.3886E-05	2.8039E-06	2.9210E-04
8.300	3.4250E-07	3.5709E-04	9.1959E-08	9.4673E-05	2.8800E-06	3.0720E-04
8.600	3.4810E-07	3.6978E-04	9.2136E-08	9.5450E-05	2.9469E-06	3.2148E-04
8.900	3.5329E-07	3.8231E-04	9.2301E-08	9.6218E-05	3.0066E-06	3.3503E-04
9.200	3.5812E-07	3.9470E-04	9.2453E-08	9.6977E-05	3.0603E-06	3.4793E-04
9.500	3.6261E-07	4.0695E-04	9.2595E-08	9.7728E-05	3.1087E-06	3.6024E-04
9.800	3.6678E-07	4.1907E-04	9.2727E-08	9.8471E-05	3.1523E-06	3.7202E-04
10.100	3.7066E-07	4.3106E-04	9.2850E-08	9.9206E-05	3.1917E-06	3.8331E-04
10.400	3.7426E-07	4.4294E-04	9.2964E-08	9.9935E-05	3.2274E-06	3.9416E-04
24.000	4.5139E-07	9.1753E-04	9.5402E-08	1.2907E-04	3.9230E-06	7.2457E-04
45.500	4.5596E-07	1.5428E-03	9.5435E-08	1.3593E-04	3.9427E-06	8.9620E-04
96.000	4.5596E-07	1.5428E-03	9.5435E-08	1.3593E-04	3.9427E-06	9.1925E-04
720.000	4.5596E-07	1.5428E-03	9.5435E-08	1.3593E-04	3.9427E-06	9.1925E-04

Worst Two-Hour Doses

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
2.6	9.7823E-05	1.0814E-07	9.9596E-05