

NLS2009044
Enclosure 3

**NEDC 07-082, Rev. 2, "Radiological Dose Analysis for a Loss of Coolant Accident (LOCA)
at Cooper Nuclear Station," (Non-Proprietary Version)**

Title: <u>Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station</u>	Calculation Number: <u>NEDC 07-082</u>
System/Structure: <u>MS, MSIVs, PC, SC, ECCS, SLC, Alternate Leakage Treatment, CREFS</u>	CED/EE Number: <u>EE 06-025</u>
Component: <u>N/A</u>	Setpoint Change/Part Eval Number: <u>N/A</u>
Classification: <input checked="" type="checkbox"/> Essential; <input type="checkbox"/> Non-Essential	Discipline: <u>DED Mechanical</u>
Proprietary Information Included? <input checked="" type="checkbox"/> Yes; <input type="checkbox"/> No	SQAP Requirements Met? <input type="checkbox"/> Yes; <input checked="" type="checkbox"/> N/A

Description:

This calculation determines the radiological dose consequences for a postulated design basis Loss of Coolant Accident (LOCA) at Cooper Nuclear Station using an Alternative Source Term (AST).

This calculation determines the dose to a Control Room occupant and to a person at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) at the Cooper Nuclear Station site following a design basis Loss of Coolant Accident (LOCA). The analysis is performed using an Alternative Source Term (AST) in accordance with the guidance provided by the NRC in Regulatory Guide 1.183 (July 2000) and as authorized by 10CFR50.67. This calculation has been prepared as a Status 3 calculation for NRC review and will be taken to Status 1 after NRC approval of the LOCA AST methodology.

This calculation incorporates by attachment Alion Science & Technology Calculation No. ALION-CAL-NPPD-3236-002, Rev. 1, in accordance with CNS Engineering Procedure 3.4.7. The calculation also presents results from additional shine sources for Control Room occupants.

Conclusions and Recommendations:

The results are tabulated in Section 5 of this calculation for each of the three (3) receptor locations:

1. Control Room
2. Low Population Zone (LPZ)
3. Exclusion Area Boundary (EAB)

All calculated doses were found to be below the stipulated limits. It is therefore concluded that the regulatory dose limits will not be exceeded following a postulated design basis LOCA at Cooper Nuclear Station.

ATTACHMENTS:

1. Alion calculation ALION-CAL-NPPD-3236-002, Rev. 1 (including attachments thereto).

2	3	Alion Science & Technology 8/19/08	<i>M. J. Bennett 10/1/08</i> <i>Drasler 10/1/08</i> M. J. Bennett/Jim Drasler	N/A	<i>10-1-08</i> <i>Stan Domikaitis</i> Stan Domikaitis
1	3	Alion Science & Technology 8/19/08	M. J. Bennett/Cory Kelsey 9/14/08	N/A	Stan Domikaitis 9/16/08
0	3	Alion Science & Technology 7/12/07	Jim Drasler/ Billy W. Reid 7/25/07	N/A	Stan Domikaitis 9/19/07
Rev. Number	Status	Prepared By/Date	Reviewed By/Date	IDVed By/Date	Approved By/Date

Status Codes

- | | | |
|---------------------|--------------------------------------|------------|
| 1. Active | 4. Superseded or Deleted | 7. PRA/PSA |
| 2. Information Only | 5. OD/OE Support Only | |
| 3. Pending | 6. Maintenance Activity Support Only | |

Revision Summary

- Revision 0 - Initial issue.
- Revision 1 - Revision 1 revised the MSIV pathway leakage from 100 scfh/MS line & 200 scfh total MS pathway leakage to 150 scfh/MS line & 300 scfh total MS pathway leakage. In Sections 2.4.1 and 2.4.2, new Main Steam Line decontamination factors were calculated for particulate and elemental deposition, based on the increased MSIV leakage flowrates; however, credit for decontamination via these mechanisms was removed. Section 2.4.2 was revised to remove the development of the condenser elemental iodine removal. New Appendix A, "Condenser Effective Filter Efficiency Calculation," was developed to calculate condenser effective filter efficiency for iodine removal. The results of Appendix A have been included as input parameters for Drywell-MSIV Leakage Pathway as calculated in Appendices D and E based on the BWROG model documented in NEDC 35858P-A, Design Input 15. Only calculations for leakage through the MSIVs have been affected. The other two pathways, leakage from the drywell through the reactor building and release from the suppression pool through ESF components have remained unaffected. All input changes to this calculation are conservative.
- Revision 2 - Revision 2 clarifies that the limiting single failure assumed in the AST LOCA dose calculation is the failure of a filter heater in one of the two Standby Gas Treatment System trains. The Alion calculation uses language implying consideration of an MSIV failure; no such failure was assumed or required to be assumed in the calculation. Revision 2 also clarifies that the MS Pathway also includes leakage through the inboard MS drain line (through penetration X-8); therefore, the total leakage (300 scfh at P_a) includes leakage through this flow path.

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DESIGN CALCULATION CROSS-REFERENCE INDEX

ITEM NO.	DESIGN INPUTS	REV. NO.	PENDING CHANGES TO DESIGN INPUTS
1	NOT USED		
2	Cooper Nuclear Station USAR, Chapter VI, XIV	loep. xxii5	UCR 2007-015, UCR 2007-016
3	JELCO Drawing 2841-2	N04	
4	B&R Drawing #2052	N31	DCN 06-0624
5	B&R Drawing 2019, Sh. 1	N41	DCN 05-1819
6	Drawing EC93877GA, Sh. 1	N02	DCN 06-0364
7	NEDC 94-034C	3	C/N 3C1 (EE 03-118)
8	Proc. 2.2.73	47	
9	NEDC 07-071	0	
10	Proc. 6.MISC.501	6	
11	Proc. 6.SC.201	25	
12	B&R Drawing #2001 SH 2	N07	
13	NEDC 07-056	0	
14	NEDC 05-045	1	
15	GE Topical Report NEDC-31858P-A	2	
16	NRC Reg Guide 1.183	0	
17	Drawing EC93877E3	B	
18	Drawing EC93877GA, Sh. 2	M	DCN 06-0365
19	Drawing EC93877E2-A	A	
20	Drawing M-81762	7	
21	Drawing DC93877EP	N01	
22	Drawing CC93877EP-A-13	N01	
23	Drawing CC93877EP-A-12	N01	
24	Drawing CC93877EP-A-11	N01	
25	Drawing CC93877EP-A-10	N01	
26	Drawing CC93877EP-A-9	N02	
27	Drawing DC93877SC-H	N02	
28	Drawing EC93877SC-1A	N01	DCN 06-0362
29	Drawing CNS-MS-43	N04	DCN 07-1606

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DESIGN CALCULATION CROSS-REFERENCE INDEX

ITEM NO.	AFFECTED DOCUMENTS*	REV. NUMBER
1	Inservice Testing Program	6
2	Appendix J (PCLRT)	9
3	CNS Procedure 6.MISC.501	6
4	USAR (and ESAR) Section XIV-6.3	loep.xxii5
5	USAR (and ESAR) Section III-9.2	loep.xxii5
6	CNS Technical Specifications, Section 3.1.7 & Bases	Amend. 178
7	CNS Technical Specifications, Section 3.6.1.3.10 & Bases	Amend. 220
8	DCD 10	04/18/08
9	DCD 19	10/26/04
10	DCD 31	04/18/08
11	DCD 39	11/08/06
12	ATLAS Database	N/A
13	NEDC 99-033	5
14	EQ Program	N/A
15	CNS Procedure 6.SC.201	25
	<p>*Actual document changes will be via the implementation process per EE 06-025 and NRC review of AST methodology. Both of these processes could generate additional document changes or remove those listed here. Since the EE is the governing implementing document, it has the final authority. Therefore, any changes made by the implementing EE are not to be reflected by a revision to this calculation solely for that purpose.</p>	

The purpose of this form is to assist the Preparer in screening new and revised design calculations to determine potential impacts to procedures and plant operations.^①

<u>SCREENING QUESTIONS</u>		<u>YES</u>	<u>NO</u>	<u>UNCERTAIN</u>
1.	Does it involve the addition, deletion, or manipulation of a component or components which could impact a system lineup and/or checklist for valves, power supplies (breakers), process control switches, HVAC dampers, or instruments?	[]	[X]	[]
2.	Could it impact system operating parameters (e.g., temperatures, flow rates, pressures, voltage, or fluid chemistry)?	[]	[X]	[]
3.	Does it impact equipment operation or response such as valve closure time?	[X]	[]	[]
4.	Does it involve assumptions or necessitate changes to the sequencing of operational steps?	[]	[X]	[]
5.	Does it transfer an electrical load to a different circuit, or impact when electrical loads are added to or removed from the system during an event?	[]	[X]	[]
6.	Does it influence fuse, breaker, or relay coordination?	[]	[X]	[]
7.	Does it have the potential to affect the analyzed conditions of the environment for any part of the Reactor Building, Containment, or Control Room?	[X]	[]	[]
8.	Does it affect TS/TS Bases, USAR, or other Licensing Basis documents?	[X]	[]	[]
9.	Does it affect DCDs?	[X]	[]	[]
10.	Does it have the potential to affect procedures in any way not already mentioned (refer to review checklists in Procedure EDP-06)? If so, identify: <u>Affected Documents identified on Page 3.</u>	[X]	[]	[]

If all answers are NO, then additional review or assistance is not required.

If any answers are YES or UNCERTAIN, then the Preparer shall obtain assistance from the System Engineer and other departments, as appropriate, to determine impacts to procedures and plant operations. Affected documents shall be listed on Attachment 2.

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DESIGN CALCULATIONS SHEET

PURPOSE:

This calculation incorporates by attachment Alion Science & Technology Calculation No. ALION-CAL-NPPD-3236-002, Rev. 1, in accordance with CNS Engineering Procedure 3.4.7. This calculation determines the dose to a Control Room occupant and to a person at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) at the Cooper Nuclear Station site following a design basis Loss of Coolant Accident (LOCA). The analysis is performed using an Alternative Source Term (AST) in accordance with the guidance provided by the NRC in Regulatory Guide 1.183 (July 2000) and as authorized by 10CFR50.67. This calculation has been prepared as a Status 3 calculation for NRC review and will be taken to Status 1 after approval of the LOCA AST methodology by the NRC. This calculation also presents the results from additional shine sources to the Control Room occupants.

Revision 1 increases MSIV leakage from 100scfh/MS line and 200 scfh MS pathway total, to 150 scfh/MS line and 300 scfh MS pathway total to the condenser. In Sections 2.4.1 and 2.4.2, new Main Steam Line decontamination factors were calculated for particulate and elemental deposition, based on the increased MSIV leakage flowrates; however, credit for decontamination via these mechanisms was removed. Section 2.4.2 was revised to remove the development of the condenser elemental iodine removal. New Appendix A, "Condenser Effective Filter Efficiency Calculation," was developed to calculate condenser effective filter efficiency for iodine removal. The results of Appendix A have been included as input parameters for Drywell-MSIV Leakage Pathway as calculated in Appendices D and E based on the BWROG model documented in NEDC 35858P-A, Design Input 15. As expected, the dose results presented in Tables 6-1 and 6-2 show an increase in dose from increasing the allowed leakage past the MSIVs. However, the resultant doses remain significantly below the acceptance criteria. The change in calculated doses are shown below. An additional review summary has been added for review and acceptance Appendix A of Revision 1 as this is added to the calculation by Revision 1.

EXTENT OF REVIEW

Alion's calculation was performed under their own QA program, which included an independent technical review. Therefore, the NPPD review does not include in-depth checks of mathematical calculations, but rather focuses on general acceptability of design inputs, assumptions, methodology, and conclusions. Any significant comments or concerns identified during the review have been resolved with Alion and incorporated.

REVIEW SUMMARY

Alion's calculation is organized into a single main portion along with Attachments A through K, which include the computer files as well as Alion's Design Review Checklist.

1. Purpose - The purpose of the calculation is as given above and as stated in Section 1 of Alion's calculation.
2. Design Inputs - Design Inputs are contained in the Cross Reference Index given on page 6 of 292 of Alion's calculation and are discussed in Sections 2 and 3 of Alion's calculation. The design inputs were reviewed and found to be acceptable, with minor clarifications shown in the Cross Reference Index on Page 2 of 8.
3. Assumptions - Major assumptions are identified in Section 4 of Alion's calculation. Additional assumptions are inferred in the input documents used and identified throughout Alion's calculation by inference according to context and use. The assumptions were reviewed and found to be acceptable.

Throughout ALION-CAL-NPPD-3236-002, the calculation refers to a "faulted" or "failed" MSIV (e.g., pages 21, 40, D3, D10, D14, H4, H14, H22 and K7). This language is potentially misleading; as the limiting single failure assumed in the analysis is the failure of a filter heater in one of the Standby Gas Treatment System trains. This is discussed in Section 2.3.2 of the calculation, and identified in Table 5-5, "Input Parameters for Drywell-Reactor Building Leakage Pathway." As discussed in NRC RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Section 5.1.2, "Credit for Engineered Safeguards Features," the single active failure that results in the most limiting radiological consequences should be assumed. Therefore there is no requirement to assume an additional engineered safeguard failure, nor any impact to the dose consequences to assume the failure of an MSIV. In reality, the AST LOCA dose analysis assumed that a large portion (50%) of the MS Pathway leakage traveled down one MS line, and 50% traveled down a second MS line to calculate conservative deposition efficiencies for the MS lines. However, in Revision 1 of this calculation, credit for deposition in the MS lines was removed.

ALION-CAL-NPPD-3236-002, Section 2.4.3 states that the two possible flowpaths from the MSIV leakage to the condenser: through the MS lines via the Alternate Leakage Treatment (ALT) pathway, or through the MS drain lines originating just downstream of the MSIVs. This is accurate; however, the total MS Pathway leakage includes the leakage from the MSIVs and the leakage from the inboard MS drain line, through Containment isolation valves MS-MOV-MO74 and MS-MOV-MO77 via Containment penetration X-8. Therefore, the total (aggregate) leakage will apply, as a limit, to the sum total of the leakage from all four MSIVs plus the leakage from Containment penetration X-8. This is acceptable, and does not alter either the model or the dose consequences reported in

ALION-CAL-NPPD-3236-002, because no credit is taken for deposition in the MS lines, and no time is assumed in the RADTRAD model for transport of MSIV leakage from the Drywell to the Condenser, and therefore no credit is taken for any radionuclide decay in the transport of the MSIV leakage between these two compartments.

4. Methodology - The methodology is described in Section 5 of Alion's calculation. The methodology was reviewed and found to be acceptable, with the following clarification. Dose consequences computed by RADTRAD include air immersion (shine) and inhalation (DI / Ref. 2). As stated in the PURPOSE, control room occupants could also receive immersion (shine) doses from other sources. These doses have been determined in calculation NEDC 05-045 (DI / Ref. 46). The results are given in the next section.

5. Conclusions and Recommendations - Results and conclusions are given in Section 6 of Alion's calculation. The results and conclusions were reviewed and found to be acceptable, with the following clarification. As stated in the PURPOSE, control room occupants could also receive immersion (shine) doses from other sources. These doses have been determined in calculation NEDC 05-045 (DI / Ref. 46). The results are given in the following tables, which replace those in Attachment 1. The revision 1 doses including the increase in MSIV leakage from 100/200 scfh to 150/300 scfh and the condenser effective filter efficiency are included under column for Rev 1.

TEDE Dose as a Function of Release Path

Dose Location	Leakage (rem TEDE)		MSIV w/Bypass (rem TEDE)		ESF (rem TEDE)		Additional Shine (rem TEDE)	
	Rev 0	Rev 1	Rev 0	Rev 1	Rev 0	Rev 1	Rev 0	Rev 1
Control Room	0.374	NC*	0.562	2.401	0.102	NC	0.153	0.319
EAB	0.458	NC	0.136	0.374	0.170	NC	N/A	N/A
LPZ	1.559	NC	0.489	2.311	1.727	NC	N/A	N/A

* NC – No change from previous Revision 0.

Total LOCA TEDE Dose

Dose Location	Total Dose (rem TEDE)		Accident Dose Criteria (rem TEDE)
	Rev 0	Rev 1	
Control Room	1.191	3.196	5
EAB	0.763	1.002	25
LPZ	3.775	5.596	25

6. References - References are listed in Section 8 of Alion's calculation. The references were reviewed and found to be acceptable, with minor clarifications shown on the Cross Reference Index on Page 2 of 8.

REVIEW SUMMARY FOR APPENDIX A- Condenser Effective Filter Efficiency Calculation

ALION's Appendix A Revision 1 of NEDC 07-082 is a stand alone calculation that requires inputs to the Design Input Sheet and is reviewed and accepted per Procedure 3.4.7 below: The PURPOSE and EXTENT OF REVIEW remain the same as provided above.

Purpose- The purpose this calculation is stated in Section 1 of Appendix A and is to determine the main condenser free volume above the highest penetration transporting MSIV leakage, and the main condenser's effective filter efficiency (radionuclide removal efficiency) to be credited in the main body of this calculation (NEDC 07-082 Rev. 1).

Design Inputs-Design Inputs specific to the Appendix A calculation have been added to the Design Inputs in the Cross Reference Index on Page 2 of 8. The design inputs required for Appendix A were reviewed and found to be acceptable with minor clarifications shown in the Cross Reference Index.

Assumptions- Major assumptions are identified in Section A3 of Appendix A. As some drawings did not include all required dimensioning for satisfying this calculation, some drawings were printed to scale and component measured. An additional 5 % margin was removed from the volume of the condenser as a conservative measure and was found to be conservative and thus acceptable.

Methodology- The methodology is described in Section A4 of the Appendix A. The methodology was reviewed and found to be acceptable, based on proven documentation and accepted industry references.

The analysis implements the methodology and determines the inputs for the computer calculation. Computations for determining the condenser effective filter efficiency is based on a NRC approved BWROG model documented in NEDC-31858P-A, Design Input 15. This methodology is found to be acceptable for application at CNS.

Conclusions and Recommendations- This is included in Section A6 of Appendix A. The condenser free volume was conservatively determined and the main condenser effective filter efficiencies were determined for three separate MSIV leak conditions. These are found to be acceptable and the appropriate values have been added to the body of this calculation, Table 5.4.2, and input to the RADTRAD model.

References-References are listed in Section A7 of Appendix A. In this appendix, design inputs were mixed in with the references; these design inputs have been added to the Design Inputs on Page 2 of 8. This has been reviewed and found to be acceptable.

ATTACHMENTS

1. Alion calculation ALION-CAL-NPPD-3236-002, Rev. 1 (including attachments thereto). Attachment A is new to this revision and has been found to be acceptable as stated above.



DESIGN CALCULATION AND ANALYSIS COVER PAGE

Calculation No: ALION-CAL-NPPD-3236-002	Revision: 1	Page 1 of 51
Calculation Title: Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station		
Project No: NPPD-3236		
Project Name: AST Methodology Implementation at CNS		
Client: Nebraska Public Power District (NPPD)		
<p>Document Purpose/Summary: The purpose of this calculation is to determine the dose to the control room occupant and to a person at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) at the Cooper Nuclear Station site following a design basis Loss of Coolant Accident (LOCA). The analysis is performed using an Alternative Source Term (AST) in accordance with the guidance provided by the NRC in Regulatory Guide 1.183 (July 2000) and as allowed by 10 CFR 50.67. All calculated doses are shown to be below the regulatory limits for all three stipulated locations.</p> <p>Per NPPD General Services Agreement No. 05A-MS3, Task Authorization 4700000649, Revision 0, July 15, 2005, the format of this calculation meets the requirements of Nebraska Public Power District procedure NPPD CNS Operations Manual Engineering Procedure 3.4.7 "Design Calculations". Although the calculation format of the NPPD procedure differs slightly from ALION procedure QAP 3.4, Design Calculation and Analysis, revision 9, the formats are similar enough to ensure that the technical and programmatic content of the calculation is neither jeopardized nor compromised and meets the intent of the ALION and NPPD Quality Assurance programs</p> <p>This calculation is safety related and complies with the Alion Science and Technology QA Program.</p>		
All software used in the preparation of this calculation meets QAP 3.5, <i>Use of Computer Software and Error Reporting</i> requirements.		
Preparer Signature: _____		Date: _____

DESIGN VERIFICATION METHOD	QA APPLICABILITY LEVEL
<input checked="" type="checkbox"/> Design Review <input type="checkbox"/> Alternative Calculation <input type="checkbox"/> Qualification Testing	<input checked="" type="checkbox"/> Nuclear Safety Related <input type="checkbox"/> Quality Significant <input type="checkbox"/> Nuclear Non-Safety Related
Professional Engineer Approval (if required) _____ Date _____	
Signature _____	

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REVISION HISTORY LOG

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Document Number: ALION-CAL-NPPD-3236-002 Revision: 1

Document Title: Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

Instructions:

Project Manager to provide a brief description of each document revision, including rationale for the change and, if applicable, identification of source documents used for the change.

REVISION	DATE	Description
0	13 July 2007	Original Issue
1	7 August 2008	Modify MSIV leak path decontamination

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DESIGN CALCULATION CROSS-REFERENCE INDEX

Item Number	Design Inputs	Revision Number, Section, or Date	Pending Changes to Design Inputs
1	Regulatory Guide 1.183	Jul-00	N/A
2	NUREG/CR-6604	Apr-98	N/A
3	Cooper Nuclear Station USAR, Chapter VI, XIV	July, 2008	N/A
4	Cooper Nuclear Station Technical Specifications	Sections 1.1, 3.3.4, 3.6.1.3, 3.6.1.5, 3.7.4, 5.5.12, 5.5.7, B.3.6.1.5, SR 3.5.1.6	N/A
5	GE-NEDC-32868P	Proprietary Document	N/A
6	USAEC TID 14844	1962	N/A
7	USNRC NUREG 1465	Feb-95	N/A
8	GE-MIG-1H69L-062	Feb-00	N/A
9	GE Drawing #731E611	Sheet 1 Rev. N04 Sheets 5-8 Rev. NO1	N/A
10	JELCO Drawing #2841-2	Rev. N04	N/A
11	Control Room Envelope Inleakage Testing at Cooper Nuclear Station (NCS Corp.)	2004	N/A
12	CNS Burns & Roe Drawing #2051	Rev. N23	N/A
13	CNS Burns & Roe Drawing #2052	Rev. N31	N/A
14	CNS Burns & Roe Drawing #2019	Rev. N40	N/A
15	USNRC AEB 98-03	Dec-98	N/A
16	CNS Calc. NEDC-99-031	Rev. 5	N/A
17	NUREG CR-6331 ARCON 96	Rev. 1	N/A
18	CNS Calc. NEDC-99-036	Rev 3	N/A



Item Number	Design Inputs	Revision Number, Section, or Date	Pending Changes to Design Inputs
19	FGR 11 EPA-520/1-88-020	1988	N/A
20	FGR 12 EPA-402/R-93-081	1993	N/A
21	NUREG/CR-6189	1996	N/A
22	STP 94-199 (TS 3.6.1.5)	2000	N/A
23	CNS Licensing Amendment #206	2004	N/A
24	EC93877GA (Condenser dwg), Sh. 1	Rev 2	N/A
25	Heinsohn, Industrial Ventilation	1991	N/A
26	CNS Calc. NEDC 94-034C	3	N/A
27	NPPD Letter LQA8000581	1980	N/A
28	CNS Operating Proc. 2.2.73	47	N/A
29	Cline MSIV Leakage	1991	N/A
30	CNS Calc. NEDC 07-071	Rev 0	N/A
31	CNS Surv. Proc. 6.MISC.501	Rev 6	N/A
32	CNS Calc. NEDC 05-031	3	N/A
33	License Amendment 220	2006	N/A
34	Bird, Transport Phenomena	1960	N/A
35	CNS Surv. Proc. 6.SC.201	Rev 25	N/A
36	CNS EE 06-008	0	N/A
37	CNS Burns & Roe Dwg #2001, Sh 2	Rev. N07	N/A
38	CNS Contract No. E-68-4	0	N/A
39	CNS Contract No. E-66-31	0	N/A
40	Regulatory Guide 1.52	Rev 3	N/A
41	CNS Calc. NEDC 07-056	Rev 0	N/A
42	License Amendment 196	2003	N/A
43	License Amendment 187	2001	N/A
44	CNS Design Change, DC 94-102	2004	N/A
45	CNS Calc. NEDC 05-045	Rev 1	N/A
46	GE Design Spec 22A1472AB	1977	N/A
47	GE NEDC-31858P-A	1999	N/A
48	License Amendment 231	2008	N/A
A7.8	Drawing EC93877E3	B	N/A
A7.9	Drawing EC93877GA	M	DCN 06-0365
A7.10	Drawing EC93877E2-A	A	N/A
A7.11	Drawing M-81762	7	N/A
A7.12	Drawing DC93877EP	N01	N/A


Item Number	Design Inputs	Revision Number, Section, or Date	Pending Changes to Design Inputs
A7.13	Drawing CC93877EP-A-13	N01	N/A
A7.14	Drawing CC93877EP-A-12	N01	N/A
A7.15	Drawing CC93877EP-A-11	N01	N/A
A7.16	Drawing CC93877EP-A-10	N01	N/A
A7.17	Drawing CC93877EP-A-9	N02	N/A
A7.18	Drawing DC93877SC-H	N02	N/A
A7.19	Drawing EC93877SC-1A	N01	DCN 06-0362
A7.20	Drawing CNS-MS-43	N04	DCN 07-1606

DEFINITIONS AND ACRONYMS

Acronym	Definition
AST	Alternative Source Term
CEDE	Committed Effective Dose Equivalent (Effective Inhalation)
CREFS	Control Room Emergency Filtration System
DBA	Design Basis Accident
DCF	Dose Conversion Factor
DDE	Deep Dose Equivalent (Cloudshine)
DF	Decontamination Factor
EAB	Exclusion Area Boundary
ESF	Engineered Safety Features
HEPA	High Efficiency Particulate Aerosol
HVAC	Heating, Ventilation, and Air Conditioning
LOCA	Loss Of Coolant Accident
LPZ	Low Population Zone
LWL	Low Water Level
OLTP	Original Licensed Thermal Power
ORIGEN	Isotope Generation and Depletion Code
MSIV	Main Steam Isolation Valve
REM	Roentgen Equivalent Man
RP	Regulatory Position (Regulatory Guide 1.183)
RADTRAD	A Simplified Model for RA Dionuclide Transport and Re moval And D ose Estimation
SGTS	Standby Gas Treatment System
SSE	Safe Shutdown Earthquake
TEDE	Total Effective Dose Equivalent (CEDE+DDE)
TS	Technical Specification
USAR	Updated Safety Analysis Report
V&V	Verification and Validation
Variable	Definition and Units of Measure
A	Radionuclide Activity (Ci/MWt)
A _F	Flow Area (ft ²)
A _S	Upward facing surface area of pipe
D _F	Decontamination Factor, [Concentration _{Intake} / Concentration _{Exit}]
g _c	Gravitational constant (981 cm/sec ²)
Q	Flow (ft ³ /min.)
P	Pressure (psi)
T	Temperature (K)
U	Velocity (ft/s)
V	Volume (ft ³)
W	Mass Flow (lb/s)
η	Deposition Efficiency, [1.0-Concentration _{Exit} / Concentration _{Intake}]
X/Q	Atmospheric Dispersion Factor (sec/m ³)
ρ	Particle (gm/cc)
v	Specific Volume (ft ³ /lb)

1 PURPOSE

The purpose of this calculation is to determine the dose to the control room occupant and to a person at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ) at the Cooper Nuclear Station (CNS) site following a design basis Loss of Coolant Accident (LOCA). The analysis is performed using an Alternative Source Term (AST) in accordance with the guidance provided by the NRC in Regulatory Guide 1.183 (July 2000) [Ref. 1] and as allowed by 10 CFR 50.67. The RADTRAD Version 3.03 [2] computer code (currently used by the USNRC in performing radiological consequences assessments) is used to estimate the dose values at the above mentioned locations. This calculation does not include the dose to the control room occupant due to shine from the reactor building, the passing cloud, the core spray line, or the CREFS filter. These dose additions are reported elsewhere [45].

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2 DESIGN INPUT & DEVELOPEMENT

2.1 Postulated Accident

The design basis LOCA event begins with a break of the recirculation line on the suction side of the reactor. This results in shutdown of the reactor, the reactor coolant system water flashing into the drywell, and the fuel rods rupturing (gap release of radionuclides) with some fuel melting (in-vessel radionuclide release) before the core is cooled. A fraction of these radionuclides will be released to the environment through 3 possible paths. (1) Radionuclides will be transported as the steam and radionuclides fill and pressurize the drywell allowing leakage into the reactor building (secondary containment) and release into the environment through the (SGTS). During the period of reactor building pressurization the leakage path is directly to the environment [Section 2.3]. (2) Radionuclides will also be transported from the drywell through the main steam lines as leakage past the Main Steam Isolation Valves (MSIV) into the condenser and then to the environment [Section 2.4]. (3) Additional release will occur from radionuclides deposited in the suppression pool and then drawn through the Engineered Safety Features (ESF) where leakage from pumps and lines into the reactor building allows release to the environment through the (SGTS) [Section 2.6]. Release of the radionuclides to the environment will result in a calculated dose to the control room occupants and to personnel located both at the EAB and LPZ.

2.2 Source Term Release Fraction

Since the publication of TID-14844 [6], significant advances have been made in understanding the timing, magnitude, and chemical form of fission product releases from severe nuclear power plant accidents. In 1995, the NRC published NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants" [7]. NUREG-1465 used this research to provide estimates of the accident source term that were more physically based and that could be applied to the design of future light-water power reactors. NUREG-1465 presents a representative accident source term for a boiling-water reactor (BWR) and for a pressurized-water reactor (PWR). These source terms are characterized by the composition and magnitude of the radioactive material, the chemical and physical properties of the material, and the timing of the release to the containment.

The radionuclide source term generated during a LOCA is based upon the core inventory and the radionuclide release fraction versus time. This analysis utilizes the 60 nuclide collection as referenced in NUREG/CR-6604, Section 1.4.3.2, Table 1.4.3.2-3 [2]. This collection contains representative nuclides from all the groups that are to be considered in a design basis accident, Regulatory Guide 1.183 [1], Regulatory Position (RP) 3.4. General Electric has provided CNS with a letter report "GE14 Source Term Description for NPPD" [8]. This report details the specific core inventory (Curies/MWt) by nuclide

for the end of cycle core average exposure of 33.7 GWd/Mt, about 1226 full power days of operation.

Regulatory Guide 1.183, RP 3.2, Table 1 release fractions are released into the drywell over a time interval as specified in RP 3.3, Table 4. The release fractions and timings from that report are presented in Table 2-1 and Table 2-2.

Table 2-1 BWR Core Inventory Release Fractions


	Gap Release Phase	Early In - Vessel Phase	Total
Noble Gases	0.05	0.95	1.00
Halogens	0.05	0.25	0.30
Alkali Metals	0.05	0.20	0.25
Tellurium	0.00	0.05	0.05
Ba, SR	0.00	0.02	0.02
Noble Metals	0.00	0.0025	0.0025
Cerium	0.00	0.0005	0.0005
Lanthanides	0.00	0.0002	0.0002

Table 2-2 BWR LOCA Core Release Timing

	Onset	Duration
Gap Release Phase	2 minutes	0.5 hours
Early In - Vessel Phase	0.5 hours	1.5 hours

In the design basis LOCA all of the activity released from the damaged fuel rods enters only the drywell per Regulatory Guide 1.183, Appendix A, RP 3.1 and escapes to the environment, Appendix A, RP 3.2. It is conservatively assumed that there is insufficient mixing to allow both drywell and wetwell free air volumes to be used. The chemical form of radioiodine released from the fuel to the drywell is set at 95% particulate (cesium iodide, CsI), 4.85 percent elemental iodine, and 0.15 percent organic iodide as specified in RP 3.5. With the exception of elemental and organic iodine and noble gas, fission products are assumed to be in particulate form as specified in RP 3.5. In addition, because the pool pH is kept greater than 7, any iodine that enters the pool will not re-evolve into a more volatile form and potentially escape to the environment. An analysis [30] verifying that the pool pH will be kept higher than 7 was performed.

The inventory of fission products in the reactor core and available for release to the containment is based on the maximum full power operation of the core with a core power equal to the original licensed thermal power (OLTP) level of 2381 MWt [4.i] times the original ECCS evaluation uncertainty [1] of 2%. CNS license amendment 231 [48].

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authorized an increase in maximum power level to 2419 MWt, accepting existing accident dose consequence analyses performed at 1.02% of OLTP. The effect of this change is a reduction of instrumentation uncertainty from 2% to 0.38%. Thus, the core is assumed to have operated at OLTP plus 2% for an extended period of time such that fission product equilibrium is reached. For radionuclides which have not reached equilibrium the core inventory at time of shutdown is used. The source term used for this accident is based on General Electric's GE14 Amendment 22 bounding core inventory source term [5 and 8]. The core inventory source term was calculated using the isotope generation and depletion code ORIGEN2, incorporating the BWR extended burnup library BWRUE.

2.3 Leakage from the Drywell

Activity released from the reactor core during the blowdown phase of a LOCA will be mixed in the drywell atmosphere instantaneously and homogeneously in accordance with the guidance in Regulatory Guide 1.183 [1] Appendix A, Section 3. This analysis uses natural deposition in the drywell (Appendix A, RP 3.2), but does not include sprays (Appendix A, RP 3.3), or recirculation filters (Appendix A, RP 3.4) to further reduce the concentration of radionuclides. The Powers natural deposition model [21] is used with the minimum deposition option set (10%) as recommended (Appendix A, RP 3.2).

As a result of the pressure buildup in the drywell, radionuclides may leak from the pressure vessel along various penetrations into the reactor building (secondary containment) [Section 2.3.1].

A CNS pressurization analysis [41] indicates that the reactor building may have a positive pressure for 210 seconds in the worst case, a failure to close the intake damper. In this analysis it is assumed that the drywell releases directly to the environment during that time period as a ground release in accordance with Regulatory Guide 1.183, App A, RP 4.2. To account for this worst case, this analysis uses a 5 minute release. Potential leakage pathways from the drywell directly into the condenser, reactor building, or environment have also been evaluated. It was determined that there is no identifiable containment bypass leakage other than that through the MSIV's [36].

2.3.1 Drywell to Reactor Building Release

The drywell leakage into the reactor building is set at 0.635 %/day based on an assumed drywell pressure of 58 psig per CNS Technical Specifications [4.vi]. The Cooper LOCA containment analysis, that gives the worst case leakage at 24 hours and beyond, shows that there is only one minute before the pressure within the drywell falls to 42.3 psia and the temperature falls below 300 F [26]. After 24 hours, the drywell leakage into the reactor building is reduced because that document shows that under worst case cooling conditions, the long term peak drywell pressure is about 22 psig (240 F) and occurs in approximately 8 hours post-accident. Table 2-3 details the temperatures and pressures

used for this analysis. Note that the steam line wall temperature chosen is the design value; following a LOCA this temperature will decrease as soon as the MSIV's close. Similarly the condenser temperature chosen is based on the design flows and temperatures entering the condenser during normal operation which will also decrease once the MSIV's close.

Table 2-3 Steam Line and Condenser Pressure and Temperature

Dry Well [27]	Pressure	Tempertaure
Time (hr)	(psia)	(F)
0.02	42.28	297
7.96	36.95	239
24	31.5	221
Steam Line Wall [38]	>14.7	563
Drains [39]	>14.7	146
Condenser [39]	>14.7	107

When the ratio of the drywell pressure to the downstream pressure (atmospheric) is greater than approximately 2, i.e. critical pressure ratio (0.55 for air and steam), the resulting mass flow, W_2 can be determined as was done in Section 15.5 of Transport Phenomena [34]

$$W_2 = A_F \left[\frac{\gamma P_1 g_c}{v_1} \left(\frac{2}{\gamma + 1} \right)^{\frac{\gamma + 1}{\gamma - 1}} \right]^{\frac{1}{2}} \quad (\text{Eq. 1})$$

Where:

- A_F leakage flow area
- γ ratio of the specific heats, 1.28 for steam
- P_1 drywell pressure (lb/ft²)
- g_c gravitational constant (ft/sec²)
- v_1 drywell specific volume (ft³/lb)

It can be shown that by accounting for the change in drywell pressure and steam specific volume over time that the leakage can be reduced to 34% of the original value at 24 hours. The leakage in this analysis is conservatively reduced to 50% of the original value, or 0.3175 %/day at 24 hours in accordance with Regulatory Guide 1.183, App A, RP 3.7.

2.3.2 Reactor Building to Environment Release

The existing licensing basis for the NPPD DBA LOCA is that all of the release from the reactor building (secondary containment) is transported via the Standby Gas Treatment System (SGTS) to the Elevated Release Point. After an initiation signal is given, the

reactor building ventilation system completely coasts down in less than 90 seconds [28, 35]. The Reactor Building SGTS is initiated within 30 seconds of receiving the same signal and the exhaust fans are capable of coming to full speed in 15 seconds as discussed in Chapter V Section 3.3.4 of the USAR [3], i.e. 45 seconds after signal initiation. The SGTS exhaust path is therefore active from 1 minute after signal initiation.

It should also be noted that the gap release phase of the event does not start for 2 minutes after the accident (Regulatory Guide 1.183[1], RP 3.3). As a conservatism this 2 minute gap delay is not included in this LOCA analysis. SGTS elevated release dilution values are also ignored for the first half hour of the worst two hour time period (RP 5.3) to capture fumigation effects by using the SGTS ground release dilution values [27]. This analysis does not take credit for any holdup in the reactor building (secondary containment) but releases the radionuclides to the environment through the SGTS (Appendix A, RP 4.4). The no holdup (no mixing) assumption is included in the input by setting the fraction retained, *Frac*, within the volume in a unit of time at less than 0.1% and then solving for the reactor building volume from the transient exhaust equation [25] shown below.

$$Frac = \exp\left(-Q_{Exhaust} * t / V\right) \quad (Eq. 2)$$


where

- $Q_{Exhaust}$ Volumetric flow exiting the building (1492 ft³/m, [Section 5.4.1.7])
- V Reactor building compartment volume (200 ft³, [Section 5.4.1.2])
- t No mixing release time (1 min)

This analysis also allows for the failure of the power to one of the SGTS heaters. Within one hour the operator reduces the flow to the idle system. The resulting Technical Specification flows and filter efficiencies [4.viii] have been conservatively adjusted with R.G. 1.52 [40], Table 1, and are shown in Table 2-4. For additional conservatism, the filter efficiencies are further reduced by 1% from specifications.

Table 2-4 SGTS Filter Flow and Efficiency

	Time (hr)	Flow (cfm)	Filter Efficiencies (%)		
			Particulate	Elemental	Organic
Active Heater	0.0166 - 1	1492	98	94	94
Failed Heater	0.0166 - 1	1492	98	89	29
Active Heater	1-720	1492	98	94	94
Failed Heater	1-720	288	98	89	29

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2.4 Release through the MSIV to the Condenser

Radionuclides may also pass from the drywell to the environment through the main steam lines in accordance with Regulatory Guide 1.183 [1], Appendix A, RP 6. Four steam lines transport the steam from the reactor to the main turbine [9]. These four lines each have inboard and an outboard main steam isolation valves (MSIV) that close in the event of a LOCA. The outboard MSIV is in the steam tunnel within the secondary containment. The 4 steam lines reach a common header some 250 feet beyond the outboard valve [10]. From the common header, the steam line goes either to the turbine or can be bypassed directly to the condenser. The MSIV leak rate currently is limited by CNS License Amendment 220 [33] to a total 46 scfh consistent with Appendix A, RP 6.2. However, in this analysis a value of 150 scfh maximum in any one steam line and 300 scfh total leakage from all steam lines into the condenser is used.

In the LOCA scenario, the main steam isolation valves (MSIV) close reducing the release from the catastrophic failure of one of the recirculating lines. Regulatory Guide 1.183 [1], Appendix A, RP 6.5, states that submittals may assume a deposition in the main steam piping and in the condenser if the components are capable of performing their safety function following a safe shutdown earthquake (SSE). In the Cooper facility, the Alternate Leakage Treatment pathway between the outboard MSIV's and condenser has been accepted by the NRC in CNS License Amendments 196 [42] and 206 [23] as being capable of withstanding the seismic loadings of a safe shutdown earthquake (SSE). The steam lines, turbine, and condenser were all found to be seismically robust, thus they conform to RP 6.5.

Two sections of pipe are analyzed here; (1) the line from the reactor drywell through the valves to where all 4 steam lines converge, and (2) the condenser system.

Drawing 2841-2 [10] shows that the distance from the outer MSIV to the header has between 245' and 265' of horizontal piping in the 4 steam lines. In addition, drawing 731E611 [9] indicates that there is at least 16 feet of horizontal piping between the inner and outer MSIV's. Table 2-5 and following, details these values for each steam line and condenser. Note that although some of these drawings are classified as Status 2 (i.e. information only), this is acceptable because the overall layout of the turbine building, main steam lines, and main condenser has not changed in the areas of concern.

Table 2-5 Steam Line Geometry

Steam Line	A	B	C	D	Notes
dwg	731E611 #5	731E611 #6	731E611 #7	731E611 #8	
Pipe diameter (ft)	2	2	2	2	(nominal) ¹
Horizontal Length Vessel to inboard MSIV (ft)	44.34	30.49	29.41	43.83	
Total Length Vessel to inboard MSIV (ft)	51.50	33.99	32.82	50.83	
dwg	731E611 #1	731E611 #1	731E611 #1	731E611 #1	
in-between MSIVs (ft)	18.57	16.64	16.64	18.57	²
dwg	2841-2	2841-2	2841-2	2841-2	
MSIV to Header (ft)	263.31	259.79	252.78	249.27	³
Total length (ft)	326.22	306.92	298.83	311.68	³

- (1) Approximately 80% is 24" ID, remainder is 24" OD
- (2) Valve length not included
- (3) Vertical lengths not included

The flows and areas for the steam lines are given in Table 2-6

Table 2-6 Calculated Steam Line Information

Vessel to Header	A	B	C	D
Steam Line				
A_Surf_Up, A _S (ft ²)	652	614	598	623
A_Surf_total, A _{S_Total} (ft ²)	2095	1950	1899	2002
A_flow (ft ²)	3.14	3.14	3.14	3.14
Volume (ft ³)	1047	975	950	1001
Flow, Q (scfh)	0	150	150	0
Flow, Q (cfs) ⁴	0.000	0.022	0.022	0.000

- (4) Flow calculated based on drywell peak T=239 F and p=37 psia [Table 2-3]

USAR, Chapter XI-3.5 [3] states that the condenser has a total condensing surface area of 465,000 ft², utilizing 7/8 in OD, 0.028 in thick, and 40 ft long stainless steel tubes. There are in excess of 25,000 tubes in each of the 32 ft wide once through condenser shells. As a conservative assumption this analysis will only account for one of the two shells in this condenser. Table 2-7 presents the information from the manufacturer for a single shell. Note that the flow area is assumed to be the steam volume divided by the width.

Table 2-7 Condenser Information [24, 38, 39]

A_Surf_total, A _S _Total (ft ²)	232500
A_flow_steam (ft ²)	1500
Volume_Steam (ft ³)	48000

As discussed in Section 2.3.1, the calculated drywell pressure will reduce the leakage to 34% of the peak pressure within approximately 24 hours post-accident. Therefore, the MSIV leakage is conservatively reduced 50%, from 300 scfh to 150 scfh, at 24 hours in accordance with Regulatory Guide 1.183[1], Appendix A, RP 6.2. This is conservative because no credit is taken for further leakage reduction as the pressure continues to decrease.

2.4.1 Particulate Deposition in the Steam Lines

In the vast majority of main steam line scenarios laminar flow is found to be dominant (i.e. Reynolds Numbers < 250) because the velocity in the isolated section of pipe is low (< 1 cm/s). As a conservatism, it is assumed that the entering steam and radionuclides are instantly mixed throughout the steam line due to turbulence. The resulting formulation is termed the homogeneous model and in AEB-98-03 [15], Gingrich detailed this model as

$$\eta_{grav} = 1 - \frac{1}{\left(1 + \frac{U_g A_s}{Q}\right)} \quad \text{(Eq. 3)}$$

Where

- η_{grav} Deposition efficiency due to settling
- U_g Settling velocity
- Q Volumetric flow
- A_s Surface area

In the Gingrich analysis the surface area was incorrectly formulated as one half of the pipe surface area. To be correct it should be only the upward facing surfaces, or pipe length (L) * the pipe diameter (D). The settling velocity, U_g , is not a function of the flow mixing assumption and can be written as shown in Section 8.5 of Industrial Ventilation [25]

$$U_g = \frac{\rho_p d_p^2 g_c C_s}{18\mu k} \quad \text{(Eq. 4)}$$

Where

- ρ_p Particle density (default is water @ 1 gm/cc)
- d_p Particle diameter (default is 1 micron)

- g_c Gravitational constant (981 cm/sec²)
- C_s Cunningham slip factor (~1.0)
- μ Fluid viscosity (~ 1.20e-4 Pa-s)
- k Shape factor (~1.0)

In AEB 98-03 a Monte Carlo analysis was done using Equation 4 and accounting for the distributions of densities, diameters, shape factors, and viscosities to determine a mean settling velocity, U_g . Note that these variations are not plant specific and hence the results are applicable from facility to facility. However, these results are only applicable to a single volume situation, that is the user cannot use the correlations for the volume between the pressure vessel and the upstream MSIV and the same correlation between the two MSIV's and then again from the downstream MSIV to the condenser intake. Therefore, this analysis would use only a single volume from the vessel to the common steam line header. The results from AEB 98-03 are presented in a cumulative probability curve as shown in Figure 2-1.

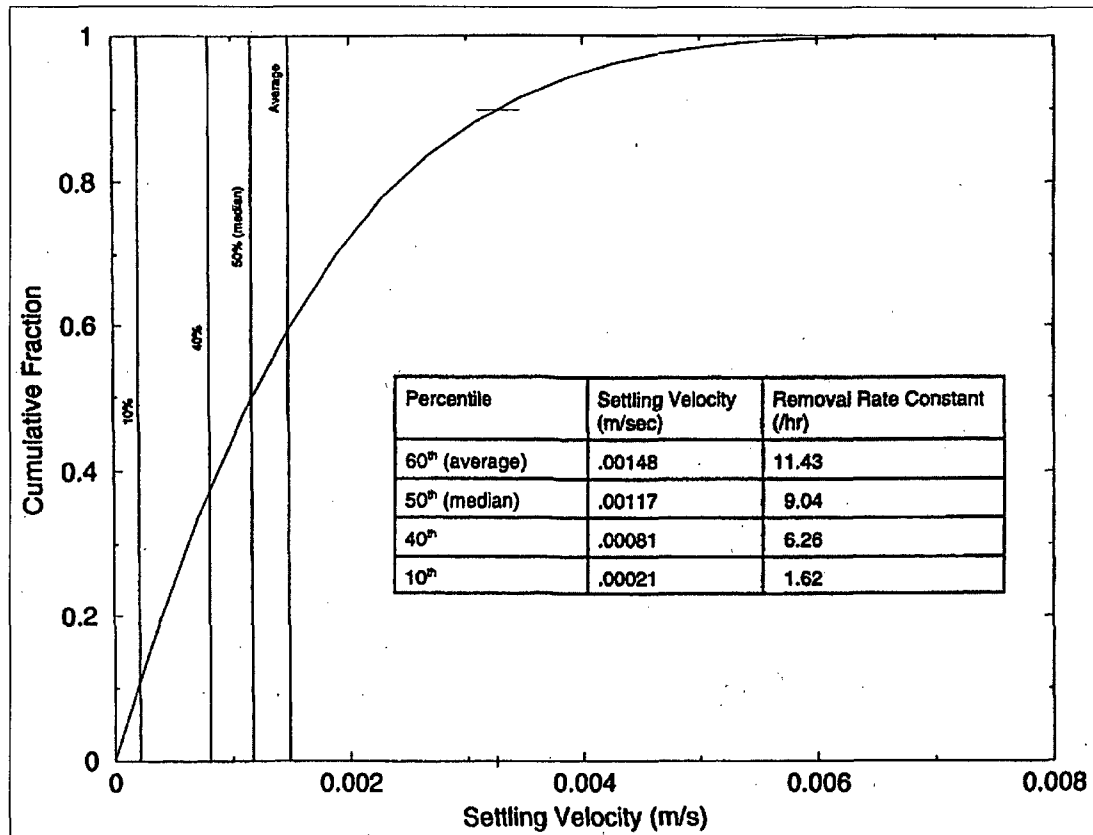


Figure 2-1 Monte Carlo probability curve

In that analysis the mean settling velocity, U_g , was found to be 0.00117 m/s for the median value and 0.00021 m/s for the 10th percentile. In that analysis it was noted that the use of a homogeneous mixing model in large volumes with small flow rates instead of a slug like model introduced sufficient conservatism to warrant the use of the median settling velocities. In this analysis, as an additional conservatism, the 10th percentile value is used.

One can determine the deposition efficiency from Equation 3 for the two sections assuming a volumetric flow of 150 scfh in the faulted MSIV steam line and conservatively assuming 150 scfh in one of the other three steam lines. To minimize the deposition the transit time should be small, thus the volumetric flow should be a maximum, therefore the temperatures should be high and the pressures should be low. Therefore the pressure in the lines and condenser is assumed to be atmospheric, 14.7 psia. Table 2-3 details the pressures and temperatures that are used in this analysis. For the steam line flows the peak long term values [Section 2.3.1] are used to determine the flow out of the drywell, similarly the mean steam line temperature is used to determine the flow into the condenser, and the mean condenser temperature (107 F [38]) to determine the condenser to turbine building flow of 5.452 cfm (300 scfh).

The results for two shorter length steam lines, "B" and "C" both using the 150 scfh flows respectively are given in Table 2-8 for both the median and the 10th percentile settling velocities.

Table 2-8 Steam Line Gravitation Settling Efficiency

Steam Line	B	C	B	C
Particulate AEB 98-03	50th %	50th %	10th %	10th %
Settling Velocity, U_g (m/s)	0.00117	0.00117	0.00021	0.00021
Deposition coef, $U_g A_s / Q$	106	103	19	18
Particulate Deposition eff, η_{grav}	99.1%	99.0%	95.0%	94.9%
Decontamination Factor, DF	106	103	19	18

Note that as a conservatism, particulate deposition in the steam lines as allowed in Regulatory Guide 1.183 [1], Appendix A, RP 6.5 was not included in this analysis.

2.4.2 Elemental Deposition in the Steam Lines

In NUREG/CR-6604 [2], a model for elemental iodine and organic iodine vapor was included. This model is applicable for both horizontal and vertical lines; note that the surface area for vapor deposition is the total surface area as opposed to the horizontal upward face surface area used for settling calculations. The model assumes that after the initial blowdown the variation in temperature and pressure over time is small, hence there would be no revaporization. In addition it assumes that the velocity changes in time are also small, hence there would be little if any resuspension of deposited material. The

RADTRAD 3.03 model further assumes that there would be no chemical changes of the deposited elemental iodine into a more volatile form. In the original Cline model [29] this latter assumption was not included, instead Cline determined that the elemental form of iodine (I_2) would react with the hydrogen on the wall and form HI, which is more volatile. In this analysis the Cline model is followed for elemental deposition in compliance with Regulatory Guide 1.183 [1], Appendix A, RP 6.5. In the Cline model the following equations were developed for minimizing the deposition velocity, U_{I_2} (cm/s) and maximizing the resuspension rate, $Resus_{I_2}$ (1/s) of elemental iodine.

$$U_{I_2} = \exp\left(\frac{2809}{T(K)} - 12.5\right) \quad (\text{Eq. 5})$$

$$Resus_{I_2} = 4.32 \times 10^{-5} \exp\left(\frac{-600}{T(K)}\right) \quad (\text{Eq. 6})$$

Deposition velocity is transformed to deposition rate, DR_{I_2} in section 1.2 of Cline [29] as

$$DR_{I_2} = U_{I_2} \left(\frac{A_{S_Total}}{Volume} \right) \quad (\text{Eq. 7})$$


The Cline model also includes a fixation rate to account for the interaction of iodine with the walls, this has been conservatively ignored. Using the difference in rates to determine the net deposition one determines the effective deposition efficiency as

$$\eta_{I_2} = 1 - \left[\frac{1}{1 + (DR_{I_2} - Resus_{I_2}) * \left(\frac{Volume}{Q} \right)} \right] \quad (\text{Eq. 8})$$

Note that this equation is a combination of the Cline model and the RADTRAD use of efficiencies from Equation 3. The results for elemental deposition in the steam lines are given in Table 2-9.

Table 2-9 Steam Line Elemental Deposition Results

Steam Line	B	C
Temperature (F) [38]	563	563
Deposition Velocity, U (cm/s)	0.0005222	0.0005222
Deposition rate, DR (1/s)	0.0000343	0.0000343
Resuspension rate, RR (1/s)	0.0000150	0.0000150
Elemental Deposition eff, η	45.71%	45.04%
Decontamination Factor, DF	1.8	1.8

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Note that as a conservatism, elemental deposition in the steam lines as allowed in Regulatory Guide 1.183 [1], Appendix A, RP 6.5 was not included in this analysis.

2.4.3 Elemental and Particulate Deposition in the Condenser


The CNS main condenser effective filter efficiency (radionuclide removal efficiency) is developed in Appendix A based on the BWROG model documented in NEDC-31858-P-A, Appendix C [47]. That model examined the deposition of elemental iodine and stated that for the low velocity cases examined particulates would deposit with 100% efficiency, therefore it is conservative to assume that particulates would only deposit with the efficiency of elemental iodine. Thus the elemental deposition efficiencies determined in Appendix A for elemental iodine are applied to both elemental iodine and all particulates.

[[

]] In Appendix A, a study was performed varying the MSIV leakage and examining its effect on deposition efficiency.

The efficiencies calculated are conservative in two additional ways. There are 2 possible flow paths between the MSIV leakage and the condenser, either through the Alternative Leakage Treatment (ALT) Pathway (the steam lines discussed previously) or through the Main Steam drain line pathway (originating just downstream of the outboard MSIVs). The flow split is not important for the dose analysis because deposition was conservatively neglected for both paths. However, the Main Steam drain line pathway penetrates the condenser shell much higher than the ALT Pathway connection, thus significantly reducing the condenser free volume credited in determination of filtration efficiencies. Therefore, even though most of the MSIV leakage flow would probably enter the condenser at an elevation that would enable credit of a much larger condenser volume, and thus improved filtration efficiencies (as determined in Appendix A), 100% of the MSIV leakage flow was assumed to enter the condenser through the higher MS drain line connection. Secondly, only the volume of one of the two condenser shells was credited in the determination of the filtration efficiencies. Thus, the volume of the second condenser shell and the volume connecting the twin condenser shells was conservatively neglected. These two assumptions provide significant conservatism in the amount of credit taken within the condenser model.

For the 300/150 scfh MSIV leakage rate case used in this analysis, the main condenser effective filter efficiency (radionuclide removal efficiency) value determined in Appendix A for the initial 24 hour post-LOCA period is 94.91%. The main condenser effective filter efficiency (radionuclide removal efficiency) value for use following the initial 24 hour post-LOCA period is 97.39%.

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2.5 Release from the Condenser to the Environment

The release rate from the condenser to the turbine building used in this analysis is 300 scfh (5.452 cfm) for the first 24 hours and is reduced by 50% after that time interval. The volume of the condenser from Table 2-7 provides some holdup (Regulatory Guide 1.183 [1], Appendix A, RP 6.5). After leaving the condenser the radionuclides enter the turbine building where they are released to the environment assuming that there is no holdup (Appendix A, RP 6.4). The turbine building volume used in this analysis is 100 ft³, this comes from the no holdup assumption using Eq. 2. The release of radionuclides to the environment from the turbine building is at the ground level (Appendix A, RP 6.4).

2.6 Release from the ESF Components to the Environment

Radionuclides may also pass from the reactor to the environment as a result of Engineered Safety Features (ESF) component leakage. These systems take suction from the suppression pool. Assumed leakage from pump seals, valve packing glands, flanged connections and other locations is released to the reactor building and, from there, to the environment via the SGTS.

Regulatory Guide 1.183 [1], Appendix A, Section 5 provides the guidance for this leak path. All the radionuclides released from the fuel are assumed to enter the suppression pool water as they are released with the exception of the noble gases which are assumed to be instantaneously released (Appendix A, RP 5.1). All radioactive materials other than iodine are retained in the water (Appendix A, RP 5.3). The iodine is in the form of 97% elemental and 3% organic (Appendix A, RP 5.6).

CNS has neither quantitative ECCS leakage Technical Specifications nor made quantitative commitments to NUREG-0737 Item III.D.1.1. The current licensing basis limit for ESF leakage is 1000 cc/min per License Amendment 187[43]. A conservative factor of 45 times this value is assumed (45,000 cc/min) during postulated LOCA conditions. The ESF leakage value thus used for this analysis is 1.59 cfm (11.9 gpm).

There are 3 ESF systems that may be in use during the LOCA, the core spray (CS), the residual heat removal (RHR), and the low pressure injection (LPCI) systems. The leakage from the ESF components is proportional to the pressure difference, i.e. the line pressure minus atmospheric and inversely proportional to the viscosity of the liquid in the line; the Hagen-Poiseuille flow equation in section 2.3 of Transport Phenomena [34] expresses the relationship as

$$Q = \frac{\pi(P_0 - P_L)R^4}{8\mu L} \quad (\text{Eq. 10})$$

where

- Q Volumetric flow rate (ft³/s)
- P Pressure (lbf/ft²) at the upstream (0) and downstream (L) locations
- R Radius of the line (ft)
- μ Water viscosity (lbf-s/ft²)
- L Length of the line (ft)

Table 2-10 indicates the situations at testing and during the LOCA. The columns indicate the determination of the differential line pressure, $P_0 - P_L$, in both the test configuration and during the LOCA. The last column indicates the ratio of these differentials, thus a proportionality constant between test and accident. The difference in test temperature 80 F versus the LOCA temperature of 208 F [26] causes a viscosity change of 65% thus increasing the leakage by a factor of 2.9. ESF leakage is assumed to come from the more conservative suction side, perhaps the valve packing. The table indicates that all the suction side ESF leakage will be increased by a total factor of 15 (2.9x5.1) between test results and the design basis LOCA. Therefore, the assumed analysis ESF leakage of 1.59 cfm is equivalent to approximately 3000 cc/min leakage during a test of the ESF system.

Table 2-10 ESF Line Pressures


System Config	TEST (psig)				LOCA (psig)				P_{LOCA} / P_{TEST}
	Pool Elev Head ¹	Surface Press. ²	Pump Head ³	Total Head, $P_0 - P_L$	Pool Elev Head ¹	Surface Press. ²	Pump Head ³	Total Head, $P_0 - P_L$	
CS Suct	5.6	0	0	5.6	5.6	22.8	0	28.4	5.1
CS Disch	5.6	0	290	295.6	5.6	22.3	290	317.9	1.1
RHR Suct	5.6	0	0	5.6	5.6	22.8	0	28.4	5.1
RHR Disch	5.6	0	182	187.6	5.6	22.3	182	209.9	1.1
LPCI Suct	5.6	0	0	5.6	5.6	22.8	0	28.4	5.1
LPCI Disch	5.6	0	20	25.6	5.6	22.3	20	47.9	1.9

- 1) Torus LWL = elev. 874'-10" [NEDC 98-042];
CS/RHR pump suction = elev 861'-10" [2063-1, 2625-2].
- 2) Suction sees Wet Well pressure, Discharge sees Drywell using peak [26].
- 3) Pump curve; design operating point [46], [TC-3351, 27953].

The input leakage value of 0.159 cfm includes the 10% flash fraction (Regulatory Guide 1.183, Appendix A, RP 5.5). The flash fraction of 10% is allowable because the pool water temperature is always less than 212 °F [26]. The released iodine enters secondary containment directly and passes through the SGTS without holdup within buildings (Appendix A, RP 5.6) as described in Section 2.3.1.

2.7 Control Room HVAC System

The air intake rate to the control room, the control room HVAC system filter efficiency, and the control room volume are needed to determine the portion of radiological dose received within the control room area.

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The total control room volume is made up of the control room proper and the cable spreading room area [12 and 13]. Note that although some of these drawings are classified as Status 2, this is acceptable because the overall layout of the control room and cable spreading area has not changed in the areas of concern. The volume of the control room is given in Section 2.4 of the CNS FHA analysis [32] as 141,860 ft³. This value assumes that 20% of the volume is occupied by walls, floors, and equipment.

The air intake to the control room is modeled using two flow rates in order to represent the two distinct operating modes of normal fresh air intake prior to a high radiation isolation signal and operation in the Control Room Emergency Filtration (CREFs) lineup following a Group 6 isolation (low-low reactor water level, high DW pressure, RB HV exhaust plenum high radiation). This is discussed in Chapter X section 10.4.5.2 and Chapter VII section 3.5 of the USAR[3].

Prior to isolation:

- 3235 cfm normal ventilation system fresh air intake flow per CNS drawings [14]
- A control room unfiltered inleakage value of 400 cfm was assumed for this analysis in order to provide future analytical and operational margin in lieu of the current tracer gas testing results [11] measuring an inleakage value of 64 cfm with the CREF system in the pressurization mode in recirculation. This value includes the standard value of 10 cfm recognized by the industry for access/egress to the control room envelope. A previous tracer gas test [22] measured a value of 71 scfm.
- Total air intake rate = 3,635 cfm. CREFS isolation occurs at approximately 1 minute [Section 4.2].
- 900 +/- 10% cfm (810 cfm) CREFS design air intake flow as given in the technical specifications [4.v and 4.viii] (lower value picked for conservative removal rate of radionuclides from control room space)
- Total air intake rate = 1,210 cfm.

The control room emergency filtration system is currently specified as supporting 99.95% efficiency for the HEPA filters and 99% efficiency for the charcoal filters [4.viii] in accordance with Regulatory Guide 1.52 [40]. In this analysis, in order to provide future analytical and operational margin, filter efficiencies of 99% for particulate and 90% for both elemental and organic material are conservatively assumed. This efficiency is further reduced by 1% to account for maximum bypass [4.vii] thus 98% for particulates and 89% for the elemental and organic forms of iodine are used.

2.8 Atmospheric Dispersion (X/Q) Factors

The X/Q values are taken from existing CNS calculations developed specifically for various Control Room Intake, Exclusion Area Boundary (EAB), and Low Population Zone (LPZ) receptor points for use in the development of the bounding Design Basis Accidents (DBA) Radiological Analysis. The offsite receptor locations were previously determined to be the most limiting in determining compliance with the dose criteria established [16 and 18].

The control room intake X/Q values were taken from CNS calculations [16]. In the LOCA scenario the majority of the release comes either through the SGTS or through the turbine building. The values were developed using the ARCON 96 computer code [17] and are presented in Table 2-11 for the three release points.

Table 2-11 Control Room Dispersion Coefficients [16]

Time (hr)	SGTS Elevated Release	Turbine Ground Release	Reactor Building Ground Release
0.0 - 2.0	1.00E-10	8.64E-04	4.15E-03
2.0 - 8.0	8.58E-10	4.66E-04	3.24E-03
8.0 - 24	1.41E-08	2.32E-04	1.32E-03
24 - 96	5.62E-09	1.53E-04	9.01E-04
96 - 720	5.69E-09	1.25E-04	7.22E-04

The leakage calculation includes both the SGTS release path and also an initial release directly from the drywell to the environment at the reactor building ground level for 5 minutes. The release from the SGTS is elevated except for the fumigation period when the release is assumed to be at ground level at a dispersion value of 3.03×10^{-4} s/m³ [27]. The fumigation period must occur during the first half hour of the worst 2 hour exposure period in accordance with Regulatory Guide 1.183[1], RP 5.3. The worst 2 hour period for the Exclusion Area Boundary dose was determined to be between 1.3 and 3.3 hours, hence the effect of fumigation was included between 1.3 and 1.8 hours. The MSIV calculation uses the turbine ground release path information. The ESF calculation includes the SGTS path, also with the effect from fumigation. The final X/Q's used for these 3 calculations are shown in Table 2-12.

Table 2-12 Control Room Dispersion Coefficients by Path


Time (hr)	Leak - Reactor Building	MSIV - Turbine Building	ESF - Reactor Building
0.0 - 0.083	4.15E-03	8.64E-04	1.00E-10
0.083 - 1.3	1.00E-10	8.64E-04	1.00E-10
1.3 - 1.8	3.03E-04 ¹	8.64E-04	3.03E-04 ¹
1.8 - 2.0	1.00E-10	8.64E-04	1.00E-10
2.0 - 8.0	8.58E-10	4.66E-04	8.58E-10
8.0 - 24	1.41E-08	2.32E-04	1.41E-08
24 - 96	5.62E-09	1.53E-04	5.62E-09
96 - 720	5.69E-09	1.25E-04	5.69E-09

The EAB and LPZ Atmospheric Dispersion X/Q values were taken from the applicable CNS calculation [18] for a release emanating from the SGTS. Note that effect of fumigation occurs between 1.3 and 1.8 hours. The final values are presented in Table 2-13.

Table 2-13 Cooper Offsite Dispersion Coefficients

Time (hr)	SGTS Elevated Release	Turbine & Reactor Building Ground Release
EAB		
0.0 – 1.3 hours	1.60E-05	5.20E-04
1.3 – 1.8 hours	1.20E-04 (1)	5.20E-04
1.8 – 10 hours	1.60E-05	5.20E-04
LPZ		
0.0 – 1.3 hours	4.00E-05	2.90E-04
1.3 – 1.8 hours	1.40E-04 (1)	2.90E-04
1.8 – 8 hours	4.00E-05	2.90E-04
8. - 24. hours	1.60E-05	7.30E-05
24 - 96 hours	5.80E-06	2.50E-05
4 – 30 days	1.70E-06	5.20E-06

(1) Includes fumigation considerations

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3 ADDITIONAL DESIGN INPUTS

The following inputs are used by the RADTRAD code in determining the TEDE for persons located either onsite or offsite and are consistent with Regulatory Guide 1.183, RP 4.0.

Dose calculations are based on the TEDE. The TEDE is the sum of the committed effective dose equivalent (CEDE) from inhalation and the deep dose equivalent (DDE) from external exposure.


All doses are determined by RADTRAD using the Federal Guidance Reports 11 and 12 [19 and 20] dose conversion factors (DCFs) for the following organs and pseudo organs:

- Gonads
- Breast
- Lungs
- Red bone marrow
- Bone surface
- Thyroid
- Skin

EAB and LPZ - For the first 8 hours, the breathing rate of persons is assumed to be $3.5 \times 10^{-4} \text{ m}^3/\text{sec}$. From 8 to 24 hours following the accident, the breathing rate is assumed to be $1.8 \times 10^{-4} \text{ m}^3/\text{sec}$. After that and until the end of the accident, the rate is assumed to be $2.3 \times 10^{-4} \text{ m}^3/\text{sec}$.


Control Room - The dose receptor for this analysis 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 is assumed to be $3.5 \times 10^{-4} \text{ m}^3/\text{sec}$.

The radiological acceptance criteria for the EAB, the outer boundary of the LPZ, and for the control room are in 10 CFR 50.67. These criteria are stated for evaluating reactor accidents of exceedingly low probability of occurrence and low risk of public exposure to radiation. For the LOCA the EAB and LPZ dose criteria are presented in Table 6 of Regulatory Guide 1.183 and stated as 25 Rem TEDE. The dose at the EAB is determined from the worst 2 hour period of dose increase, while for the LPZ the entire 30 day (720 hour) duration is included. The acceptance criteria for the control room dose is given in 10 CFR 50.67 as 5 Rem TEDE as measured over the entire 30 day duration.

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4 ASSUMPTIONS

1. A control room unfiltered inleakage value of 400 cfm was assumed for this analysis in order to provide future analytical and operational margin in lieu of the current tracer gas testing results [11] measuring an inleakage value of 64 cfm with the CREF system in the pressurization mode during recirculation.
2. The required time for isolation of the control room intake from initiation of the LOCA is assumed to be 1 minute (60 seconds). This was selected as a conservative value in order to provide future analytical and operational margin in lieu of the current CNS CREF system which isolates automatically within 11 seconds upon receipt of ESF actuation signal.
3. The control room emergency filtration system is currently specified as supporting 99.95% efficiency for the HEPA filters and 99% efficiency for the charcoal filters [4.viii] in accordance with Regulatory Guide 1.52 [40]. In this analysis, in order to provide future analytical and operational margin, filter efficiencies of 99% for particulate and 90% for both elemental and organic material are assumed. This efficiency is further reduced by 1% to account for maximum bypass [4.vii].
4. No decontamination credit for core spray or residual heat removal systems.
5. No credit is taken for the use of personal protective equipment or prophylactic drugs.
6. Release from the core to the pressure vessel is instantly mixed with drywell volume due to the LOCA, but the release is not diluted with the wet well volume [Section 2.3].
7. Fumigation effects are included thru the first half hour of the worst 2 hour EAB period [Section 2.8]
8. Decay and Daughtering of radionuclides is included.
9. Drywell compartment pressure change qualifies as a reduction in pressure that allows a reduction in flow of 50% after 24 hours [Section 2.3.1].
10. No credit for dilution or holdup in the reactor building (secondary containment).
11. No holdup in a volume is approximated by releasing at least 99% of radionuclides in the compartment every minute.
12. Cooper Nuclear Station's Safe Shutdown Earthquake capability allows for deposition credit within the condenser [Section 2.4].
13. No credit for deposition in the steam or drain lines is taken [Section 2.4]
14. A reduced condenser volume is assumed so that only one shell of the two shell condenser is available for deposition [Appendix A].
15. No re-evolution of iodine from the suppression pool due to pH being greater than 7 for entire 30 days [30].
16. Releases from the purge system are not considered as the primary containment is isolated post-LOCA.
17. No correction is made for depletion of the plume due to ground deposition.

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5 ANALYSIS METHODOLOGY/CALCULATION

A V&V version (developed by Alion Science & Technology, ITSCO) of the NRC computer code RADTRAD Version 3.03 was used to analyze a design basis Loss of Coolant Accident (LOCA) at the Cooper Nuclear Station. The radiological consequences of an accident in a nuclear power plant depend upon the quantity of the radioactive material that escapes to the environment and/or enters the plant's control room. RADTRAD is designed to calculate doses at offsite locations, such as the exclusion area boundary, and in the control room. The code has two default source terms to describe fission product release to the containment: those from TID-14844 [6] and those from NUREG-1465 [7]. As the material is transported through the containment and other buildings, credit is given for several natural and engineered removal mechanisms. Containment sprays remove particulates, elemental iodine, and organic iodine. The flow between buildings or rooms may be through HEPA filters or a suppression pool. Leakage to the environment may occur. Particulates can deposit on surfaces within rooms and also in connecting paths. Models are provided within RADTRAD for these different removal mechanisms. Alternatively, the user may elect to input time-dependent values for a specific removal coefficient. After transporting the nuclides to different locations, RADTRAD calculates the dose at user-specified locations (i.e., EAB, LPZ, control room, etc.).

5.1 Loss of Coolant Accident Scenario

The postulated Design Basis LOCA event begins with a break of the recirculation line on the suction side of the reactor. This results in the shutdown of the reactor, the reactor coolant system water flashing into the drywell, and the assumption of the fuel rods rupturing (gap release of radionuclides) with some fuel melting (in-vessel radionuclide release) before the core is cooled. A fraction of these radionuclides are postulated to be released to the environment through 4 possible paths:

- (1) The release from the pressurized drywell that leaks directly to the reactor building is labeled "Leakage" and then through both the SGTS active and idle trains to the environment labeled "SGTS" in Figure 5-1.
- (2) The release from the pressurized drywell that leaks directly to the reactor building and then through reactor building ventilation system to the environment is labeled "Ventilation" in Figure 5-1.
- (3) The release from the pressure vessel and drywell via the main steam lines that passes thru the condenser into the turbine building and exhausts at ground level to the environment is labeled "MSIV" in Figure 5-1.
- (4) The release from the suppression pool that leaks from the Engineered Safety Features components into the reactor building is labeled "ESF" and then through both the SGTS active and idle trains to the environment labeled "SGTS" in Figure 5-1.

All 4 release paths, after passing through different levels of decontamination, result in limited release of radionuclides to the environment with consequential dose to the control room occupants and to personnel located both within and beyond the site boundary.

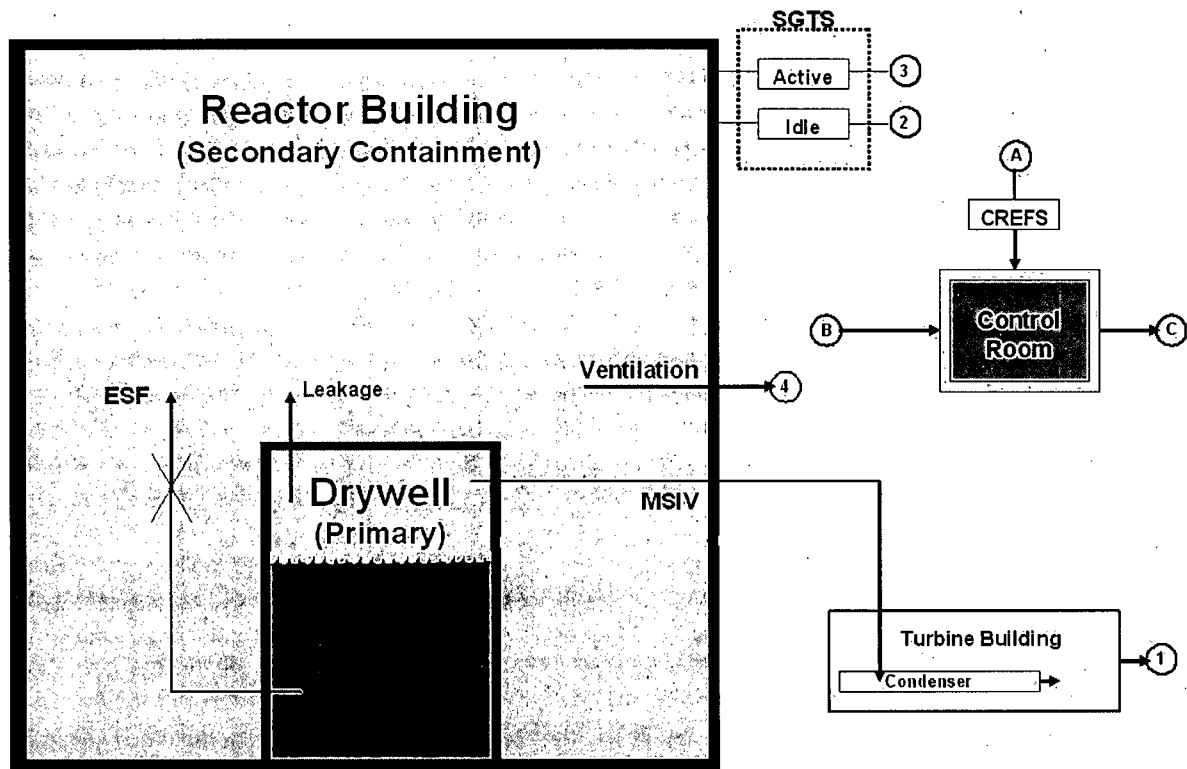



Figure 5-1 Radionuclide Release and Transport Model

5.2 RADTRAD 3.03 Computer Model

Figure 5-1 is a simplified representation of the radiological release and transport model used in the CNS LOCA analysis. The model simulates an accident which has initially released within the primary containment and mixes with the drywell. Because of the assumptions needed to conform to Regulatory Guide 1.183 Appendix A and the limitations of the RADTRAD 3.03 code, the calculation must be run 3 times with the dose results then added together. Because the three cases are added together there is a conservative multiple accounting of those radionuclides that contribute to dose, for example all the iodines are in the suppression pool for ESF leakage and in the drywell for MSIV and drywell to secondary containment leakages.

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The “Leakage” case determines the dose from the release to the drywell that leaks to the reactor building and subsequently exhausts to the environment either thru the SGTS or the ventilation system includes the first two release paths, SGTS and ventilation. The “MSIV” case determines the dose from the release to the drywell that exits the turbine building to the environment and includes the third path, MSIV. The “ESF” case determines the dose from the release to the suppression pool that leaks from the ESF components, i.e. the fourth path.

Once released to the environment, radionuclides are diluted as a function of the atmospheric conditions (X/Q values), thus leaving a smaller fraction available for intake into adjacent buildings (i.e., control room) or site defined locations (i.e. the exclusion area boundary and low population zone). The radionuclides may enter the control room from either the Control Room Emergency Filtration System (CREFS) air intake (pathway A) or as unfiltered inleakage (pathway B). Radionuclides are mixed within the control room volume and then exhausted (pathway C) to the environment.

5.3 RADTRAD 3.03 FILES

RADTRAD 3.03 requires the use/development of four individual input files in order to perform a radiological dose analysis. These files include; the plant specific compartment/pathway model file (PSF), the nuclide inventory file (NIF), the release fraction and timing file (RFT), and the dose conversion factor file (INP).

Because there are 3 separate cases, there are 3 separate compartment/pathway (PSF) files, labeled LEAKAGE [Section 5.4.1], MSIV [Section 5.4.2], and ESF [Section 5.4.3]. All 3 input PSF files reference the Cooper dependent (specific inventories) 60 nuclides dataset (cooper_60.nif) and the accompanying 60 nuclide dose conversion factor table (FGR11&12.inp). Table 5-1 and Table 5-2 detail the 60 nuclides used, their specific inventory [8], their half-life [2], and the dose conversion factors from the FGR 11 & 12 documents [19 and 20]. Note that the specific inventory for Co-58 and Co-60 are the default values from NUREG/CR-6604 [2] and were included to generate conservative doses. Also note that the Kr-88 short lived daughter, Rb-88, has been included in the Kr-88 dose conversion factors resulting in a moderate value for the effective inhalation value.

The volume into which radionuclides are released varies with each case. In the “Leakage” and “MSIV” cases the release is into the drywell and hence these cases use the same release table (Table 5-3) as required in Regulatory Guide 1.183 [1], Appendix A, Sections 1 and 6. However, for the ESF pathway the release is assumed to enter the suppression pool directly, hence it has a separate release table (Table 5-4) as required in Regulatory Guide 1.183, Appendix A, Section 5. Note that Strontium and Barium have been separated but still have the same release fractions as required by Regulatory Guide

1.183. This is an idiosyncrasy of the RADTRAD code historical development. Group names and numbers are selected for consistency with the RADTRAD 3.03 Users Manual [2]; there are slight differences with RG 1.183 [1].

Table 5-1 Cooper Inventories and Dose Conversion Factors (Nuclides 1-30)

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)
Co-58	7	1.53E+02	6.12E+06	4.76E-14	8.72E-10	2.94E-09
Co-60	7	1.83E+02	1.66E+08	1.26E-13	1.62E-08	5.91E-08
Kr-85	1	3.66E+02	3.38E+08	1.19E-16	0.00E+00	0.00E+00
Kr-85m	1	6.81E+03	1.61E+04	7.48E-15	0.00E+00	0.00E+00
Kr-87	1	1.30E+04	4.58E+03	4.12E-14	0.00E+00	0.00E+00
Kr-88	1	1.83E+04	1.02E+04	1.36E-13	1.37E-12	2.26E-11
Rb-86	3	6.99E+01	1.61E+06	4.81E-15	1.33E-09	1.79E-09
Sr-89	5	2.44E+04	4.36E+06	7.73E-17	7.96E-12	1.12E-08
Sr-90	5	2.90E+03	9.19E+08	7.53E-18	2.69E-10	3.51E-07
Sr-91	5	3.10E+04	3.42E+04	3.47E-14	1.45E-11	7.52E-09
Sr-92	5	3.38E+04	9.76E+03	6.79E-14	3.92E-12	2.18E-10
Y-90	9	3.00E+03	2.30E+05	1.90E-16	5.17E-13	2.28E-09
Y-91	9	3.17E+04	5.06E+06	2.60E-16	8.50E-12	1.32E-08
Y-92	9	3.39E+04	1.27E+04	1.30E-14	1.05E-12	2.11E-10
Y-93	9	3.96E+04	3.64E+04	4.80E-15	9.26E-13	5.82E-10
Zr-95	9	4.45E+04	5.53E+06	3.60E-14	1.44E-09	6.39E-09
Zr-97	9	4.51E+04	6.08E+04	4.44E-14	2.31E-11	1.17E-09
Nb-95	9	4.48E+04	3.04E+06	3.74E-14	3.58E-10	1.57E-09
Mo-99	7	5.12E+04	2.38E+05	7.28E-15	1.52E-11	1.07E-09
Tc-99m	7	4.52E+04	2.17E+04	5.89E-15	5.01E-11	8.80E-12
Ru-103	7	4.30E+04	3.39E+06	2.25E-14	2.57E-10	2.42E-09
Ru-105	7	3.03E+04	1.60E+04	3.81E-14	1.50E-10	1.52E-08
Ru-106	7	1.74E+04	3.18E+07	1.04E-14	1.72E-09	1.29E-07
Rh-105	7	2.77E+04	1.27E+05	3.72E-15	2.88E-12	2.58E-10
Sb-127	4	3.02E+03	3.33E+05	3.33E-14	6.15E-11	1.63E-09
Sb-129	4	8.93E+03	1.56E+04	7.14E-14	9.72E-12	1.74E-10
Te-127	4	3.05E+03	3.37E+04	2.42E-16	1.84E-12	8.60E-11
Te-127m	4	4.06E+02	9.42E+06	1.47E-16	9.66E-11	5.81E-09
Te-129	4	8.79E+03	4.18E+03	2.75E-15	5.09E-13	2.09E-11
Te-129m	4	1.30E+03	2.90E+06	3.34E-15	1.56E-10	6.48E-09

Table 5-2 Cooper Inventories and Dose Conversion Factors (Nuclides 31-60)

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)
Te-131m	4	3.96E+03	1.08E+05	7.46E-14	3.67E-08	1.76E-09
Te-132	4	3.85E+04	2.82E+05	1.03E-14	6.28E-08	2.55E-09
I-131	2	2.72E+04	6.95E+05	1.82E-14	2.92E-07	8.89E-09
I-132	2	3.93E+04	8.28E+03	1.12E-13	1.74E-09	1.03E-10
I-133	2	5.51E+04	7.49E+04	2.94E-14	4.86E-08	1.58E-09
I-134	2	6.04E+04	3.16E+03	1.30E-13	2.88E-10	3.55E-11
I-135	2	5.16E+04	2.38E+04	8.29E-14	8.46E-09	3.32E-10
Xe-133	1	5.26E+04	4.53E+05	1.56E-15	0.00E+00	0.00E+00
Xe-135	1	1.86E+04	3.27E+04	1.19E-14	0.00E+00	0.00E+00
Cs-134	3	6.75E+03	6.51E+07	7.57E-14	1.11E-08	1.25E-08
Cs-136	3	2.16E+03	1.13E+06	1.06E-13	1.73E-09	1.98E-09
Cs-137	3	4.05E+03	9.47E+08	2.73E-14	7.93E-09	8.63E-09
Ba-139	6	4.90E+04	4.96E+03	2.17E-15	2.40E-12	4.64E-11
Ba-140	6	4.71E+04	1.10E+06	8.58E-15	2.56E-10	1.01E-09
La-140	9	4.87E+04	1.45E+05	1.17E-13	6.87E-11	1.31E-09
La-141	9	4.46E+04	1.42E+04	2.39E-15	9.40E-12	1.57E-10
La-142	9	4.30E+04	5.55E+03	1.44E-13	8.74E-12	6.84E-11
Ce-141	8	4.47E+04	2.81E+06	3.43E-15	2.55E-11	2.42E-09
Ce-143	8	4.11E+04	1.19E+05	1.29E-14	6.23E-12	9.16E-10
Ce-144	8	3.66E+04	2.46E+07	2.78E-15	2.92E-10	1.01E-07
Pr-143	9	4.02E+04	1.17E+06	2.10E-17	1.68E-18	2.19E-09
Nd-147	9	1.80E+04	9.49E+05	6.19E-15	1.82E-11	1.85E-09
Np-239	8	5.86E+05	2.04E+05	7.69E-15	7.62E-12	6.78E-10
Pu-238	8	1.28E+02	2.77E+09	4.88E-18	3.86E-10	7.79E-05
Pu-239	8	1.29E+01	7.59E+11	4.24E-18	3.75E-10	8.33E-05
Pu-240	8	1.77E+01	2.06E+11	4.75E-18	3.76E-10	8.33E-05
Pu-241	8	5.34E+03	4.54E+08	7.25E-20	9.15E-12	1.34E-06
Am-241	9	6.87E+00	1.36E+10	8.18E-16	1.60E-09	1.20E-04
Cm-242	9	1.73E+03	1.41E+07	5.69E-18	9.41E-10	4.67E-06
Cm-244	9	1.11E+02	5.72E+08	4.91E-18	1.01E-09	6.70E-05

Table 5-3 Release Fraction and Timing for Release into the Drywell

	Onset	Gap Release	In-Vessel Release	Release Mass
TIME INTERVAL	2 min	0.50 hr	1.50 hrs	(gm)
NOBLE GAS	0.00E+00	5.00E-02	9.50E-01	2.97E+03
IODINE	0.00E+00	5.00E-02	2.50E-01	2.10E+02
CESIUM	0.00E+00	5.00E-02	2.00E-01	3.15E+04
TELLURIUM	0.00E+00	0.00E+00	5.00E-02	2.82E+01
STRONTIUM	0.00E+00	0.00E+00	2.00E-02	1.07E+03
BARIUM	0.00E+00	0.00E+00	2.00E-02	3.14E+01
RUTHENIUM	0.00E+00	0.00E+00	2.50E-03	4.16E+01
CERIUM	0.00E+00	0.00E+00	5.00E-04	4.38E+02
LANTHANUM	0.00E+00	0.00E+00	2.00E-04	4.44E+00

Table 5-4 Release Fraction and Timing for Release into the Suppression Pool

	Onset	Gap Release	In-Vessel Release	Release Mass
TIME INTERVAL	2 min	0.50 hr	1.50 hrs	(gm)
NOBLE GAS	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IODINE	0.00E+00	5.00E-02	2.50E-01	2.10E+02
CESIUM	0.00E+00	5.00E-02	2.00E-01	3.15E+04
TELLURIUM	0.00E+00	0.00E+00	5.00E-02	2.82E+01
STRONTIUM	0.00E+00	0.00E+00	2.00E-02	1.07E+03
BARIUM	0.00E+00	0.00E+00	2.00E-02	3.14E+01
RUTHENIUM	0.00E+00	0.00E+00	2.50E-03	4.16E+01
CERIUM	0.00E+00	0.00E+00	5.00E-04	4.38E+02
LANTHANUM	0.00E+00	0.00E+00	2.00E-04	4.44E+00

5.4 Plant Specific Files (PSF)

5.4.1 Leakage from the Drywell through the Reactor Building

Table 5-5 Input Parameters for Drywell-Reactor Building Leakage Pathway

No.	Parameter	Value	Description	Source	other
5.4.1.1	Drywell Volume	1.3225E+5 ft ³	Free Air Volume of Reactor Drywell only	USAR [3] Table XIV-6-4	
5.4.1.2	Reactor Building Volume	200 ft ³	Reduced volume of the reactor building to allow for no holdup (mixing) approx Section 2.3.2	Applied Method based on compliance with RG 1.183 App. A4.4 [1]	0.057% of RN's remain after 1 min at SGTS flows
5.4.1.3	Environment	N/A			
5.4.1.4	Control Room Volume	1.419E+5 ft ³	Free Volume Control Room Envelope	USAR [3] Sec. 6.4.7.4.2	Sec. 2.4 NEDC 05-031[34]
5.4.1.5	Drywell to Reactor Building Leakage	0.635 %/day (5 min-24 hr) 0.3175 %/day (24-720 hrs)	Drywell Leakage. Leakage reduced after 24 hours due to reduced drywell volume pressure	CNS T.S. 5.5.12 [4] USAR [3] 6.3.7.2	Sect. 2.3.1
5.4.1.6	Drywell to Environment Leakage	0.635 %/day (0-5 min)	Initial release due to reactor building positive pressurization	CNS calc [43]	Sect. 2.3
5.4.1.7	Drywell Natural Deposition	10% (minimum deposition)	Powers model for BWR deposition (NUREG/CR-6189) [22]	RG 1.183 App A 3.2 [1]	NUREG/6604 details implementation in RADTRAD 3.03 [2]
5.4.1.8	Reactor Building to Environment Flow Through SGTS (ACTIVE)	1492 cfm	Table 2-4 SGTS Filter Flow and Efficiency	CNS Design Change 94-102 [44]	DC is also reflected in USAR Chapter XIV section 6.3.8.3 [3]
5.4.1.9	Reactor Building to Environment Flow Through SGTS (IDLE)	1492 cfm (0-1 hr.) 288 cfm (1-720 hr.)	Table 2-4 SGTS Filter Flow and Efficiency. 1 hour delay covers operator shutting off the train with the failed filter heater.	CNS Design Change 94-102 [44]	Maximum bypass flow per DC 94-102 [44] & Surveillance Procedure 6.1[32] is 280 cfm. To account for various uncertainties, 288 cfm is conservatively used.
5.4.1.10	Reactor Building to Environment Filter Efficiency Through SGTS (Active)	98% Aerosol 94% Elemental 94% Organic	Tech spec efficiencies were reduced by 1%. Section 2.3.2	CNS Tech. Spec. 5.5.7 [4.vii]	Correction of -1% to account for filter bypass R.G 1.52 [42]



No.	Parameter	Value	Description	Source	other
5.4.1.11	Reactor Building to Environment Filter Efficiency Through SGTS (Idle)	98% Aerosol 89% Elemental 29% Organic	Tech spec efficiencies were reduced by 1%. Section 2.3.2	CNS Tech. Spec. 5.5.7 [4.vii]	Correction of -1% to account for filter bypass R.G 1.52 [42]
5.4.1.12	Environment to Control Room Unfiltered Inleakage	400 cfm (0-720hrs)	Tracer gas test results - 64 cfm. Section 2.7	NCS report [11]	
5.4.1.13	Environment to Control Room Filtered Intake Flow	3235 cfm (0-1min) 810 cfm (1min-720 hr)	Used recommended 900-10% cfm for filtered flow. 1 min delay is used to provide operational margin. Sect. 2.7	Normal supply air: CNS dwg 2019 sheet 1[14] & filtered air: T.S. 5.5.7	T.S. 5.5.7 value is 900+/-10%.
5.4.1.14	Environment to Control Room Filtered Intake Efficiencies	0.0% (0-1min) 98%,89%,89% (1min-720hr)	The filter efficiency includes the 1% maximum bypass. Sect. 2.7		
5.4.1.15	Control Room to Environment Exhaust	3635 cfm (0-1 min.) 1210 cfm (1min-720hr)	Exhaust from control room (sum of all inflows)	Calculated	Based on RADTRAD Methodology
5.4.1.16	χ / Q Control Room Intake	4.15E-03 sec/m ³ (0-5min) 1.0E-10 sec/m ³ (5 min-1.3hr) 3.03E-04 sec/m ³ (1.3-1.8hr) 1.0E-10 sec/m ³ (1.8-2hr) 8.58E-10 sec/m ³ (2-8hr) 1.41E-8 sec/m ³ (8-24hr) 5.62E-9 sec/m ³ (24-96hr) 5.69E-9 sec/m ³ (96-720hr)	χ / Q Calculated by ARCON 96 Table 2, page 18 of 18 Scientech Calc. 17080-M-01 Rev 5 [16] 0-5 min = drywell>environ. 1.3-1.8 hr X/Q fumigation Sect. 2.8	NEDC 99-031 Rev. 5 [16]	Sect. 2.8 & 6, worst 2 hr EAB from 1.3 – 3.3 hour.
5.4.1.17	Breathing Factor (all offsite breathing locations)	3.5E-4 m ³ /sec (0-8.0hr) 1.8E-4 m ³ /sec (8-24hr) 2.3E-4 m ³ /sec (24-720hr)	RADTRAD Default Value (RG 1.183)	RG 1.183 RP 4.1.3 [1]	
5.4.1.18	Control Room Breathing Rate	3.5E-4 m ³ /sec (0-720 hr)	RADTRAD Default Value (RG 1.183)	RG 1.183 RP 4.2.6 [1]	
5.4.1.19	Control Room Occupancy Factors	1.0 (0-1 day) 0.6 (1-4 days) 0.4 (4-30 days)	RADTRAD Default Value (RG 1.183)	RG 1.183 RP 4.2.6 [1]	
5.4.1.20	χ / Q EAB (SGTS)	1.6E-5 sec/m ³ (0.0-1.3hr) 1.2E-4 sec/m ³ (1.3-1.8hr) 1.6E-5 sec/m ³ (1.8-10hr)	SGTS elevated release to EAB, fumigation until 1.8 hr Sect. 2.8	NEDC 99-036 Table 9.1 [18]	Sect. 2.8 & 6, worst 2 hr EAB from 1.3 – 3.3 hour
5.4.1.21	χ / Q LPZ (SGTS)	1.4E-4 sec/m ³ (0.0-1.8hr) 4.0E-5 sec/m ³ (1.8-8hr) 1.6E-5 sec/m ³ (8-24hr) 5.8E-6 sec/m ³ (24-96hr) 1.7E-6 sec/m ³ (96-720hr)	SGTS elevated release to LPZ, fumigation until 0.5 hr of worst 2 hr EAB finished (1.3-1.8 hr). Sect. 2.8	NEDC 99-036 Table 9.1 [18]	Calculated in NEDC 99-036 based upon parametric curves in figure 2 of RG 1.25

No.	Parameter	Value	Description	Source	other
5.4.1.22	Source Term Inventory	Inventory file on sheet "GE 14 RN"	GE 14 source term letter report, Feb. 29.2000	GE-MIG-1H69L-062 [8]	Nuclide selection from RADTRAD 3.03 [2] for generating offsite doses
5.4.1.23	Power Level	2381 MWt (OLTP)X 1.02 (2429)	Accepting existing accident dose consequence analyses performed at 1.02% of OLTP. The effect of this change is a reduction of instrumentation uncertainty from 2% to 0.38%.	CNS license amendment 231 [48] authorized an increase in maximum power level to 2419 MWt.	The OLTP has been increased by 2% to account for uncertainty associated with power measurement in accordance with SRP 15.6.5.
5.4.1.24	Decay & Daughtering	Active	Consistency With Reg. Guide Assumption "May Be Included"	RG 1.183 3.1 and 4.1.1 [1]	
5.4.1.25	Release Fractions	100% Noble Gases 30% Halogens 25% Alkali Metals 5% Tellurium Metals 2% Sr & Ba 0.25% Noble Metals 0.05% Ce 0.02% Lanthanides	Timed Release Fractions Consistent with Table 1 of RG 1.183. Used default BWR release fractions from RADTRAD 3.03	RG 1.183, Table 1 [1]	RADTRAD 3.03 Methodology outlined in NUREG/CR-6604 [2]
5.4.1.26	Dose Conversion Factors	FGR 11 (Inhalation) & FGR 12 (Submersion)		FGR 11/12 [19,20]	
5.4.1.27	Iodine Chemical Form Fractions	95% Aerosol 4.85% Elemental 0.15% Organic	RG 1.183, RADTRAD 3.03 Default for AST [1]	NUREG/CR-6604 [2]	

5.4.2 Release from the Drywell through the MSIV

Table 5-6 Input Parameters for Drywell-MSIV Leakage Pathway

No.	Parameter	Value	Description	Source	other
5.4.2.1	Drywell Volume	1.3225E+5 ft ³	Free Air Volume of Reactor Drywell only	USAR [3] Table XIV-6-4	
5.4.2.2	Turbine Building Volume	100 ft ³	Reduced volume of the reactor building to allow for no holdup (mixing) approx. Section 2.3.2	RG 1.183 App. A4.4 [1]	frac=exp(-500*time/100)
5.4.2.3	Condenser Volume	48000 ft ³	Section 2.4	[24]	
5.4.2.4	Environment	N/A			
5.4.2.5	Control Room Volume	1.419E+5 ft ³	Free Volume Control Room Envelope, Sec. 2.4	USAR [3] Sec. 6.4.7.4.2	NEDC 05-031[34]
5.4.2.6	Drywell Natural Deposition	10% (minimum deposition)	Powers model for BWR deposition (NUREG/CR-6189) [22]	RG 1.183 App A 3.2 [1]	NUREG/6604 details implementation in RADTRAD 3.03 [2]
5.4.2.7	Drywell to Condenser Leakage Failed MSIV steam line	1.337 cfm (0-24hrs) 0.6685 cfm (24-720 hrs)	Flowrate through the MSIV's 150 scfh in faulted line. Flow reduced to 75 scfh after 24 hours due to reduced drywell pressure, Sec. 2.4		
5.4.2.8	Drywell to Condenser Leakage in the 3 Un-failed MSIV steam lines	1.337 cfm (0-24hrs) 0.6685 cfm (24-720 hrs)	Total flowrate through all 3 un-failed MSIV's 150 scfh. Flow reduced to 75 scfh after 24 hours due to reduced drywell pressure, Sec. 2.4		
5.4.2.9	Failed MSIV Steam Line Aerosol DF		1 10 percentile settling DF=28, not credited	AEB 98-03 [15]	
5.4.2.10	Failed MSIV Steam Line Elemental DF		1 settling DF=1.8, not credited	Cline [30]	
5.4.2.11	Un-failed MSIV Steam Line Aerosol DF		1 10 percentile settling DF=28, not credited	AEB 98-03 [15]	
5.4.2.12	Un-failed MSIV Steam Line Elemental DF		1 settling DF=1.8, not credited	Cline [30]	

No.	Parameter	Value	Description	Source	other
5.4.2.13	Condenser Aerosol Effective Filtration	94.91% (0-24hrs) 97.39% (24-720 hrs)	Same as elemental deposition	Appendix A	
5.4.2.14	Condenser Elemental Effective Filtration	94.91% (0-24hrs) 97.39% (24-720 hrs)	Based on BWROG technique	Appendix A	
5.4.2.15	Condenser to turbine building transport	5.452 cfm (0-24 hrs) 2.726 cfm (24-720 hrs)	Condenser flow combines the 300 through the steam lines, Sect. 2.5	Conserving flow	
5.4.2.16	Turbine Building to Environment Leakage	500 cfm	Volumetric Release for no holdup in turbine building (5.4.2.2)	RG 1.183 App. A4.4 [1]	releases 99.3% / min
5.4.2.17	Environment to Control Room Inleakage (unfiltered)	400 cfm (0-720hrs)	Tracer gas test results - 64 cfm. Section 2.7	NCS report [11]	
5.4.2.18	Environment to Control Room Inleakage (filtered)	3235 cfm (0-1 min.) 810 cfm (1min-720 hr)	Used recommended 900-10% cfm for filtered flow. 1 min delay is used to provide operational margin. Section 2.7	Normal supply air: CNS dwg 2019 sheet 1[14] & filtered air: T.S. 5.5.7	T.S. 5.5.7 value is 900+/-10%.
5.4.2.19	Environment to Control Room Filtered Intake Efficiencies	0.0% (0-1min) 98%,89%,89% (1min-720hr)	The filter efficiency includes the 1% maximum bypass. Sect. 2.7	T.S. 5.5.7	
5.4.2.20	Control Room to Environment Exhaust	3635 cfm (0-1 min.) 1210 cfm (1min-720hr)	Sum of all inflows	NUREG/CR-6604 [2]	RADTRAD Methodology
5.4.2.21	χ / Q Control Room Intake from Turbine Building ground release	8.64E-4 sec/m ³ (0-2hr) 4.66E-4 sec/m ³ (2-8hr) 2.32E-4 sec/m ³ (8-24hr) 1.53E-4 sec/m ³ (24-96hr) 1.25E-4 sec/m ³ (96-720hr)	Turbine Building ground release. Section 2. 8	Table 2 NEDC 99-031 Sciencetech Calc 17080-M-01 Approved 3//19/03	NEDC 99-031 Rev. 4 [16]
5.4.2.22	Breathing Rates (all offsite breathing locations)	3.5E-4 m ³ /sec (0-8.0hr) 1.8E-4 m ³ /sec (8-24hr) 2.3E-4 m ³ /sec (24-720hr)	RADTRAD Default Value (RG 1.183)	NUREG/CR-6604 [2]	
5.4.2.23	Control Room Breathing Rate	3.5E-4 m ³ /sec (0-720 hr)	RADTRAD Default Value (RG 1.183)	NUREG/CR-6604 [2]	
5.4.2.24	Control Room Occupancy Factors	1.0 (0-1 day) 0.6 (1-4 days) 0.4 (4-30 days)	RADTRAD Default Value (RG 1.183)	NUREG/CR-6604 [2]	
5.4.2.25	χ / Q EAB (SGTS)	5.2E-4 sec/m ³ (0-10hrs)	Turbine building ground release to EAB. Includes building wake effects. Section 2. 8	NEDC 99-036 Table 9.1 [18]	Calculated in NEDC 99-036 based upon parametric curves in figure 2 of RG 1.25
5.4.2.26	χ / Q LPZ (SGTS)	2.9E-4 sec/m ³ (0-8hr) 7.3E-5 sec/m ³ (8-24hr) 2.5E-5 sec/m ³ (24-96hr) 5.2E-6 sec/m ³ (96-720hr)	Turbine building ground release to EAB. Includes building wake effects. Section 2.8		Calculated in NEDC 99-036 based upon parametric curves in figure 2 of RG 1.25

No.	Parameter	Value	Description	Source	other
5.4.2.27	Source Term Inventory	Inventory file on sheet "GE 14 RN"		GE-MIG-1H69L-062 [8]	Nuclide selection from RADTRAD 3.03 (2) for generating offsite doses
5.4.2.28	Power Level	2381 MWt (OLTP)X 1.02 (2429)	Accepting existing accident dose consequence analyses performed at 1.02% of OLTP. The effect of this change is a reduction of instrumentation uncertainty from 2% to 0.38%.	CNS license amendment 231 [48] authorized an increase in maximum power level to 2419 MWt.	The OLTP has been increased by 2% to account for uncertainty associated with power measurement in accordance with SRP 15.6.5.
5.4.2.29	Decay & Daughtering	Active	Consistency With Reg. Guide Assumption "May Be Included"	RG 1.183, RP 3.1	
5.4.2.30	Release Fractions	100% Noble Gases 30% Halogens 25% Alkali Metals 5% Tellurium Metals 2% Sr & Ba 0.25% Noble Metals 0.05% Ce 0.02% Lanthanides	Timed Release Fractions Consistent with Table 1 of RG 1.183. Used default BWR release fractions from RADTRAD 3.03. Section 2.2	NUREG/CR-6604 [2]	RADTRAD 3.03 Methodology outlined in NUREG/CR-6604
5.4.2.31	Dose Conversion Factors	FGR 11 (Inhalation) & FGR 12 (Submersion)	RG 1.183, RADTRAD Default for AST	FGR 11/12 [19 & 20]	
5.4.2.32	Iodine Chemical Form Fractions	95% Aerosol 4.85% Elemental 0.15% Organic	RG 1.183, RADTRAD Default for AST. Section 2.2	NUREG/CR-6604 [2]	


5.4.3 Release from the Suppression Pool through the ESF Components

Table 5-7 Input Parameters for the Suppression Pool-ESF Components Leakage Pathway

No.	Parameter	Value	Description	Source	other
5.4.3.1	Suppression Pool	9.6445E4 ft ³	Volume of Suppression Pool Liquid	USAR Table V-2-1 [3]	
5.4.3.2	Reactor Building Volume	200 ft ³	Volume of the reactor building reflects no holdup (mixing) approx. Section 2.3.1	RG 1.183 App. A4.4 [1]	0.057% of RN's remain after 1 min at SGTS flows
5.4.3.3	Environment	N/A			
5.4.3.4	Control Room Volume	1.419E+5 ft ³	Free Volume Control Room Envelope. Sec. 2.4	USAR 6.4.7.4.2 [3]	NEDC 05-031[34]
5.4.3.5	Pool to Reactor Building ESF Leakage	0.159 cfm	Flowrate from the suppression pool that leaks from ESF's and flashes. 1.59 cfm *10% flash = 0.159 cfm). Sect. 2.6		Using 45,000 cc/min. equivalent to 3000 cc/min at test conditions
5.4.3.6	Pool Release decontamination	Aerosols = 100%, Elementals = 0.0%, Organics = 0.0%	All aerosols retained in water	RG 1.183 App. A 5.3 [1]	
5.4.3.7	Reactor Building to Environment Flow Through SGTS (ACTIVE)	1492 cfm	Table 2-4 SGTS Filter Flow and Efficiency. With a 0.0166 hr start up delay, Sect. 2.3.2	CNS Design Change 94-102 [44]	DC is also reflected in USAR Chapter XIV section 6.3.8.3
5.4.3.8	Reactor Building to Environment Flow Through SGTS (IDLE)	1492 cfm (0.0166-1hrs) 288 cfm (1-720hrs)	Table 2-4 SGTS Filter Flow and Efficiency. 1 hour delay covers operator shutting off the train with the failed filter heater	CNS Design Change 94-102 [44]	Maximum bypass flow per DC 94-102 & Surveillance Procedure 6.1[32] is 280 cfm. To account for various uncertainties, 288 cfm is conservatively used.
5.4.3.9	Reactor Building to Environment Filter Efficiency Through SGTS (Active)	98% Aerosol 94% Elemental 94% Organic	Tech spec efficiencies were reduced by 1%. Section 2.3.2	CNS Tech. Spec. 5.5.7 [4.vii]	Correction of -1% to account for filter bypass R.G 1.52 [42]
5.4.3.10	Reactor Building to Environment Filter Efficiency Through SGTS (Idle)	98% Aerosol 89% Elemental 29% Organic	Tech spec efficiencies were reduced by 1%. Section 2.3.2	CNS Tech. Spec. 5.5.7 [4.vii]	Correction of -1% to account for filter bypass R.G 1.52 [42]
5.4.3.11	Environment to Control Room Unfiltered Inleakage	400 cfm (0-720hrs)	Tracer gas test results - 64 cfm. Section 2.7	NCS report [11]	

No.	Parameter	Value	Description	Source	other
5.4.3.12	Environment to Control Room Filtered Intake Flow	3235 cfm (0-1min) 810 cfm (1min-720 hr)	Used recommended 900-10% cfm for filtered flow. 1 min delay is used to provide operational margin. Sect. 2.7	Normal supply air: CNS dwg 2019 sheet 1[14] & filtered air: T.S. 5.5.7	T.S. 5.5.7 value is 900+/-10%.
5.4.3.13	Environment to Control Room Filtered Intake Efficiencies	0.0% (0-1min) 98%,89%,89% (1min-720hr)	The filter efficiency includes the 1% maximum bypass. Sect. 2.7		
5.4.3.14	Control Room to Environment Exhaust	3635 cfm (0-1min) 1210 cfm (1min-720 hr)	Exhaust from control room (sum of all inflows). Sect. 2.7	NUREG/CR-6604 [2]	RADTRAD 3.03 Methodology
5.4.3.15	χ / Q Control Room Intake SGTS	1.0E-10 sec/m ³ (0-1.3hr) 3.03E-04 sec/m ³ (1.3-1.8hr) 1.0E-10 sec/m ³ (1.8-2hr) 8.58E-10 sec/m ³ (2-8hr) 1.41E-8 sec/m ³ (8-24hr) 5.62E-9 sec/m ³ (24-96hr) 5.69E-9 sec/m ³ (96-720hr)	χ / Q Calculated by ARCON 96 Table 2, page 18 of 18 Review Scientech Calc [16]. 1.3-1.8 hr χ / Q is due to fumigation assumption. Sect. 2.8 & 6	NEDC 99-031 Rev. 5 [16]	NEDC 99-031 values were calculated based on ARCON96
5.4.3.16	Breathing Factor (all offsite breathing locations)	3.5E-4 m ³ /sec (0-8.0hr) 1.8E-4 m ³ /sec (8-24hr) 2.3E-4 m ³ /sec (24-720hr)	RADTRAD Default Value (RG 1.183)	RG 1.183 RP 4.1.3 [1]	
5.4.3.17	Control Room Breathing Rate	3.5E-4 m ³ /sec (0-720 hr)	RADTRAD Default Value (RG 1.183)	RG 1.183 RP 4.2.6 [1]	
5.4.3.18	Control Room Occupancy Factors	1.0 (0-1 day) 0.6 (1-4 days) 0.4 (4-30 days)	RADTRAD Default Value (RG 1.183)	RG 1.183-RP 4.2.6 [1]	
5.4.3.19	χ / Q EAB (SGTS)	1.6E-5 sec/m ³ (0.0-1.3hr) 1.2E-4 sec/m ³ (1.3-1.8hr) 1.6E-5 sec/m ³ (1.8-10hr)	SGTS elevated release to EAB, fumigation 0.5 hr taken at 1.3-1.8 hour.	NEDC 99-036 Table 9.1 [18]	Worst 2 hours between 1.3 and 3.3 hours. Sect 2.8 & 6
5.4.3.20	χ / Q LPZ (SGTS)	4.0E-5 sec/m ³ (0.0-1.3hr) 1.4E-4 sec/m ³ (1.3-1.8hr) 4.0E-5 sec/m ³ (1.8-8hr) 1.6E-5 sec/m ³ (8-24hr) 5.8E-6 sec/m ³ (24-96hr) 1.7E-6 sec/m ³ (96-720hr)	SGTS elevated release to LPZ, fumigation 0.5 hr taken at 1.3-1.8 hour. Sect. 2.8 & 6	NEDC 99-036 Table 9.1 [18]	Calculated in NEDC 99-036 based upon parametric curves in figure 2 of RG 1.25
5.4.3.21	Source Term Inventory	Inventory file on sheet "GE 14 RN"	GE 14 source term letter report, Feb. 29.2000. Sect 2.2	GE-MIG-1H69L-062 [8]	Nuclide selection from RADTRAD (2) for generating offsite doses
5.4.3.22	Power Level	2381 MWt (OLTP)X 1.02 (2429)	Accepting existing accident dose consequence analyses performed at 1.02% of OLTP. The effect of this change is a reduction of instrumentation uncertainty from 2% to 0.38%.	CNS license amendment 231 [48] authorized an increase in maximum power level to 2419 MWt.	The OLTP has been increased by 2% to account for uncertainty associated with power measurement in accordance with SRP 15.6.5.

No.	Parameter	Value	Description	Source	other
5.4.3.23	Decay & Daughtering	Active	Consistency With Reg. Guide Assumption "May Be Included"	RG 1.183 3.1	
5.4.3.24	Release Fractions	0% Noble Gases 30% of Iodine	Timed Release Fractions Consistent with Table 1 of RG 1.183. and from Appendix A RP 5. Particulate remains in pool.	RG 1.183 Table 1 [1]	RADTRAD 3.03 Methodology outlined in NUREG/CR-6604
5.4.3.25	Dose Conversion Factors	FGR 11 (Inhalation) & FGR 12 (Submersion)		FGR 11/12 [19 & 20]	
5.4.3.26	Iodine Chemical Form Fractions	0% Aerosol 97% Elemental 3% Organic	RG 1.183, RADTRAD 3.03 Default for AST, Sect. 2.6	NUREG/CR-6604 [2]	

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Detailed Input File

RADTRAD 3.03 develops a detailed input file for each case generated. The “Leakage” release path input is in Attachment B, it combines the data read into the code with a list of the values the code will use with definitions. The “MSIV” release path input is in Attachment D and the “ESF” release path input is in Attachment F.

Detailed Output File

RADTRAD 3.03 develops a detailed output file sequentially numbered (.o0, o1, o2, etc) as a function of the amount of cases generated. The “Leakage” release path output is in Attachment C, it details the growth in dose at several steps with the variation of I-131 in each compartment and the final dose results. The “MSIV” release path output is shown in Attachment E and the “ESF” release path output is shown in Attachment G.

Activity Variation with time results (Shielding data)

Alion-RADTRAD 310 was used to examine the nuclide inventory versus time for the control room filter. Thus, all 3 paths were merged into the “Leakage-MSIV-ESF” input is shown in Attachment H and output in Appendix I. As is shown, the input for the “310” run is the same as the “303” runs except for the lack of multiple X/Q’s for the offsite EAB and LPZ dose analysis which results in a lower dose at those locations.

Appendix J details the radionuclide activity (Ci) at each shielding location as generated by the Alion-310 analysis. The locations chosen were: Drywell, Reactor Building, Suppression Pool, Environment, and Control Room Filter

Table Audits

Many of the tables used in this document are spreadsheet based. These tables are detailed in formula audit mode in Appendix K.

6 RESULTS AND CONCLUSIONS

The results of the RADTRAD 3.03 generated TEDE dose analyses are summarized in Table 6-1 and Table 6-2:

Table 6-1 TEDE Dose as a Function of Release Path


Dose Location	Leakage (rem TEDE)	MSIV (rem TEDE)	ESF (rem TEDE)
Control Room	0.374	2.401	0.102
EAB	0.458	0.375	0.170
LPZ	1.559	2.311	1.727

The worst 2 hour increase in EAB TEDE dose occurs between 1.3 and 3.3 hours, based upon the summation of the drywell leakage, the MSIV and the pool ESF path transient dose results.

Table 6-2 Total LOCA TEDE Dose


Dose Location	Total Dose (rem TEDE)	Accident Dose Criteria (rem TEDE)
Control Room	2.877	5
EAB	1.002	25
LPZ	5.596	25

All calculated TEDE doses were found to be below the stipulated limits. It is therefore concluded that the regulatory dose limits will not be exceeded following a postulated design basis LOCA at Cooper Nuclear Station.


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- B. RADTRAD 3.03 Plant Specific Input Leakage Pathway
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APPENDIX A

Condenser Effective Filter Efficiency Calculation

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Definitions and Acronyms

Acronym	Definition
ALT	Alternate Leakage Pathway
AST	Alternative Source Term
CNS	Cooper Nuclear Station
LOCA	Loss of Coolant Accident
LPT	Low Pressure Turbine
MSIV	Main Steam Isolation Valve
NRC	Nuclear Regulatory Commission
RG	Regulatory Guide
RP	Regulatory Position (Regulatory Guide 1.183, Reference A7.1)
Sch	Pipe Schedule
SSE	Safe Shutdown Earthquake


Variable	Definition and Units of Measure
scfh	Standard Cubic Feet per Hour

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Computer/Software Data

Nuclear safety related computer software/programs are not used within this appendix calculation.

The Microsoft Program EXCEL spreadsheet is used to perform numeric calculations as described within the appendix calculation.

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A1.0 Purpose

The purpose of this appendix calculation is to determine the main condenser's effective filter efficiency (radionuclide removal efficiency) to be credited in the Cooper Nuclear Station (CNS) Alternative Source Term (AST) Loss of Coolant Accident (LOCA) dose calculation (main body of this calculation). The CNS main condenser effective filter efficiency (radionuclide removal efficiency) are developed based on the BWROG model documented in NEDC-31858-P-A, Appendix C (Reference A7.5). [[

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The LOCA dose calculation (main body of this calculation) assumes that the MSIV leakage travels through both the long run of the 24-inch steam lines (Pathway P2 as depicted in Reference A7.20) and through the drain lines (Pathway P1) immediately downstream of the outboard MSIVs (MS-AOV-86A, MS-AOV-86B, MS-AOV-86C, MS-AOV-86D). In this analysis of the condenser efficiency it is conservatively assumed that all the MSIV leakage flow is through the drain line and enters near the top of the condenser, thus reducing the decontamination. Main condenser effective filter efficiency (radionuclide removal efficiency) values are determined for particulates including particulate iodine and for elemental iodine. MSIV leakage rates considered in this analysis are 200 scfh, 300 scfh (current value in the main body of this calculation, Section 2.4), and 400 scfh.

The main condenser effective filter efficiency (radionuclide removal efficiency) values determined within this appendix calculation are subsequently used in the main body of this document for the determination of the radiological dose consequence from a postulated LOCA.

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A2.0 Design Input and Development

A2.1 The MSIV leakage rate post-LOCA directed to the main condenser via the MSIV leakage pathway is 300 scfh as documented in the radiological dose consequence calculation (main body of this calculation, Section 2.4.3). As documented in the main body of this calculation, Section 2.5, this MSIV leakage rate is reduced as a step function at 24 hours to 150 scfh.

A main condenser effective filter efficiency (radionuclide removal efficiency) sensitivity study using MSIV leakage rates of 200 scfh until 24 hours post-LOCA with 100 scfh thereafter and 400 scfh until 24 hours post-LOCA with 200 scfh thereafter are also evaluated.

A2.2 As previously developed and documented in calculation ALION-CAL-NPPD-3236-002 (main body of this calculation, Section 2.4), at the Cooper facility, the MSIV leakage pathway between the outboard MSIV's and the main condenser has been accepted by the NRC in CNS License Amendments 196 (Reference A7.3) and 206 (Reference A7.4) as being capable of withstanding the seismic loadings of a safe shutdown earthquake (SSE). The steam lines, turbine, and condenser were all found to be seismically robust, thus they conform to USNRC RG 1.183, Appendix A, RP 6.5 (Reference A7.1). Therefore, radionuclide removal within the main condenser via decay and deposition (plate-out) may be credited.

A2.3 Design input used in the calculation of main condenser volume above the MSIV leakage pathway P1, steam drain line, connection (calculation section A5.1) consists of the main condenser and associated component drawings documented within calculation section A5.1 and listed in calculation section A7. A 5% reduction in volume was assumed for additional conservatism.

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A3.0 Assumptions

A3.1 The Reference A7.5, Appendix C, Section 7 methodology for elemental iodine mixing and removal in the main condenser is utilized in this appendix calculation. Justification for the use of the same methodology for deposition of particulates within either pipes or the condenser is taken from Reference A7.6 (referenced within RG 1.183, Appendix A, Reference A-9) Section 1.1 which states "For the low-velocity transport in the present study, particulates would deposit quantitatively with near 100% efficiency. This analysis, therefore, treats airborne particulate iodine as though it were gaseous elemental iodine." This position is further substantiated by the NRC staff conclusions from Section 3.2.1.4 of Reference A7.7.


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A3.2 No decay or plate-out of organic iodine within the main condenser is credited.

A3.3 Conservatively, credit for main condenser volume above the MSIV leakage pathway P1 drain line elevation is taken only within the single shell in which the MSIV leakage enters. This assumption significantly under-predicts the condenser volume available for calculation of effective removal efficiency, and is thus conservative.

A3.4 All of the MSIV leakage flow is assumed to travel through pathway P1 as depicted in Reference A7.20. This is conservative because a significant fraction of the MSIV leakage flow should flow through the larger diameter Alternative Leakage Treatment (ALT) Pathway, P2.

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A4.0 Methodology

A4.1 Determination of Main Condenser Free Volume above ALT Pathway Inlet Elevation

Calculation Section A5.1 quantifies the condenser free volume to be credited in the Cooper Nuclear Station (CNS) Alternative Source Term (AST) Loss of Coolant Accident (LOCA) calculation for the twin condensers and the connection between the condensers above the drain line connection "BM" and below the top of the exhaust trunk.


The free volume is computed by using the condenser fabrication drawings (calculation section A7) to calculate the condenser shell volume above the drain line and below the top of the exhaust trunk, and subtracting the volume of structural members or other features, e.g., feedwater heater. The following calculations provide the results by condenser section.


Calculation dimensions are obtained where identified on the applicable drawings. Where dimensions are not specifically identified, dimensions used were developed via use of "to-scale" drawing prints.

A4.2 Determination of Main Condenser Effective Filter Efficiency

Overview:

Reference A7.5, Appendix C, Section 7 develops the effective filter efficiency (radionuclide removal efficiency) for elemental iodine [[

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A5.0 Analysis

A5.1 Determination of Main Condenser Free Volume above ALT Pathway Inlet Elevation

The following section provides the calculation of the condenser volume by section. References to the applicable drawings are noted.

A5.1.1 Exhaust Trunk (Dwg. EC93877E3, Reference A7.8)

Exhaust Trunk gross volume:

Volume depicted in Figure A5.1 below.

$$\begin{aligned}
 V_{EH \text{ gross}} &= (L)(W)(H) \\
 &= (30.06 \text{ ft})(27.15 \text{ ft})(4.50 \text{ ft}) \\
 &= \underline{3672.58 \text{ ft}^3}
 \end{aligned}$$

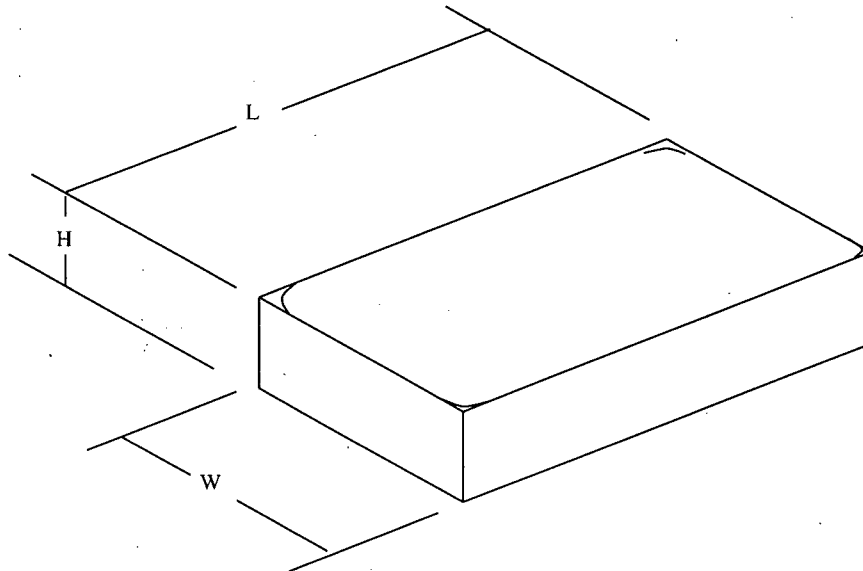



Figure A5.1 – Exhaust Trunk

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Angle Bracing – E-310 (8 Pieces – 4” Φ Sch 80; 4.5” OD)

$$\begin{aligned}
 V_{310} &= -(L_{total})(\pi/4)(D) \\
 &= -[(1.25/12 + 15-8.5)/\cos(45)][(\pi/4)(4.5/12)^2(8 \text{ pieces})] \\
 &= \underline{-8.25 \text{ ft}^3}
 \end{aligned}$$

Angle Bracing – E-309 (8 pieces 4.5” OD)

$$\begin{aligned}
 V_{309} &= -(L_{total})(\pi/4)(D) \\
 &= -[(1.25/12+15-4.5)/\cos(45)][(\pi/4)(4.5/12)^2(8 \text{ pieces})] \\
 &= \underline{-13.25 \text{ ft}^3}
 \end{aligned}$$


Cross Bracing – Lower Assy – E-317A (2 pieces 5.563” OD, Sch 40); E-318A (2 pieces 3.5” OD, Sch 80)

Neglect bar stock:

$$\begin{aligned}
 V_{\text{cross br}} &= (L_1)(\pi/4)(D_1^2) + (L_2)(\pi/4)(D_2^2) \\
 &= (24\text{ft})(\pi/4)(5.563/12)^2 + (27)(\pi/4)(3.5/12)^2 \\
 &= \underline{-5.85 \text{ ft}^3}
 \end{aligned}$$

Cross Bracing – Upper Assy

$$\begin{aligned}
 &= [(13\text{ft})(2) + (11.67)(2)][(\pi/4)(5.563/12)^2 + (4)(8)^{1/2}(\pi/4)(3.5/12)^2] \\
 &= \underline{-9.08 \text{ ft}^3}
 \end{aligned}$$


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Corner Segments – Expansion Joint

$$\begin{aligned}
 V_{\text{joint corners}} &= (A_{\text{segment}})(H)(4 \text{ segments}) \\
 &= \frac{1}{2} R^2(\theta - \sin(\theta))(H) \quad [\text{Reference A 7.21}] \\
 &= \frac{1}{2}(22.625/12)^2(0.4647 - \sin(26.63))(27.75/12)(4 \text{ segments}) \\
 &= \underline{-0.27 \text{ ft}^3}
 \end{aligned}$$

Exhaust Trunk Net Volume

$$V_{\text{Trunk Net}} = 3635.88 \text{ ft}^3 (3672.58 - 8.25 - 13.25 - 5.85 - 9.08 - 0.27)$$

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A5.1.2 Exhaust Hood Gross Volume (Dwgs. EC93877GA, EC93877E2-A, References A7.9 & A7.10)

The exhaust hood is depicted in Figure A5.2 below.

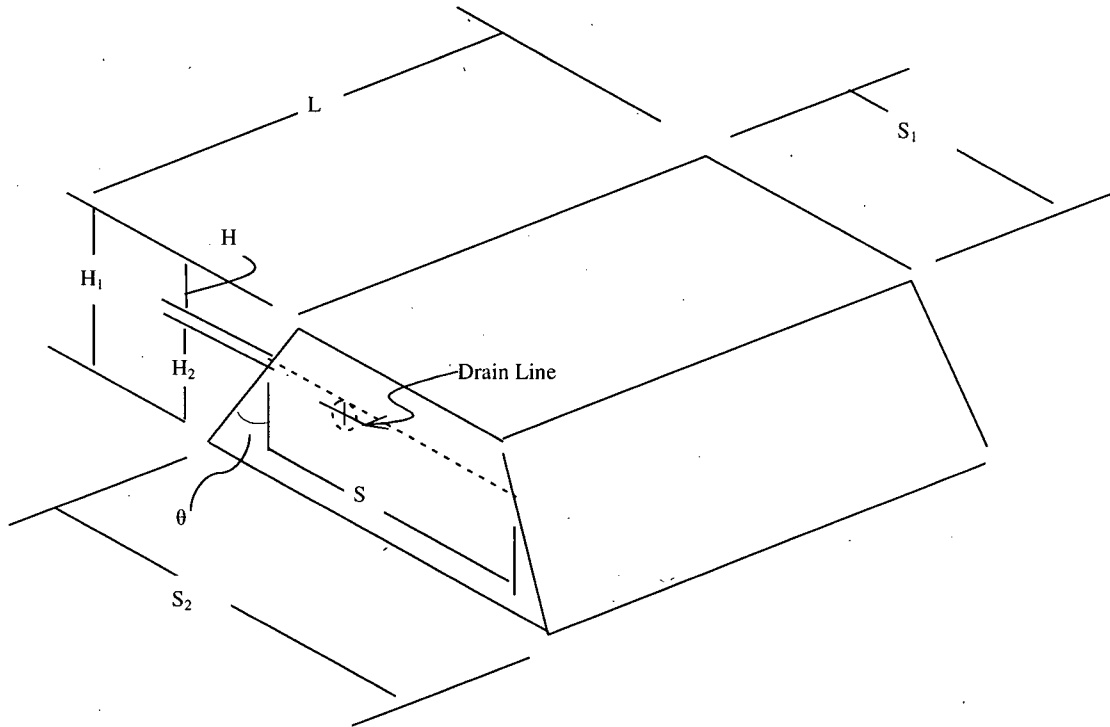


Figure A5.2 – Exhaust Hood

Table A5.1 – Exhaust Hood Gross Volume

Exhaust Hood Gross Volume			
Dimension	Value	Comments	Drawing Number
H ₁ (ft)	16.75	Top @ 921 ft	EC93877GA
		Bot @ 904.25 ft	Reference A7.9
H ₂ (ft)	9.25 (centerline of connection BM)	Top @ 913.5 ft Bot @ 904.25 ft	EC93877GA
Height above drain line (H) (ft)	7.375	H ₁ – H ₂ - .125 ft (3" drain connection, 913.625)	EC93877GA
Length (L) (ft)	30		EC93877GA
S ₁ (ft)	27		EC93877GA
S ₂ (ft)	39.5		EC93877GA
S (ft)	32.544	Derived, see box	
Volume	6587.06 ft³	$\frac{1}{2}(S + S_1)(h)(L)$	

$$\tan \theta = \frac{H_1}{\frac{1}{2}(S_2 - S_1)}$$

$$\text{So } \theta = \tan^{-1} \left(\frac{16.75}{\frac{1}{2}(39.5 - 27)} \right)$$


$$\text{So } \theta = 69.54^\circ$$

$$\text{So } S' = \frac{H}{\tan(69.54^\circ)}$$

$$S' = 2.772 \text{ ft ; thus}$$

$$S = S_1 + 2(S')$$

$$S = 32.544 \text{ ft}$$

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A5.1.3 Feedwater Heater (Dwgs. EC93877GA, EC93877E2-A, References A7.9 & A7.10)

The Feedwater heater is depicted in Figure A5.3 below.

Diameter Adjustment for Erosion Shroud

1.25" added to top 180°; so

$$\begin{aligned}
D_{1 \text{ adjusted}} &= 89.25/12 \text{ ft} + (2)(1.25/12)/2 \text{ ft} \\
&= 7.54 \text{ ft}
\end{aligned}$$

$$\begin{aligned}
D_{2 \text{ adjusted}} &= 84.25/12 \text{ ft} + (2)(1.25/12)/2 \text{ ft} \\
&= 7.13 \text{ ft}
\end{aligned}$$

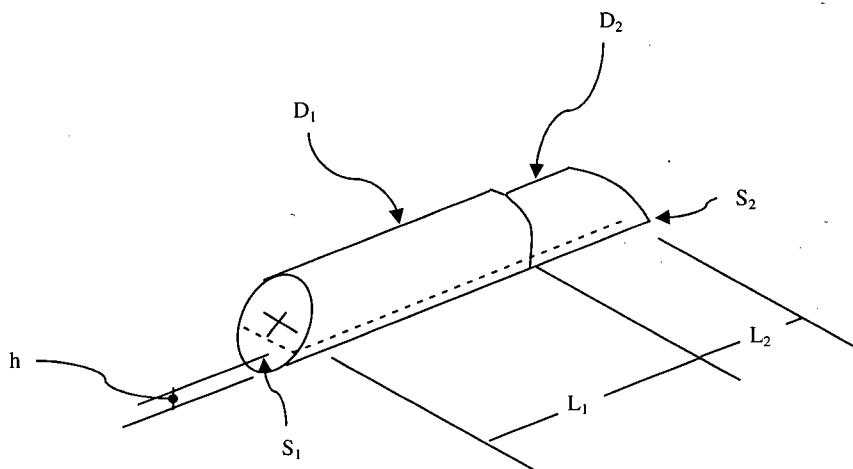


Figure A5.3 – Feedwater Heater

Table A5.2 – Feedwater Heater Volume

Feedwater Heater Volume			
Dimension	Value	Comments	Drawing Number
Length (L ₁) (ft)	22.51		M-81762, Ref A7.11
Length (L ₂) (ft)	9.75		M-81762
Adj Diameter (D ₁) (ft)	7.54	adjusted for erosion shroud	M-81762
Adj Diameter (D ₂) (ft)	7.13	adjusted for erosion shroud	M-81762
Height below Drain Line (h) (ft)	2.25	approximated based on D ₂	EC93877GA, Ref. A7.9
Volume 1 (ft ³)	1005.10	$\pi/4(D_1)^2(L_1)$	
Volume 2 (ft ³)	389.29	$\pi/4(D_2)^2(L_2)$	
Area Sector 1 (A _{s1}) (ft ²)	11.18	See below	
Area Sector 2 (A _{s2}) (ft ²)	10.80	See below	
Volume Sector 1 (V _{s1}) (ft ³)	251.74	(A _{s1})(L ₁)	
Volume Sector 2 (V _{s2}) (ft ³)	105.35	(A _{s2})(L ₂)	
Total Volume above Drain Line	-1037.30		

Circular Segment Area [Reference A 7.21]

$$A_s = R^2 \cos^{-1} \left[\frac{R-h}{R} \right] - (R-h) (2Rh - h^2)^{1/2}$$

For example,

$$A_{s1} = (7.54/2)^2 \cos^{-1} (7.54/2 - 2.25)/7.54/2 - (7.54/2 - 2.25) * (2*7.54/2*2.25 - 2.25^2)^{1/2}$$

$$A_{s1} = 11.18 \text{ ft}^2$$

A5.1.4 Extraction Steam Piping

Long Radius Elbow

For a long radius elbow:

$$r/d = 1.5;$$

Thus the equivalent axial length

$$L_{LR} = (1/4)(2)(\pi)(R) \quad \text{or}$$

$$L_{LR} = (1/4)(2)(\pi)(1.5)(d) \quad \text{or}$$

$$L_{LR} = 0.75\pi d$$

Short Radius Elbow

For a short radius Elbow:

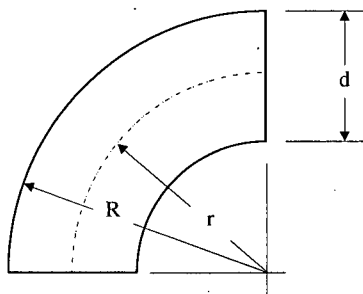
$$r/d = 1.0$$

Thus the equivalent axial length

$$L_{SR} = (1/4)(2)(\pi)(R) \quad \text{or}$$

$$L_{SR} = (1/4)(2)(\pi)(1.0)(d) \quad \text{or}$$

$$L_{SR} = 0.50\pi d$$



45° Elbow

For a 45° Elbow:

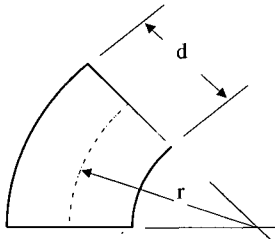
$$r/d = 1.5$$

Thus the equivalent axial length

$$L_{45} = (1/2)(1/4)(2)(\pi)(R) \quad \text{or}$$

$$L_{45} = (1/2)(1/4)(2)(\pi)(1.5)(d) \quad \text{or}$$

$$L_{45} = 0.375\pi d$$




A5.1.4.1 Feedwater Heater Nozzles – 4 Total – 30” OD (Drawing M-81762, Reference A7.11)

Four nozzles total; assume all 1 ft long;

$$V = (\pi/4)(30/12)^2(4)$$

$$= 19.63 \text{ ft}^3$$

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A5.1.4.2 30" Extraction Steam Piping – Two (2) Long Spools (EP-A-14) (Drawing DC93877EP)
(Reference A7.12)

Conservatively neglect the reduction from 30" pipe to 24" pipe to account for bellows; two SR elbows:

Equivalent Length (L_{equiv}):

$L_{equiv} = L_{centerline} - D_1 - D_2 + 2(0.50)(\pi)(D_1)$, where straight pipe length is calculated by subtracting the pipe diameters D_1 and D_2 from the given centerline length of the short radius elbows (with $r/d = 1$).

$$= [12.75 \text{ ft} - 30/12 \text{ ft} - 26/12 \text{ ft} + 2(0.50)(\pi)(30/12\text{ft})][2 \text{ spools}]$$

$$= 31.87 \text{ ft}$$

Volume (V)

$$V = (31.87)(\pi/4)(30/12)^2 \text{ ft}^3$$

$$= -156.44 \text{ ft}^3 \text{ (for 2 spools)}$$

A5.1.4.3 30" Extraction Steam Piping – Two (2) Short Spools (EP-A-15) (Drawing DC93877EP)
(Reference A7.12)

These piping spools consist of a 30" SR elbow connected to a fabricated elbow reducing to 26", plus a 26" bellows assembly. Conservatively assume two (2) 30" SR elbows plus two feet of 30" pipe.

Equivalent Length (L_{equiv}):

$$L_{equiv} = L_{centerline} - D_1 - D_2 + 2(0.50)(\pi)(D_1)$$


$$= [5.0 \text{ ft} - 30/12 - 26/12 + 2(0.50)(\pi)(30/12\text{ft})][2 \text{ spools}]$$

$$= 16.37 \text{ ft}$$

Volume (V)

$$V = (16.37)(\pi/4)(30/12)^2 \text{ ft}^3$$

$$= -80.36 \text{ ft}^3$$

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A5.1.4.4 24" Extraction Steam Piping – One (1) Spool (EP-A-13) (Drawing CC93877EP-A-13)
(Reference A7.13)

Spool consists of 24" piping, 2 LR elbows, and one (1) 24 x 22" reducer. Conservatively neglect reduction.

Equivalent Length (L_{equiv}):

$$\begin{aligned}
 L_{equiv} &= L_1 + L_2 + L_3 + + (2 \text{ elbows})(0.75)(\pi)(D) \\
 &= (17.5 - 3.75) + 2.5 + 3 + 2(0.75)(\pi)(24/12\text{ft}) \\
 &= 28.67 \text{ ft}
 \end{aligned}$$

Volume (V)

$$\begin{aligned}
 V &= (28.67)(\pi/4)(24/12)^2 \text{ ft}^3 \\
 &= -90.07 \text{ ft}^3
 \end{aligned}$$

A5.1.4.5 24" Extraction Steam Piping – One (1) Spool (EP-A-12) (Drawing CC93877EP-A-12)
(Reference A7.14)


Spool consists of 24" piping, two (2) SR elbows, one (1) 45° elbow, and one (1) 24 x 22" reducer. Conservatively neglect reduction.

Equivalent Length (L_{equiv}):

$$\begin{aligned}
 L_{equiv} &= L_1 + L_2 + L_3 + L_4 + (2 \text{ elbows})(0.50)(\pi)(D) + (1 - 45^\circ \\
 &\text{elbow})(1/2)(0.75)(\pi)(D) \\
 &= (13.5 - 3.75) + (3.5/12) + (50/12) + 1.5 + (2)(0.5)(\pi)(24/12) + \\
 &(\text{.5})(0.75)(\pi)(24/12) \\
 &= 24.35 \text{ ft}
 \end{aligned}$$

Volume (V)

$$\begin{aligned}
 V &= (24.35)(\pi/4)(24/12)^2 \text{ ft}^3 \\
 &= -76.50 \text{ ft}^3
 \end{aligned}$$

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A5.1.4.6 20" Extraction Steam Piping – One (1) Spool (EP-A-11) (Drawing CC93877EP-A-11)
(Reference A7.15)

Equivalent Length (L_{equiv}):

$$\begin{aligned}
 L_{equiv} &= L_1 + (4 - 45^\circ \text{ elbows})(1/2)(0.75)(\pi)(D) + (1 \text{ LR elbow})(0.75)(\pi)(D) + L_2 + L_3 \\
 &= (7.35 - 3.75) + (4)(1/2)(0.75)(\pi)(20/12) + (1)(0.75)(\pi)(20/12) + 0.36 + 1.17 \\
 &= 16.91 \text{ ft}
 \end{aligned}$$

Volume (V)

$$\begin{aligned}
 V &= (16.91)(\pi/4)(20/12)^2 \text{ ft}^3 \\
 &= -36.89 \text{ ft}^3
 \end{aligned}$$

A5.1.4.7 20" Extraction Steam Piping – One (1) Spool (EP-A-10) (Drawing CC93877EP-A-10)
(Reference A7.16)

Equivalent Length (L_{equiv}):

$$\begin{aligned}
 L_{equiv} &= L_1 + (1 - 45^\circ \text{ elbow})(1/2)(0.75)(\pi)(D) + (1 \text{ SR elbow})(0.50)(\pi)(D) + L_2 \\
 &= (18.83 - 3.75) + (1/2)(0.75)(\pi)(20/12) + (1)(0.50)(\pi)(20/12) + 3.33 \\
 &= 22.99 \text{ ft}
 \end{aligned}$$


$$\begin{aligned}
 V_{pipe} &= (22.99)(\pi/4)(20/12)^2 \text{ ft}^3 \\
 &= 50.16 \text{ ft}^3
 \end{aligned}$$

Additional structural steel; neglect steel saddles:

$$\begin{aligned}
 L_{equiv} &= L_1 + L_2 \text{ (2" Sch 80 pipe; OD 2.375")} \\
 &= (18.83 - 4.33) + (18.83 - 3.83) \\
 &= 29.5 \text{ ft}
 \end{aligned}$$

$$\begin{aligned}
 V_{support} &= (29.5)(\pi/4)(2.375/12)^2 \\
 &= 0.91 \text{ ft}
 \end{aligned}$$

$$V_{tot} = -51.07 \text{ ft}^3$$

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A5.1.4.8 20" Extraction Steam Piping – One (1) Spool (EP-A-9) (Drawing CC93877EP-A-9)
(Reference A7.17)

Equivalent Length (L_{equiv}):

$$\begin{aligned}
 L_{equiv} &= L_1 + (1 - 45^\circ \text{ elbow})(1/2)(0.75)(\pi)(D) + (1 \text{ LR elbow})(0.75)(\pi)(D) + L_2 \\
 &= (15.5 - 3.75) + (1/2)(0.75)(\pi)(20/12) + (1)(0.75)(\pi)(20/12) + 3.31 \\
 &= 20.95 \text{ ft}
 \end{aligned}$$

$$\begin{aligned}
 V_{pipe} &= (20.95)(\pi/4)(20/12)^2 \text{ ft}^3 \\
 &= 45.71 \text{ ft}^3
 \end{aligned}$$

Additional structural steel; neglect steel saddles:

$$\begin{aligned}
 L_{equiv} &= L_1 + L_2 && (2" \text{ Sch 80 pipe; OD } 2.375") \\
 &= (15.50 - 4.33) + (15.50 - 3.83) \\
 &= 22.84 \text{ ft}
 \end{aligned}$$

$$\begin{aligned}
 V_{support} &= (22.84)(\pi/4)(2.375/12)^2 \\
 &= 0.70 \text{ ft}
 \end{aligned}$$

$$V_{tot} = -46.41 \text{ ft}^3$$



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Table A5.3 – Extraction Steam Piping Total

Extraction Steam Piping Total				
Item	Dimension	Length (ft)	Volume (ft ³)	Remarks
1	Fdwtr Htr Nozzles (4 @ 1' x 30" OD)	4.00	19.63	Ref. A7.11
2	30" Extraction Steam Piping (2 long spools)	31.87	156.46	Ref. A7,12
3	30" Extraction Steam Piping (2 short spools)	16.37	80.38	
4	24" Extraction Steam Piping Spool EP-A-13	28.67	90.08	
5	24" Extraction Steam Piping Spool EP-A-12	24.35	76.49	
6	20" Extraction Steam Piping Spool EP-A-11	16.91	36.89	
7	20" Extraction Steam Piping Spool EP-A-10	22.99	51.07	Volume Includes 0.91 ft ³ Struct Steel
8	20" Extraction Steam Piping Spool EP-A-9	20.95	46.41	Volume Includes 0.70 ft ³ Struct Steel
	Total Volume above Drain Line		-557.42	


Note that due to the extra precision of the EXCEL calculation in the above table, the Volume results differ slightly from those presented in the preceding calculation text.

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A5.1.5 Condenser Structural Steel

Table A5.4 – Condenser Structural Steel

Condenser Structural Steel Summary (Ref A 7.18)				
No	Item	Volume (ft ³)	Drawing Number	Remarks
3.5.1	EA 208	-0.858	EC93877E2-A, Ref. A7.10	2 pieces 3.5" OD
3.5.2	EA 205	-1.144	EC93877E2-A	2 pieces 3.5" OD
3.5.3	EA 206	-1.175	EC93877E2-A	4 pieces 3.5" OD - Detail "H"
3.5.4	EA 207	-1.240	EC93877E2-A	2 pieces 3.5" OD
3.5.5	EA 209, 310, 211	-50.286	EC93877E2-A	2 Assy's total
3.5.6	EA 212	0.000	EC93877E2-A	Not included; below drain line
3.5.7	EA 213	-3.258	EC93877E2-A	1 piece
3.5.8	EA 214, 215	-10.506	EC93877E2-A	3 pieces 4.5" OD
3.5.9	EA 216	-3.912	EC93877E2-A	2 pieces 4.5" OD
3.5.10	EA 217	-1.596	EC93877E2-A	2 pieces 6.625" OD
3.5.11	EA 219	-2.913	EC93877E2-A	2 pieces 6.625" OD
3.5.12	EA 218	-2.479	EC93877E2-A	8 pieces 3.5" OD
3.5.13	EA 220	-0.496	EC93877E2-A	1 piece 3.5" OD
3.5.14	EA 221	-0.418	EC93877E2-A	1 piece 3.5" OD
3.5.15	EA 252	0.000	EC93877E2-A	Not included; shipping braces
3.5.16	EA 240	-3.464	EC93877E2-A DC93877SC-H, Ref. A7.18	Connection "J" plates
3.5.17	EA 238	-1.246	EC93877E2-A	Support plate
3.5.18	EA 225, 226, 227, 228	-0.384	EC93877E2-A	2 sets cross-bracing
3.5.19	EA 233, 234, 235, 236, 237	-0.186	EC93877E2-A	Cross bracing, Section "KK"
3.5.20	EA 229, 230, 231, 232	-0.226	EC93877E2-A	Cross bracing, Section "LL"
3.5.21	EA 222, 223, 224	-0.403	EC93877E2-A	Cross bracing ass'y; 1.660" OD
3.5.22	EA 242, 243, 244, 245	-10.434	EC93877E2-A	Top flange
3.5.23	EA 246	-0.422	EC93877E2-A	4 pieces, corner flange
3.5.24	Baffled Conn. "L" & "M"	-0.188	DC93877SC-H	2 connections each
3.5.25	Baffled Conn "AM"	-0.196	DC93877SC-H	4 Assy's
3.5.26	Baffled Conn. "BK, BJ, BM"	-0.022	DC93877SC-H	Detail "Z-B"
3.5.27	Baffled Conn. "BH"	-0.043	DC93877SC-H	Detail "BH"
TOTAL Structural Steel		-97.495		

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A5.1.6 Condenser Volume Not Credited

Condenser Connection

Work with Drawings EC93877GA (Reference A7.9) & EC93877SC-1A (Reference A7.19)

$$\text{Width} = 14' - 6'' \text{ minus } 2 \text{ times plate thickness of } 0.875'' = 14' - 4.25'' = 14.3542'$$

$$\text{Height} = 9' - 6''; \text{ half height} = 4' - 9'' \text{ minus } 1 \text{ plate thickness of } 0.875'' = 4' - 8.125''$$

Top of drain line is 13.5'' above connection centerline

$$\text{Height above drain line} = 4' - 8.125'' - 13.5'' = 3' - 6.625'' = 3.5521'$$

$$\text{Area} = \text{Width} * \text{Height} = (14.3542') (3.5521') = 50.9876 \text{ ft}^2$$

Reduce area for rounded corner (area outside radius arc) = $\frac{1}{2} R^2 (\theta - \sin(\theta))$

$$\text{Reduction area} = \frac{1}{2} (3' - 2'')^2 (\pi/2 - \sin(90^\circ)) = 2.8619 \text{ ft}^2 \text{ (2 corners)}$$

$$\text{Area} = 50.9876 - 2 \times 2.8619 = 45.2638 \text{ ft}^2$$

Volume = Area * Length

Length = 8' - 0'' minus reduction for change in length of upper hood

$$\text{Length reduction: Angle} = \tan^{-1} (0' - 6'' / 16' - 9'') = 1.7098^\circ$$

Length reduction based on height above drain line to top of connection


$$\text{Length reduction} = \tan(1.7098^\circ) (4' - 9'' - 13.5'' = 3' - 7.5'' = 3.625')$$

$$\text{Length reduction} = 0.1082'$$

$$\text{Volume} = (45.2638 \text{ ft}^2) (8' - 0.1082') = 357.21 \text{ ft}^3$$

Condenser 1B

Condenser 1B volume above drain line is expected to be similar to Condenser 1A by inspection of the reference drawings. Note that Condenser 1B has fewer connections. See calculation section A3.3.


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A5.1.7 Total Condenser Free Volume

Table A5.5 - Total Volume Condenser 1A

Volume	Description	Volume (ft ³)	Remarks
3.1	Exhaust Trunk	3635.88	
3.2	Exhaust Hood Gross Volume	6587.06	
3.3	Feedwater Heater	(1037.30)	
3.4	Extraction Steam Piping	(557.42)	
3.5	Condenser Structural Steel	(97.50)	
	Subtotal	8530.73	
	Additional Margin (5%)	(426.54)	
	Total Volume Condenser 1A	8104.19	

For calculation purposes, a Main Condenser 1A volume value of 8100 ft³ is used.

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A5.2 Determination of Main Condenser Effective Filter Efficiency (Radionuclide Removal Eff.)

The equations described in calculation section A4.2 are programmed into an EXCEL spreadsheet, using the CNS specific MSIV leakage rates specified in calculation section A2.1 and the effective main condenser volume value from calculation section A5.1, to determine the effective filter efficiency (radionuclide removal efficiency) of the main condenser for particulates including particulate iodine and elemental iodine.

The Appendix A1 EXCEL spreadsheet is divided into four separate worksheets. One worksheet for each of the MSIV leakage rates (200/100, 300/150 and 400/200 SCFH) identified in calculation section A2.1. Each worksheet is identical with the exception of the input MSIV leakage rates and the resultant calculation values within the spreadsheet. Only the 200/100 scfh MSIV leakage rate worksheet is described below, as the other worksheets are similar. Therefore only the 200/100 scfh worksheet is duplicated and shown in formula mode for auditing purposes.

In general, each Appendix A1 EXCEL worksheet is organized such that design input and manipulation of design input occurs on the right hand side of the worksheet and the calculation of effective filter efficiencies (radionuclide removal efficiency) occurs on the left side of the spreadsheet.

Design Input and Design Input Manipulation:

The MSIV leakage rate for the initial 24 hour post-LOCA period of 200 scfh is input in cell G26. The reduced MSIV leakage rate after the initial 24 hour period of 100 scfh (50% of 200 scfh) is calculated in cell G27.


The main condenser free volume above the ALT inlet elevation of 8,100 ft³ is input in cell G30.

The 200 scfh and 100 scfh MSIV leakage rate values are converted from units of scfh to units of standard cubic meters per hour in cells G8 and G9, respectively.

The main condenser free volume above the ALT inlet elevation is converted from units of cubic feet to units of cubic meters in cell G12.

The combined plate-out and decay time constant, α [[]] conservatively based on Iodine 131 as described in calculation section A4.2 and Reference A7.5, Appendix C, pages C-54 and C-57 is input in cell G14.

The term B [[]] as described in calculation section A4.2 and Reference A7.5, Appendix C, page C-57 is calculated in cells G16 and 17 for the initial 24 hour period and the period after 24 hours, respectively.

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Calculation of Effective Filter Efficiency (Radionuclide Removal Efficiency):

Column A, cells A7 – A35 are used to define various post-LOCA times from time 0 to 720 hours.

Column B, cells B8 – B17 are used to calculate the remaining radioactive concentration in the main condenser at time t, (C/C_m) based on the equation described in calculation section A4.2 and Reference A7.5, Appendix C, page C-57 for the initial 24 hour period. Column B, cells B18 – B35 perform the same calculation for the time periods after 24 hours.

For informational purposes, Column C, cells C8 – C35 calculate the effective removal coefficient as a function of time within the main condenser based on the equation $C/C_m = e^{-\lambda t}$

The effective filter efficiency (radionuclide removal efficiency) is calculated as described in calculation section A4.2 as $(1 - C/C_m)$ in Column D cells D8 – D35).

For the 200/100 scfh MSIV leakage rate case, the main condenser effective filter efficiency (radionuclide removal efficiency) value for use in the initial 24 hour post-LOCA period is the value at 24 hours (cell D17) of 96.55%. The main condenser effective filter efficiency (radionuclide removal efficiency) value for use following the initial 24 hour post-LOCA period is the value at 720 hours (cell D35) of 98.24%.

For the 300/150 scfh MSIV leakage rate case, the main condenser effective filter efficiency (radionuclide removal efficiency) value for use in the initial 24 hour post-LOCA period is the value at 24 hours (cell D17) of 94.91%. The main condenser effective filter efficiency (radionuclide removal efficiency) value for use following the initial 24 hour post-LOCA period is the value at 720 hours (cell D35) of 97.39%.

For the 400/200 scfh MSIV leakage rate case, the main condenser effective filter efficiency (radionuclide removal efficiency) value for use in the initial 24 hour post-LOCA period is the value at 24 hours (cell D17) of 93.32%. The main condenser effective filter efficiency (radionuclide removal efficiency) value for use following the initial 24 hour post-LOCA period is the value at 720 hours (cell D35) of 96.55%.

A6.0 Results and Conclusions

The results from the appendix calculation in section A5.1 for the main condenser free volume above the Alternate Leakage Treatment pathway inlet elevation are determined to be 8,100 ft³ (229.3665 m³).


The appendix calculation results for the effective filter efficiency (radionuclide removal efficiency) are provided in the Appendix A1 worksheets.

The effective filter efficiencies (radionuclide removal efficiencies) determined for particulates including particulate iodine and elemental iodine are as given below.

Main Condenser Effective Filter Efficiencies:


<u>MSIV Leakage Rate, SCFH</u>	<u>200/150</u>	<u>300/150</u>	<u>400/200</u>
0-24 Hours =	96.55%	94.91%	93.32%
24-720 Hours =	98.24%	97.39%	96.55%

The effective filter efficiencies (radionuclide removal efficiencies) may be used in the evaluation of post-LOCA radiological dose consequence.

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A7.0 References

- A7.1 USNRC Regulatory Guide 1.183, Revision 0, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", July, 2000.
- A7.2 Not Used.
- A7.3 Cooper Nuclear Station License Amendment No. 196, USNRC, Feb 2003.
- A7.4 Cooper Nuclear Station License Amendment No. 206, USNRC, Sept 1, 2004 (TAC MC1572).
- A7.5 GE Topical Report, NEDC-31858P-A (Proprietary GE Report), Revision 2, "BWROG Report for Increasing MSIV Leakage Limits and Elimination of Leakage Control Systems, August 1999".
- A7.6 J. E. Cline, "MSIV Leakage Iodine Transport Analysis", Letter Report dated March 26, 1991 (ADAMS Accession Number ML003683718).
- A7.7 Safety Evaluation By The Office Of Nuclear Reactor Regulation Related To Amendment No. 221 To Facility Operating License No. DPR-71 And Amendment No. 246 To Facility Operating License No. DPR-62, Carolina Power And Light Company, Brunswick Steam Electric Plant Units 1 And 2, Docket Nos. 50-325 And 50-324.
- A7.8 Drawing EC93877E3, Revision B, "Exhaust Trunk (Shell 1A and Shell 1B)".
- A7.9 Drawing EC93877GA, Revision M, "465,000 Sq. Ft. Surface Condenser, Single Pass, Divided Flow, Twin Shell (Condenser 1A)".
- A7.10 Drawing EC93877E2-A, Revision A, "Upper Slope Section (Shell 1A)".
- A7.11 Drawing M-81762, Revision 7, "Low Pressure Feedwater Heaters 1-A-1 & 1-B-1".
- A7.12 Drawing DC93877EP, Revision NO1, "Extraction Piping (To Heaters 1-A-1 & 1-B-1)".
- A7.13 Drawing CC93877EP-A-13, Revision NO1, "Extraction Piping Conn. "AW" to Turb. Conn. 13 (Shell 1A)".
- A7.14 Drawing CC93877EP-A-12, Revision NO1, "Extraction Piping Conn. "AW" to Turb. Conn. 12 (Shell 1A)".
- A7.15 Drawing CC93877EP-A-11, Revision NO1, "Extraction Piping Conn. "AX" to Turb. Conn. 11 (Shell 1A)".
- A7.16 Drawing CC93877EP-A-10, Revision NO1, "Extraction Piping Conn. "AX" to Turb. Conn. 10 (Shell 1A)".
- A7.17 Drawing CC93877EP-A-9, Revision NO2, "Extraction Piping Conn. "AY" to Turb. Conn. 9 (Shell 1A)".
- A7.18 Drawing DC93877SC-H, Revision NO2, "Details Of Baffled Connections In Condenser Exhaust Dome (H,J,L,M,P,R,Z,AM,AU,BB,BH,BI,BJ,BK,BL,BM,BU)".
- A7.19 Drawing EC93877SC-1A, Revision NO1, "Shell Connections, Slope Section, Shell 1A Only".
- A7.20 Drawing CNS-MS-43, Revision NO4, "Leakage Paths from Outboard MSIV's, Cooper Nuclear Station."
- A7.21 <http://mathworld.wolfram.com/CircularSegment.html>

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APPENDIX A-1 Main Condenser Efficiency Calculation Spreadsheet
200 scfh Leakage

CNS Condenser Removal Efficiency (Particulate & Elemental Iodine) - 200 SCFH Leakage Model

Time (Hours)	Alternate Leakage Treatment Pathway			Data	
	Activity Conc. Ratio C/C _m	Effective Removal Coefficient (Hours ⁻¹)	Effective Removal Efficiency	Leakage Treatment Pathway P1	
0	0	0	0		
0.1	0.002383	60.394088	0.997617	Q, m ³ /hr =	5.663370
1	0.017642	4.037455	0.982358	Q(24 hr), m ³ /hr =	2.831685
2	0.026275	1.819560	0.973725		
3	0.030500	1.163342	0.969500		
4	0.032567	0.856112	0.967433	V _c , m ³ =	229.366485
8	0.034435	0.421086	0.965565		
12	0.034542	0.280466	0.965458	Alpha, hr ⁻¹ =	0.690000
16	0.034548	0.210338	0.965452		
20	0.034548	0.168270	0.965452	B, hr ⁻¹ =	0.714691
24	0.034548	0.140225	0.965452	B(24 hr), hr ⁻¹ =	0.702346
32	0.017578	0.126285	0.982422		
40	0.017578	0.101028	0.982422		
48	0.017578	0.084190	0.982422	Q/(V _c *B) =	0.034548
60	0.017578	0.067352	0.982422	Q/(V _c *B) (24 hr)	
72	0.017578	0.056127	0.982422	=	0.017578
74	0.017578	0.054610	0.982422		
90	0.017578	0.044901	0.982422		
96	0.017578	0.042095	0.982422		
120	0.017578	0.033676	0.982422	Q, scfh =	200.00
144	0.017578	0.028063	0.982422	Q(24 hr), scfh =	100.00
168	0.017578	0.024054	0.982422		
192	0.017578	0.021047	0.982422		
216	0.017578	0.018709	0.982422	V _c , ft ³ =	8100
240	0.017578	0.016838	0.982422		
360	0.017578	0.011225	0.982422		
480	0.017578	0.008419	0.982422		
600	0.017578	0.006735	0.982422		
720	0.017578	0.005613	0.982422		



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200 scfh Leakage (formula audit)

CNS Condenser Removal Efficiency (Particulate & Elemental Iodine) - 200 SCFH Leakage Model

Time (Hours)	Alternate Leakage Treatment Pathway			Data	
	Activity Conc. Ratio C/C_m	Effective Removal Coefficient (Hours ⁻¹)	Effective Removal Efficiency	Leakage Treatment Pathway P1	
0	0	0	0		
0.1	$=(G\$8*(1-EXP(-G\$16*A8)))/(G\$12*G\$16)$	$=(LN(B\$8)/A8)$	$=(1-B\$8)$	Q, m ³ /hr =	$=G\$26*0.02831685$
1	$=(G\$8*(1-EXP(-G\$16*A9)))/(G\$12*G\$16)$	$=(LN(B\$9)/A9)$	$=(1-B\$9)$	Q(24 hr), m ³ /hr =	$=G\$27*0.02831685$
2	$=(G\$8*(1-EXP(-G\$16*A10)))/(G\$12*G\$16)$	$=(LN(B\$10)/A10)$	$=(1-B\$10)$		
3	$=(G\$8*(1-EXP(-G\$16*A11)))/(G\$12*G\$16)$	$=(LN(B\$11)/A11)$	$=(1-B\$11)$		
4	$=(G\$8*(1-EXP(-G\$16*A12)))/(G\$12*G\$16)$	$=(LN(B\$12)/A12)$	$=(1-B\$12)$	V _c , m ³ =	$=G\$30*0.02831685$
8	$=(G\$8*(1-EXP(-G\$16*A13)))/(G\$12*G\$16)$	$=(LN(B\$13)/A13)$	$=(1-B\$13)$		
12	$=(G\$8*(1-EXP(-G\$16*A14)))/(G\$12*G\$16)$	$=(LN(B\$14)/A14)$	$=(1-B\$14)$	Alpha, hr ⁻¹ =	0.69
16	$=(G\$8*(1-EXP(-G\$16*A15)))/(G\$12*G\$16)$	$=(LN(B\$15)/A15)$	$=(1-B\$15)$		
20	$=(G\$8*(1-EXP(-G\$16*A16)))/(G\$12*G\$16)$	$=(LN(B\$16)/A16)$	$=(1-B\$16)$	B, hr ⁻¹ =	$=G\$14+(G\$8/G\$12)$
24	$=(G\$8*(1-EXP(-G\$16*A17)))/(G\$12*G\$16)$	$=(LN(B\$17)/A17)$	$=(1-B\$17)$	B(24 hr), hr ⁻¹ =	$=G\$14+(G\$9/G\$12)$
32	$=(G\$9*(1-EXP(-G\$17*A18)))/(G\$12*G\$17)$	$=(LN(B\$18)/A18)$	$=(1-B\$18)$		
40	$=(G\$9*(1-EXP(-G\$17*A19)))/(G\$12*G\$17)$	$=(LN(B\$19)/A19)$	$=(1-B\$19)$		
48	$=(G\$9*(1-EXP(-G\$17*A20)))/(G\$12*G\$17)$	$=(LN(B\$20)/A20)$	$=(1-B\$20)$	Q/(V _c *B) =	$=G\$8/(G\$12*G\$16)$
60	$=(G\$9*(1-EXP(-G\$17*A21)))/(G\$12*G\$17)$	$=(LN(B\$21)/A21)$	$=(1-B\$21)$	Q/(V _c *B) (24 hr)	$=G\$9/(G\$12*G\$17)$
72	$=(G\$9*(1-EXP(-G\$17*A22)))/(G\$12*G\$17)$	$=(LN(B\$22)/A22)$	$=(1-B\$22)$	=	
74	$=(G\$9*(1-EXP(-G\$17*A23)))/(G\$12*G\$17)$	$=(LN(B\$23)/A23)$	$=(1-B\$23)$		
90	$=(G\$9*(1-EXP(-G\$17*A24)))/(G\$12*G\$17)$	$=(LN(B\$24)/A24)$	$=(1-B\$24)$		
96	$=(G\$9*(1-EXP(-G\$17*A25)))/(G\$12*G\$17)$	$=(LN(B\$25)/A25)$	$=(1-B\$25)$		



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120	$=($G$9*(1-EXP(-$G$17*$A26)))/(G12*G17)$	$=(LN($B26)/$A26)$	$=(1-$B26)$
144	$=($G$9*(1-EXP(-$G$17*$A27)))/(G12*G17)$	$=(LN($B27)/$A27)$	$=(1-$B27)$
168	$=($G$9*(1-EXP(-$G$17*$A28)))/(G12*G17)$	$=(LN($B28)/$A28)$	$=(1-$B28)$
192	$=($G$9*(1-EXP(-$G$17*$A29)))/(G12*G17)$	$=(LN($B29)/$A29)$	$=(1-$B29)$
216	$=($G$9*(1-EXP(-$G$17*$A30)))/(G12*G17)$	$=(LN($B30)/$A30)$	$=(1-$B30)$
240	$=($G$9*(1-EXP(-$G$17*$A31)))/(G12*G17)$	$=(LN($B31)/$A31)$	$=(1-$B31)$
360	$=($G$9*(1-EXP(-$G$17*$A32)))/(G12*G17)$	$=(LN($B32)/$A32)$	$=(1-$B32)$
480	$=($G$9*(1-EXP(-$G$17*$A33)))/(G12*G17)$	$=(LN($B33)/$A33)$	$=(1-$B33)$
600	$=($G$9*(1-EXP(-$G$17*$A34)))/(G12*G17)$	$=(LN($B34)/$A34)$	$=(1-$B34)$
720	$=($G$9*(1-EXP(-$G$17*$A35)))/(G12*G17)$	$=(LN($B35)/$A35)$	$=(1-$B35)$

Q, scfh = 200
Q(24 hr), scfh = 0.5*\$G\$26

V_c, ft³ = 8100



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300 scfh Leakage

CNS Condenser Removal Efficiency (Particulate & Elemental Iodine) - 300 SCFH Leakage Model

Time (Hours)	Alternate Leakage Treatment Pathway			Data	
	Activity Conc. Ratio C/C _m	Effective Removal Coefficient (Hours ⁻¹)	Effective Removal Efficiency	Leakage Treatment Pathway P1	
0	0	0	0		
0.1	0.003572	56.345536	0.996428	Q, m ³ /hr =	8.495055
1	0.026320	3.637427	0.973680	Q(24 hr), m ³ /hr =	4.247528
2	0.039041	1.621566	0.960959		
3	0.045190	1.032292	0.954810		
4	0.048162	0.758295	0.951838	V _c , m ³ =	229.366485
8	0.050791	0.372505	0.949209		
12	0.050934	0.248102	0.949066	Alpha, hr ⁻¹ =	0.690000
16	0.050942	0.186067	0.949058		
20	0.050942	0.148853	0.949058	B, hr ⁻¹ =	0.727037
24	0.050942	0.124044	0.949058	B(24 hr), hr ⁻¹ =	0.708519
32	0.026137	0.113888	0.973863		
40	0.026137	0.091110	0.973863		
48	0.026137	0.075925	0.973863	Q/(V _c *B) =	0.050942
60	0.026137	0.060740	0.973863	Q/(V _c *B) (24 hr) =	0.026137
72	0.026137	0.050617	0.973863		
74	0.026137	0.049249	0.973863		
90	0.026137	0.040493	0.973863		
96	0.026137	0.037963	0.973863		
120	0.026137	0.030370	0.973863	Q, scfh =	300.00
144	0.026137	0.025308	0.973863	Q(24 hr), scfh =	150.00
168	0.026137	0.021693	0.973863		
192	0.026137	0.018981	0.973863		
216	0.026137	0.016872	0.973863	V _c , ft ³ =	8100
240	0.026137	0.015185	0.973863		
360	0.026137	0.010123	0.973863		
480	0.026137	0.007593	0.973863		
600	0.026137	0.006074	0.973863		
720	0.026137	0.005062	0.973863		



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400 scfh Leakage

CNS Condenser Removal Efficiency (Particulate & Elemental Iodine) - 400 SCFH Leakage Model

Time (Hours)	Alternate Leakage Treatment Pathway			Data	
	Activity Conc. Ratio C/C _m	Effective Removal Coefficient (Hours ⁻¹)	Effective Removal Efficiency	Leakage Treatment Pathway P1	
0	0	0	0		
0.1	0.004760	53.474812	0.995240	Q, m ³ /hr =	11.326740
1	0.034903	3.355170	0.965097	Q(24 hr), m ³ /hr =	5.663370
2	0.051567	1.482440	0.948433		
3	0.059522	0.940471	0.940478		
4	0.063320	0.689890	0.936680	V _c , m ³ =	229.366485
8	0.066609	0.338615	0.933391		
12	0.066780	0.225530	0.933220	Alpha, hr ⁻¹ =	0.690000
16	0.066789	0.169139	0.933211		
20	0.066789	0.135311	0.933211	B, hr ⁻¹ =	0.739383
24	0.066789	0.112759	0.933211	B(24 hr), hr ⁻¹ =	0.714691
32	0.034548	0.105169	0.965452		
40	0.034548	0.084135	0.965452		
48	0.034548	0.070112	0.965452	Q/(V _c *B) =	0.066789
60	0.034548	0.056090	0.965452	Q/(V _c *B) (24 hr)	
72	0.034548	0.046742	0.965452	=	0.034548
74	0.034548	0.045478	0.965452		
90	0.034548	0.037393	0.965452		
96	0.034548	0.035056	0.965452		
120	0.034548	0.028045	0.965452	Q, scfh =	400.00
144	0.034548	0.023371	0.965452	Q(24 hr), scfh =	200.00
168	0.034548	0.020032	0.965452		
192	0.034548	0.017528	0.965452		
216	0.034548	0.015581	0.965452	V _c , ft ³ =	8100
240	0.034548	0.014022	0.965452		
360	0.034548	0.009348	0.965452		
480	0.034548	0.007011	0.965452		
600	0.034548	0.005609	0.965452		
720	0.034548	0.004674	0.965452		

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APPENDIX B

RADTRAD 3.03 Plant Specific Input

Leakage Pathway



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RADTRAD Version 3.03 (Spring 2001) run on 6/20/2008 at 15:15:34
#####

File information
#####

Plant file = D:\RAD303NRC\Utility\Cooper\LOCA\LOCA_leak_A100_CRflt.psf
Inventory file = d:\rad303nrc\defaults\cooper\cooper_60.nif
Release file = d:\rad303nrc\defaults\bwr_dba.rft
Dose Conversion file = d:\rad303nrc\defaults\fgr11&12.inp

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

Radtrad 3.03 4/15/2001
LOCA_leakage AST 400 unfiltered
Nuclide Inventory File:
d:\rad303nrc\defaults\cooper\cooper_60.nif
Plant Power Level:
2.4286E+03
Compartments:
4
Compartment 1:
Drywell Free Volume
3
1.3225E+05
0
0
0
1
0
Compartment 2:
Reactor Building
3
2.0000E+02
0
0
0
0
0
Compartment 3:
Environment



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2
0.0000E+00
0
0
0
0
0

Compartment 4:
Control Room

1
1.4190E+05
0
0
0
0
0

Pathways:

7

Pathway 1:

Primary to Reactor Building

1
2
4

Pathway 2:

(SGTS_Active) Reactor Building to Environment

2
3
2

Pathway 3:

(SGTS Idle) Reactor Building to Environment

2
3
2

Pathway 4:

Unfiltered Environment to Control Room

3
4
2

Pathway 5:

Filtered Environment to Control Room

3
4
2

Pathway 6:

Exhaust Control Room to Environment

4
3
2

Pathway 7:

Drywell Free Volume to Environment

1



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4

End of Plant Model File

Scenario Description Name:

Plant Model Filename:

Source Term:

1

1 1.0000E+00

d:\rad303nrc\defaults\fgr11&12.inp

d:\rad303nrc\defaults\bwr_dba.rft

0.0000E+00

1

9.5000E-01 4.8500E-02 1.5000E-03 1.0000E+00

Overlying Pool:

0

0.0000E+00

0

0

0

0

Compartments:

4

Compartment 1:

0

1

0

0

0

0

0

3

3

1.0000E+01

1

1

0.0000E+00 0.0000E+00

Compartment 2:

0

1

0

0

0

0

0

0

0

Compartment 3:

0

1



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B5 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0
0
0
0
0

Compartment 4:

0
1
0
0
0
0
0
0
0
0

Pathways:

7

Pathway 1:

0
0
0
0
0
0
0
0
0
0
1
3

0.0000E+00	0.0000E+00
8.3300E-02	6.3500E-01
2.4000E+01	3.1750E-01

Pathway 2:

0
0
0
0
0
0
1
3
0
0
0
0

0.0000E+00	0.0000E+00	9.8000E+01	9.4000E+01	9.4000E+01
1.6600E-02	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01
2.0000E+00	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B6 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

```
0
0
Pathway 3:
0
0
0
0
0
1
6
0.0000E+00  0.0000E+00  9.8000E+01  8.9000E+01  2.9000E+01
1.6600E-02  1.4920E+03  9.8000E+01  8.9000E+01  2.9000E+01
1.0000E+00  2.8800E+02  9.8000E+01  8.9000E+01  2.9000E+01
8.3330E+00  2.8800E+02  9.8000E+01  8.9000E+01  2.9000E+01
1.2000E+01  2.8800E+02  9.8000E+01  8.9000E+01  2.9000E+01
1.9444E+01  2.8800E+02  9.8000E+01  8.9000E+01  2.9000E+01
0
0
0
0
0
0
0
Pathway 4:
0
0
0
0
0
1
2
0.0000E+00  4.0000E+02  0.0000E+00  0.0000E+00  0.0000E+00
1.6700E-02  4.0000E+02  0.0000E+00  0.0000E+00  0.0000E+00
0
0
0
0
0
0
Pathway 5:
0
0
0
0
0
1
2
0.0000E+00  3.2350E+03  0.0000E+00  0.0000E+00  0.0000E+00
1.6600E-02  8.1000E+02  9.8000E+01  8.9000E+01  8.9000E+01
0
0
0
```



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B7 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0
Pathway 6:
0
0
0
0
0
0
1
2
0.0000E+00 3.6350E+03 0.0000E+00 0.0000E+00 0.0000E+00
1.6600E-02 1.2100E+03 0.0000E+00 0.0000E+00 0.0000E+00
0
0
0
0
0

Pathway 7:
0
0
0
0
0
0
0
0
0
1
2
0.0000E+00 6.3500E-01
8.3300E-02 0.0000E+00
0

Dose Locations:
3

Location 1:
Exclusion Area Boundary
3
1
4
0.0000E+00 1.6000E-05
1.3000E+00 1.2000E-04
1.8000E+00 1.6000E-05
1.0000E+01 0.0000E+00
1
4
0.0000E+00 3.5000E-04
8.0000E+00 1.8000E-04
2.4000E+01 2.3000E-04



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B8 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

7.2000E+02 0.0000E+00

0

Location 2:

Low Population Zone

3

1

6

0.0000E+00 4.0000E-05

1.3000E+00 1.4000E-04

1.8000E+00 4.0000E-05

8.0000E+00 1.6000E-05

2.4000E+01 5.8000E-06

9.6000E+01 1.7000E-06

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

8

0.0000E+00 4.1500E-03

8.3300E-02 1.0000E-10

1.3000E+00 3.0300E-04

1.8000E+00 1.0000E-10

2.0000E+00 8.5800E-10

8.0000E+00 1.4100E-08

2.4000E+01 5.6200E-09

9.6000E+01 5.6900E-09

Simulation Parameters:

2

0.0000E+00 1.0000E-01

2.4000E+01 0.0000E+00

Output Filename:

D:\RAD303NRC\Utility\Cooper\LOCA\LOCA_leak_A100_CRflt.o0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B9 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

1
1
1
0
0

End of Scenario File

RADTRAD Version 3.03 (Spring 2001) run on 6/20/2008 at 15:15:34
#####

Plant Description
#####

Number of Nuclides = 60

Inventory Power = 1.0000E+00 MWth
Plant Power Level = 2.4286E+03 MWth

Number of compartments = 4

Compartment information

Compartment number 1 (Source term fraction = 1.0000E+00
)

Name: Drywell Free Volume

Compartment volume = 1.3225E+05 (Cubic feet)

Compartment type is Normal

Removal devices within compartment:

Deposition

Pathways into and out of compartment 1

Exit Pathway Number 1: Primary to Reactor Building

Exit Pathway Number 7: Drywell Free Volume to Environment

Compartment number 2

Name: Reactor Building

Compartment volume = 2.0000E+02 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 2

Inlet Pathway Number 1: Primary to Reactor Building

Exit Pathway Number 2: (SGTS_Active) Reactor Building to Environment

Exit Pathway Number 3: (SGTS Idle) Reactor Building to Environment

Compartment number 3

Name: Environment

Compartment type is Environment

Pathways into and out of compartment 3

Inlet Pathway Number 2: (SGTS_Active) Reactor Building to Environment



Inlet Pathway Number 3: (SGTS Idle) Reactor Building to Environment
 Inlet Pathway Number 6: Exhaust Control Room to Environment
 Inlet Pathway Number 7: Drywell Free Volume to Environment
 Exit Pathway Number 4: Unfiltered Environment to Control Room
 Exit Pathway Number 5: Filtered Environment to Control Room

Compartment number 4
 Name: Control Room
 Compartment volume = 1.4190E+05 (Cubic feet)
 Compartment type is Control Room

Pathways into and out of compartment 4
 Inlet Pathway Number 4: Unfiltered Environment to Control Room
 Inlet Pathway Number 5: Filtered Environment to Control Room
 Exit Pathway Number 6: Exhaust Control Room to Environment

Total number of pathways = 7

 RADTRAD Version 3.03 (Spring 2001) run on 6/20/2008 at 15:15:34
 #####
 #####
 Scenario Description
 #####

Radioactive Decay is enabled
 Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.500000 hr	1.5000 hrs	0.0000 hrs	(gm)
NOBLES	5.0000E-02	9.5000E-01	0.0000E+00	2.972E+03
IODINE	5.0000E-02	2.5000E-01	0.0000E+00	2.104E+02
CESIUM	5.0000E-02	2.0000E-01	0.0000E+00	3.146E+04
TELLURIUM	0.0000E+00	5.0000E-02	0.0000E+00	2.823E+01
STRONTIUM	0.0000E+00	2.0000E-02	0.0000E+00	1.074E+03
BARIUM	0.0000E+00	2.0000E-02	0.0000E+00	3.140E+01
RUTHENIUM	0.0000E+00	2.5000E-03	0.0000E+00	4.161E+01
CERIUM	0.0000E+00	5.0000E-04	0.0000E+00	4.376E+02
LANTHANUM	0.0000E+00	2.0000E-04	0.0000E+00	4.442E+00

Inventory Power = 2429. 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)
Co-58	7	1.529E+02	6.117E+06	4.760E-14	8.720E-10	2.940E-09
Co-60	7	1.830E+02	1.663E+08	1.260E-13	1.620E-08	5.910E-08
Kr-85	1	3.660E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B11 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Kr-85m	1	6.810E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.300E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.830E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Rb-86	3	6.990E+01	1.612E+06	4.810E-15	1.330E-09	1.790E-09
Sr-89	5	2.440E+04	4.363E+06	7.730E-17	7.960E-12	1.120E-08
Sr-90	5	2.900E+03	9.190E+08	7.530E-18	2.690E-10	3.510E-07
Sr-91	5	3.100E+04	3.420E+04	4.924E-14	9.930E-12	4.547E-10
Sr-92	5	3.380E+04	9.756E+03	6.790E-14	3.920E-12	2.180E-10
Y-90	9	3.000E+03	2.304E+05	1.900E-16	5.170E-13	2.280E-09
Y-91	9	3.170E+04	5.055E+06	2.600E-16	8.500E-12	1.320E-08
Y-92	9	3.390E+04	1.274E+04	1.300E-14	1.050E-12	2.110E-10
Y-93	9	3.960E+04	3.636E+04	4.800E-15	9.260E-13	5.820E-10
Zr-95	9	4.450E+04	5.528E+06	3.600E-14	1.440E-09	6.390E-09
Zr-97	9	4.510E+04	6.084E+04	4.432E-14	2.315E-11	1.171E-09
Nb-95	9	4.480E+04	3.037E+06	3.740E-14	3.580E-10	1.570E-09
Mo-99	7	5.120E+04	2.376E+05	7.280E-15	1.520E-11	1.070E-09
Tc-99m	7	4.520E+04	2.167E+04	5.890E-15	5.010E-11	8.800E-12
Ru-103	7	4.300E+04	3.394E+06	2.251E-14	2.570E-10	2.421E-09
Ru-105	7	3.030E+04	1.598E+04	3.810E-14	4.150E-12	1.230E-10
Ru-106	7	1.740E+04	3.181E+07	1.040E-14	1.720E-09	1.290E-07
Rh-105	7	2.770E+04	1.273E+05	3.720E-15	2.880E-12	2.580E-10
Sb-127	4	3.020E+03	3.326E+05	3.330E-14	6.150E-11	1.630E-09
Sb-129	4	8.930E+03	1.555E+04	7.140E-14	9.720E-12	1.740E-10
Te-127	4	3.050E+03	3.366E+04	2.420E-16	1.840E-12	8.600E-11
Te-127m	4	4.060E+02	9.418E+06	1.470E-16	9.660E-11	5.810E-09
Te-129	4	8.790E+03	4.176E+03	2.750E-15	5.090E-13	2.090E-11
Te-129m	4	1.300E+03	2.903E+06	3.337E-15	1.563E-10	6.484E-09
Te-131m	4	3.960E+03	1.080E+05	7.463E-14	3.669E-08	1.758E-09
Te-132	4	3.850E+04	2.815E+05	1.030E-14	6.280E-08	2.550E-09
I-131	2	2.720E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.930E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.510E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-133	1	5.260E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-135	1	1.860E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Cs-134	3	6.750E+03	6.507E+07	7.570E-14	1.110E-08	1.250E-08
Cs-136	3	2.160E+03	1.132E+06	1.060E-13	1.730E-09	1.980E-09
Cs-137	3	4.050E+03	9.467E+08	2.725E-14	7.930E-09	8.630E-09
Ba-139	6	4.900E+04	4.962E+03	2.170E-15	2.400E-12	4.640E-11
Ba-140	6	4.710E+04	1.101E+06	8.580E-15	2.560E-10	1.010E-09
La-140	9	4.870E+04	1.450E+05	1.170E-13	6.870E-11	1.310E-09
La-141	9	4.460E+04	1.415E+04	2.390E-15	9.400E-12	1.570E-10
La-142	9	4.300E+04	5.550E+03	1.440E-13	8.740E-12	6.840E-11
Ce-141	8	4.470E+04	2.808E+06	3.430E-15	2.550E-11	2.420E-09
Ce-143	8	4.110E+04	1.188E+05	1.290E-14	6.230E-12	9.160E-10
Ce-144	8	3.660E+04	2.456E+07	2.773E-15	2.920E-10	1.010E-07
Pr-143	9	4.020E+04	1.172E+06	2.100E-17	1.680E-18	2.190E-09
Nd-147	8	1.800E+04	9.487E+05	6.190E-15	1.820E-11	1.850E-09
Np-239	8	5.860E+05	2.035E+05	7.690E-15	7.620E-12	6.780E-10
Pu-238	8	1.280E+02	2.769E+09	4.880E-18	3.860E-10	7.790E-05



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B12 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Pu-239	8	1.290E+01	7.594E+11	4.240E-18	3.750E-10	8.330E-05
Pu-240	8	1.770E+01	2.063E+11	4.750E-18	3.760E-10	8.330E-05
Pu-241	8	5.340E+03	4.544E+08	7.250E-20	9.150E-12	1.340E-06
Am-241	9	6.870E+00	1.364E+10	8.180E-16	1.600E-09	1.200E-04
Cm-242	9	1.730E+03	1.407E+07	5.690E-18	9.410E-10	4.670E-06
Cm-244	9	1.110E+02	5.715E+08	4.910E-18	1.010E-09	6.700E-05

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
Sr-90	Y-90	1.00	none	0.00	none	0.00
Sr-91	Y-91m	0.58	Y-91	0.42	none	0.00
Sr-92	Y-92	1.00	none	0.00	none	0.00
Y-93	Zr-93	1.00	none	0.00	none	0.00
Zr-95	Nb-95m	0.01	Nb-95	0.99	none	0.00
Zr-97	Nb-97m	0.95	Nb-97	0.05	none	0.00
Mo-99	Tc-99m	0.88	Tc-99	0.12	none	0.00
Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129m	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol = 9.5000E-01
Elemental = 4.8500E-02



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B13 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Organic = 1.5000E-03

COMPARTMENT DATA

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

Natural Deposition: Elemental Removal Data
 Time (hr) Removal Coef. (hr⁻¹)
 0.0000E+00 0.0000E+00

Compartment number 2: Reactor Building
 Compartment number 3: Environment
 Compartment number 4: Control Room

PATHWAY DATA

Pathway number 1: Primary to Reactor Building

Convection Data
 Time (hr) Flow Rate (% / day)
 0.0000E+00 0.0000E+00
 8.3300E-02 6.3500E-01
 2.4000E+01 3.1750E-01

Pathway number 2: (SGTS_Active) Reactor Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	9.8000E+01	9.4000E+01	9.4000E+01
1.6600E-02	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01
2.0000E+00	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01

Pathway number 3: (SGTS Idle) Reactor Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	9.8000E+01	8.9000E+01	2.9000E+01
1.6600E-02	1.4920E+03	9.8000E+01	8.9000E+01	2.9000E+01
1.0000E+00	2.8800E+02	9.8000E+01	8.9000E+01	2.9000E+01
8.3330E+00	2.8800E+02	9.8000E+01	8.9000E+01	2.9000E+01
1.2000E+01	2.8800E+02	9.8000E+01	8.9000E+01	2.9000E+01
1.9444E+01	2.8800E+02	9.8000E+01	8.9000E+01	2.9000E+01



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B14 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Pathway number 4: Unfiltered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: Filtered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6600E-02	8.1000E+02	9.8000E+01	8.9000E+01	8.9000E+01

Pathway number 6: Exhaust Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6600E-02	1.2100E+03	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 7: Drywell Free Volume to Environment

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	6.3500E-01
8.3300E-02	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	1.6000E-05
1.3000E+00	1.2000E-04
1.8000E+00	1.6000E-05
1.0000E+01	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



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix B - Page: B15 of B15

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Location Low Population Zone is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	4.0000E-05
1.3000E+00	1.4000E-04
1.8000E+00	4.0000E-05
8.0000E+00	1.6000E-05
2.4000E+01	5.8000E-06
9.6000E+01	1.7000E-06

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	4.1500E-03
8.3300E-02	1.0000E-10
1.3000E+00	3.0300E-04
1.8000E+00	1.0000E-10
2.0000E+00	8.5800E-10
8.0000E+00	1.4100E-08
2.4000E+01	5.6200E-09
9.6000E+01	5.6900E-09

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
2.4000E+01	0.0000E+00

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix C - Page: <u>C1</u> of <u>C11</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX C

RADTRAD 3.03 Plant Specific Output

Leakage Pathway



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

RADTRAD Version 3.03 (Spring 2001) run on 6/20/2008 at 15:15:34
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Dose Output
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Exclusion Area Boundary Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.1631E-05	2.0585E-03	9.8683E-05
Accumulated dose (rem)		1.1631E-05	2.0585E-03	9.8683E-05

Low Population Zone Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.9078E-05	5.1462E-03	2.4671E-04
Accumulated dose (rem)		2.9078E-05	5.1462E-03	2.4671E-04

Control room Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.6813E-06	6.3316E-03	2.6944E-04
Accumulated dose (rem)		1.6813E-06	6.3316E-03	2.6944E-04

Exclusion Area Boundary Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.3953E-07	2.4833E-05	1.1897E-06
Accumulated dose (rem)		1.1771E-05	2.0833E-03	9.9872E-05

Low Population Zone Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.4882E-07	6.2084E-05	2.9742E-06
Accumulated dose (rem)		2.9427E-05	5.2083E-03	2.4968E-04

Control room Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
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Delta dose (rem) 2.1494E-08 8.1402E-05 3.4639E-06
 Accumulated dose (rem) 1.7028E-06 6.4130E-03 2.7291E-04

Exclusion Area Boundary Doses:

Time (h) = 0.0833 Whole Body Thyroid TEDE
 Delta dose (rem) 2.7670E-04 4.9157E-02 2.3552E-03
 Accumulated dose (rem) 2.8847E-04 5.1240E-02 2.4550E-03

Low Population Zone Doses:

Time (h) = 0.0833 Whole Body Thyroid TEDE
 Delta dose (rem) 6.9174E-04 1.2289E-01 5.8879E-03
 Accumulated dose (rem) 7.2117E-04 1.2810E-01 6.1376E-03

Control room Doses:

Time (h) = 0.0833 Whole Body Thyroid TEDE
 Delta dose (rem) 3.8410E-05 1.2772E-01 5.4324E-03
 Accumulated dose (rem) 4.0113E-05 1.3414E-01 5.7053E-03

Exclusion Area Boundary Doses:

Time (h) = 0.5000 Whole Body Thyroid TEDE
 Delta dose (rem) 1.3535E-03 3.9752E-02 2.9622E-03
 Accumulated dose (rem) 1.6419E-03 9.0992E-02 5.4172E-03

Low Population Zone Doses:

Time (h) = 0.5000 Whole Body Thyroid TEDE
 Delta dose (rem) 3.3836E-03 9.9380E-02 7.4055E-03
 Accumulated dose (rem) 4.1048E-03 2.2748E-01 1.3543E-02

Control room Doses:


Time (h) = 0.5000 Whole Body Thyroid TEDE
 Delta dose (rem) 3.2542E-04 1.1296E+00 4.8014E-02
 Accumulated dose (rem) 3.6554E-04 1.2638E+00 5.3719E-02

Exclusion Area Boundary Doses:

Time (h) = 1.0000 Whole Body Thyroid TEDE
 Delta dose (rem) 9.5166E-03 1.4623E-01 1.6337E-02
 Accumulated dose (rem) 1.1158E-02 2.3722E-01 2.1754E-02

Low Population Zone Doses:

Time (h) = 1.0000 Whole Body Thyroid TEDE
 Delta dose (rem) 2.3791E-02 3.6558E-01 4.0843E-02
 Accumulated dose (rem) 2.7896E-02 5.9306E-01 5.4386E-02

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station		
	Appendix C - Page: C4 of C11		
	Calc. No.: ALION-CAL-NPPD-3236-002		
	Rev. Number: 1		

Control room Doses:

Time (h) =	1.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.6530E-04	1.0649E+00	4.5230E-02
Accumulated dose (rem)		6.3083E-04	2.3287E+00	9.8949E-02

Exclusion Area Boundary Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.1388E-02	1.4080E-01	1.8509E-02
Accumulated dose (rem)		2.2547E-02	3.7803E-01	4.0263E-02

Low Population Zone Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.8471E-02	3.5201E-01	4.6272E-02
Accumulated dose (rem)		5.6367E-02	9.4507E-01	1.0066E-01

Control room Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.1425E-04	5.1636E-01	2.1926E-02
Accumulated dose (rem)		7.4508E-04	2.8450E+00	1.2087E-01

Exclusion Area Boundary Doses:

Time (h) =	1.8000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.9958E-01	2.4324E+00	3.2534E-01
Accumulated dose (rem)		2.2212E-01	2.8104E+00	3.6560E-01

Low Population Zone Doses:

Time (h) =	1.8000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.3284E-01	2.8378E+00	3.7956E-01
Accumulated dose (rem)		2.8921E-01	3.7829E+00	4.8022E-01

Control room Doses:

Time (h) =	1.8000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.6239E-03	9.4060E-01	4.4487E-02
Accumulated dose (rem)		3.3690E-03	3.7856E+00	1.6536E-01

Exclusion Area Boundary Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.2868E-02	1.5902E-01	2.1172E-02
Accumulated dose (rem)		2.3499E-01	2.9695E+00	3.8677E-01

Low Population Zone Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
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**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Delta dose (rem)	3.2170E-02	3.9754E-01	5.2930E-02
Accumulated dose (rem)	3.2138E-01	4.1804E+00	5.3315E-01

Control room Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.8852E-03	4.1909E-01	2.1272E-02
Accumulated dose (rem)		5.2542E-03	4.2047E+00	1.8663E-01

Exclusion Area Boundary Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.2382E-01	1.7026E+00	2.9844E-01
Accumulated dose (rem)		4.5881E-01	4.6721E+00	6.8521E-01

Low Population Zone Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		5.5954E-01	4.2566E+00	7.4609E-01
Accumulated dose (rem)		8.8092E-01	8.4370E+00	1.2792E+00

Control room Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.1774E-02	3.6191E+00	1.8009E-01
Accumulated dose (rem)		1.7028E-02	7.8238E+00	3.6672E-01

Exclusion Area Boundary Doses:

Time (h) =	8.3330	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.5489E-03	2.5728E-02	7.3923E-03
Accumulated dose (rem)		4.6536E-01	4.6978E+00	6.9260E-01

Low Population Zone Doses:

Time (h) =	8.3330	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.5489E-03	2.5728E-02	7.3923E-03
Accumulated dose (rem)		8.8747E-01	8.4627E+00	1.2866E+00

Control room Doses:

Time (h) =	8.3330	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.7421E-05	2.6068E-02	1.2676E-03
Accumulated dose (rem)		1.7066E-02	7.8499E+00	3.6799E-01

Exclusion Area Boundary Doses:

Time (h) =	10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.8288E-02	1.2445E-01	3.2291E-02
Accumulated dose (rem)		4.9365E-01	4.8223E+00	7.2489E-01



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
10.0000	2.8288E-02	1.2445E-01	3.2291E-02
Delta dose (rem)			
Accumulated dose (rem)	9.1576E-01	8.5872E+00	1.3189E+00

Control room Doses:

Time (h) =	Whole Body	Thyroid	TEDE
10.0000	1.0196E-04	7.9754E-02	3.8761E-03
Delta dose (rem)			
Accumulated dose (rem)	1.7168E-02	7.9297E+00	3.7186E-01

Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
12.0000	0.0000E+00	0.0000E+00	0.0000E+00
Delta dose (rem)			
Accumulated dose (rem)	4.9365E-01	4.8223E+00	7.2489E-01

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
12.0000	2.6463E-02	1.4289E-01	3.0965E-02
Delta dose (rem)			
Accumulated dose (rem)	9.4222E-01	8.7301E+00	1.3499E+00

Control room Doses:

Time (h) =	Whole Body	Thyroid	TEDE
12.0000	3.8765E-05	3.7266E-02	1.8114E-03
Delta dose (rem)			
Accumulated dose (rem)	1.7206E-02	7.9669E+00	3.7368E-01

Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
19.4440	0.0000E+00	0.0000E+00	0.0000E+00
Delta dose (rem)			
Accumulated dose (rem)	4.9365E-01	4.8223E+00	7.2489E-01

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
19.4440	6.1978E-02	4.9886E-01	7.7442E-02
Delta dose (rem)			
Accumulated dose (rem)	1.0042E+00	9.2289E+00	1.4273E+00

Control room Doses:

Time (h) =	Whole Body	Thyroid	TEDE
19.4440	1.7663E-05	2.0130E-02	9.7907E-04
Delta dose (rem)			
Accumulated dose (rem)	1.7224E-02	7.9871E+00	3.7465E-01

Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
24.0000			



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Delta dose (rem) 0.0000E+00 0.0000E+00 0.0000E+00
Accumulated dose (rem) 4.9365E-01 4.8223E+00 7.2489E-01

Low Population Zone Doses:

Time (h) = 24.0000 Whole Body Thyroid TEDE
Delta dose (rem) 2.4785E-02 2.8750E-01 3.3643E-02
Accumulated dose (rem) 1.0290E+00 9.5164E+00 1.4610E+00

Control room Doses:

Time (h) = 24.0000 Whole Body Thyroid TEDE
Delta dose (rem) 1.2006E-06 5.7850E-04 2.5959E-05
Accumulated dose (rem) 1.7225E-02 7.9876E+00 3.7468E-01

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) 4.9365E-01 4.8223E+00 7.2489E-01

Low Population Zone Doses:

Time (h) = 96.0000 Whole Body Thyroid TEDE
Delta dose (rem) 3.4625E-02 8.3072E-01 6.0037E-02
Accumulated dose (rem) 1.0636E+00 1.0347E+01 1.5210E+00

Control room Doses:

Time (h) = 96.0000 Whole Body Thyroid TEDE
Delta dose (rem) 1.1294E-06 3.6163E-04 1.2659E-05
Accumulated dose (rem) 1.7226E-02 7.9880E+00 3.7469E-01

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) 4.9365E-01 4.8223E+00 7.2489E-01

Low Population Zone Doses:

Time (h) = 720.0000 Whole Body Thyroid TEDE
Delta dose (rem) 1.7044E-02 6.6725E-01 3.7363E-02
Accumulated dose (rem) 1.0807E+00 1.1014E+01 1.5584E+00

Control room Doses:

Time (h) = 720.0000 Whole Body Thyroid TEDE
Delta dose (rem) 1.0656E-06 5.4959E-04 1.7801E-05
Accumulated dose (rem) 1.7227E-02 7.9885E+00 3.7471E-01



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

945

I-131 Summary
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Time (hr)	Drywell Free Volume I-131 (Curies)	Reactor Building I-131 (Curies)	Environment I-131 (Curies)
0.000	3.6694E+03	0.0000E+00	2.6969E-04
0.017	1.0919E+05	0.0000E+00	2.4012E-01
0.017	1.0984E+05	0.0000E+00	2.4301E-01
0.083	5.3858E+05	0.0000E+00	5.9771E+00
0.400	2.3876E+06	7.0390E-01	8.9481E+00
0.500	2.9118E+06	8.5891E-01	1.0638E+01
0.800	5.7838E+06	1.7064E+00	1.8993E+01
1.000	7.6094E+06	2.2461E+00	2.7576E+01
1.300	1.0221E+07	5.0565E+00	4.3791E+01
1.600	1.2689E+07	6.2794E+00	6.4733E+01
1.800	1.4257E+07	7.0568E+00	8.1191E+01
2.000	1.5767E+07	7.8052E+00	9.9571E+01
2.300	1.2481E+07	6.1928E+00	1.2589E+02
2.600	9.9245E+06	4.9243E+00	1.4759E+02
2.900	7.9360E+06	3.9375E+00	1.6569E+02
3.200	6.3892E+06	3.1699E+00	1.8098E+02
3.500	5.1859E+06	2.5727E+00	1.9410E+02
3.800	4.2497E+06	2.1082E+00	2.0553E+02
4.100	3.5214E+06	1.7467E+00	2.1563E+02
4.400	2.9546E+06	1.4655E+00	2.2470E+02
4.700	2.5135E+06	1.2466E+00	2.3298E+02
5.000	2.1702E+06	1.0762E+00	2.4063E+02
5.300	1.9881E+06	9.8557E-01	2.4786E+02
5.600	1.8334E+06	9.0882E-01	2.5482E+02
5.900	1.7018E+06	8.4358E-01	2.6155E+02
6.200	1.5900E+06	7.8812E-01	2.6808E+02
6.500	1.4949E+06	7.4095E-01	2.7444E+02
6.800	1.4140E+06	7.0083E-01	2.8066E+02
7.100	1.3452E+06	6.6670E-01	2.8676E+02
7.400	1.2866E+06	6.3763E-01	2.9275E+02
7.700	1.2367E+06	6.1288E-01	2.9865E+02
8.000	1.1941E+06	5.9178E-01	3.0447E+02
8.300	1.1579E+06	5.7379E-01	3.1023E+02
8.333	1.1542E+06	5.7198E-01	3.1086E+02
8.700	1.1229E+06	5.5643E-01	3.1782E+02
9.000	1.1007E+06	5.4545E-01	3.2346E+02
9.300	1.0813E+06	5.3581E-01	3.2907E+02
9.600	1.0642E+06	5.2734E-01	3.3464E+02
9.900	1.0492E+06	5.1988E-01	3.4018E+02
10.000	1.0446E+06	5.1760E-01	3.4203E+02
10.300	1.0319E+06	5.1130E-01	3.4753E+02
12.000	9.8301E+05	4.8707E-01	3.7836E+02
19.444	9.2163E+05	4.5665E-01	5.0929E+02



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Rev. Number: 1

24.000	9.0424E+05	4.4803E-01	5.8735E+02
96.000	6.9134E+05	1.7127E-01	1.1227E+03
720.000	6.7664E+04	1.6763E-02	2.6927E+03

Time (hr)	Control Room I-131 (Curies)
0.000	1.9195E-06
0.017	1.6950E-03
0.017	1.6973E-03
0.083	6.2938E-03
0.400	5.3462E-03
0.500	5.0778E-03
0.800	4.3506E-03
1.000	3.9246E-03
1.300	3.3625E-03
1.600	4.0766E-03
1.800	4.6399E-03
2.000	4.1856E-03
2.300	3.5862E-03
2.600	3.0726E-03
2.900	2.6326E-03
3.200	2.2556E-03
3.500	1.9326E-03
3.800	1.6558E-03
4.100	1.4187E-03
4.400	1.2155E-03
4.700	1.0415E-03
5.000	8.9232E-04
5.300	7.6454E-04
5.600	6.5505E-04
5.900	5.6124E-04
6.200	4.8087E-04
6.500	4.1201E-04
6.800	3.5301E-04
7.100	3.0245E-04
7.400	2.5914E-04
7.700	2.2203E-04
8.000	1.9024E-04
8.300	1.6301E-04
8.333	1.6026E-04
8.700	1.3267E-04
9.000	1.1369E-04
9.300	9.7427E-05
9.600	8.3491E-05
9.900	7.1551E-05
10.000	6.7964E-05
10.300	5.8248E-05
12.000	2.4327E-05
19.444	6.3310E-07
24.000	1.5812E-07
96.000	1.6469E-08



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

720.000 1.6320E-09

Cumulative Dose Summary
#####

Time (hr)	Exclusion Area Bounda		Low Population Zone		Control room	
	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
0.017	2.0585E-03	9.8683E-05	5.1462E-03	2.4671E-04	6.3316E-03	2.6944E-04
0.017	2.0833E-03	9.9872E-05	5.2083E-03	2.4968E-04	6.4130E-03	2.7291E-04
0.083	5.1240E-02	2.4550E-03	1.2810E-01	6.1376E-03	1.3414E-01	5.7053E-03
0.400	7.6601E-02	4.3500E-03	1.9150E-01	1.0875E-02	1.0149E+00	4.3145E-02
0.500	9.0992E-02	5.4172E-03	2.2748E-01	1.3543E-02	1.2638E+00	5.3719E-02
0.800	1.6290E-01	1.2802E-02	4.0725E-01	3.2005E-02	1.9361E+00	8.2278E-02
1.000	2.3722E-01	2.1754E-02	5.9306E-01	5.4386E-02	2.3287E+00	9.8949E-02
1.300	3.7803E-01	4.0263E-02	9.4507E-01	1.0066E-01	2.8450E+00	1.2087E-01
1.600	1.7410E+00	2.2254E-01	2.5351E+00	3.1331E-01	3.3717E+00	1.4485E-01
1.800	2.8104E+00	3.6560E-01	3.7829E+00	4.8022E-01	3.7856E+00	1.6536E-01
2.000	2.9695E+00	3.8677E-01	4.1804E+00	5.3315E-01	4.2047E+00	1.8663E-01
2.300	3.1964E+00	4.1795E-01	4.7478E+00	6.1109E-01	4.7561E+00	2.1451E-01
2.600	3.3824E+00	4.4540E-01	5.2128E+00	6.7972E-01	5.2270E+00	2.3820E-01
2.900	3.5367E+00	4.6979E-01	5.5985E+00	7.4069E-01	5.6291E+00	2.5835E-01
3.200	3.6663E+00	4.9164E-01	5.9226E+00	7.9532E-01	5.9725E+00	2.7549E-01
3.500	3.7768E+00	5.1138E-01	6.1987E+00	8.4466E-01	6.2659E+00	2.9008E-01
3.800	3.8724E+00	5.2933E-01	6.4377E+00	8.8954E-01	6.5164E+00	3.0251E-01
4.100	3.9564E+00	5.4577E-01	6.6477E+00	9.3063E-01	6.7304E+00	3.1310E-01
4.400	4.0314E+00	5.6091E-01	6.8352E+00	9.6849E-01	6.9133E+00	3.2212E-01
4.700	4.0993E+00	5.7493E-01	7.0051E+00	1.0036E+00	7.0695E+00	3.2981E-01
5.000	4.1618E+00	5.8799E-01	7.1613E+00	1.0362E+00	7.2029E+00	3.3637E-01
5.300	4.2206E+00	6.0022E-01	7.3083E+00	1.0668E+00	7.3169E+00	3.4197E-01
5.600	4.2769E+00	6.1177E-01	7.4491E+00	1.0956E+00	7.4143E+00	3.4674E-01
5.900	4.3312E+00	6.2267E-01	7.5847E+00	1.1229E+00	7.4976E+00	3.5081E-01
6.200	4.3836E+00	6.3300E-01	7.7157E+00	1.1487E+00	7.5687E+00	3.5428E-01
6.500	4.4345E+00	6.4279E-01	7.8429E+00	1.1732E+00	7.6295E+00	3.5725E-01
6.800	4.4840E+00	6.5210E-01	7.9668E+00	1.1965E+00	7.6814E+00	3.5978E-01
7.100	4.5324E+00	6.6097E-01	8.0878E+00	1.2186E+00	7.7258E+00	3.6195E-01
7.400	4.5798E+00	6.6942E-01	8.2063E+00	1.2398E+00	7.7637E+00	3.6379E-01
7.700	4.6263E+00	6.7749E-01	8.3226E+00	1.2599E+00	7.7961E+00	3.6537E-01
8.000	4.6721E+00	6.8521E-01	8.4370E+00	1.2792E+00	7.8238E+00	3.6672E-01
8.300	4.6953E+00	6.9189E-01	8.4602E+00	1.2859E+00	7.8475E+00	3.6787E-01
8.333	4.6978E+00	6.9260E-01	8.4627E+00	1.2866E+00	7.8499E+00	3.6799E-01
8.700	4.7258E+00	7.0035E-01	8.4907E+00	1.2944E+00	7.8738E+00	3.6915E-01
9.000	4.7484E+00	7.0639E-01	8.5133E+00	1.3004E+00	7.8903E+00	3.6995E-01
9.300	4.7708E+00	7.1220E-01	8.5357E+00	1.3062E+00	7.9043E+00	3.7063E-01
9.600	4.7929E+00	7.1778E-01	8.5579E+00	1.3118E+00	7.9163E+00	3.7122E-01
9.900	4.8150E+00	7.2315E-01	8.5799E+00	1.3172E+00	7.9266E+00	3.7171E-01
10.000	4.8223E+00	7.2489E-01	8.5872E+00	1.3189E+00	7.9297E+00	3.7186E-01
10.300	4.8223E+00	7.2489E-01	8.6090E+00	1.3240E+00	7.9380E+00	3.7227E-01
12.000	4.8223E+00	7.2489E-01	8.7301E+00	1.3499E+00	7.9669E+00	3.7368E-01



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix C - Page: C11 of C11

Calc. No.: ALION-CAL-NPPD-3236-002


Rev. Number: 1

19.444 4.8223E+00 7.2489E-01 9.2289E+00 1.4273E+00 7.9871E+00 3.7465E-01
24.000 4.8223E+00 7.2489E-01 9.5164E+00 1.4610E+00 7.9876E+00 3.7468E-01
96.000 4.8223E+00 7.2489E-01 1.0347E+01 1.5210E+00 7.9880E+00 3.7469E-01
720.000 4.8223E+00 7.2489E-01 1.1014E+01 1.5584E+00 7.9885E+00 3.7471E-01

Worst Two-Hour Doses
#####

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
1.3	2.8704E-01	3.3251E+00	4.5796E-01

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix D - Page: <u>D1</u> of <u>D16</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX D

RADTRAD 3.03 Plant Specific Input

MSIV Pathway



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D3 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Environment

2

0.0000E+00

0

0

0

0

0

Compartment 4:

Control Room

1

1.4190E+05

0

0

0

0

0

Compartment 5:

Turbine Building

3

1.0000E+02

0

0

0

0

0

Pathways:

7

Pathway 1:

Failed MSIV Drywell to Condenser

1

2

1

Pathway 2:

Condenser to Turbine Building

2

5

2

Pathway 3:

Unfiltered Environment to Control Room

3

4

2

Pathway 4:

Filtered Environment to Control Room

3

4

2

Pathway 5:

Exhaust Control Room to Environment

4



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D4 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

3

2

Pathway 6:

Turbine Building to Environment

5

3

2

Pathway 7:

Intact MSIV Drywell to Condenser

1

2

1

End of Plant Model File

Scenario Description Name:

Plant Model Filename:

Source Term:

1

1 1.0000E+00

d:\rad303nrc\defaults\fgr11&12.inp

d:\rad303nrc\defaults\bwr_dba.rft

0.0000E+00

1

9.5000E-01 4.8500E-02 1.5000E-03 1.0000E+00

Overlying Pool:

0

0.0000E+00

0

0

0

0

Compartments:

5

Compartment 1:

0

1

0

0

0

0

0

3

3

1.0000E+01

1

1

0.0000E+00 0.0000E+00

Compartment 2:

0

1



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D5 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0
0
0
0
0

Compartment 3:

0
1
0
0
0
0
0
0
0
0

Compartment 4:

0
1
0
0
0
0
0
0
0
0

Compartment 5:

0
1
0
0
0
0
0
0
0
0

Pathways:

7

Pathway 1:

0

0

1

2

0.0000E+00 1.0000E+00 1.3370E+00

2.4000E+01 1.0000E+00 6.6850E-01

1

2

0.0000E+00 1.0000E+00 1.3370E+00

2.4000E+01 1.0000E+00 6.6850E-01

1



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D6 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

2
0.0000E+00 1.0000E+00 1.3370E+00
2.4000E+01 1.0000E+00 6.6850E-01

0
0
0
0
0
0
0

Pathway 2:

0
0
0
0
0
1
2

0.0000E+00 5.4500E+00 9.4900E+01 9.4900E+01 0.0000E+00
2.4000E+01 2.7260E+00 9.7400E+01 9.7400E+01 0.0000E+00

0
0
0
0
0
0

Pathway 3:

0
0
0
0
0
1
5

0.0000E+00 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00
1.6700E-02 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00
8.3330E+00 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00
1.2000E+01 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00
1.9444E+01 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00

0
0
0
0
0
0

Pathway 4:

0
0
0
0
0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D7 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

1					
2					
0.0000E+00	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	8.1000E+02	9.8000E+01	8.9000E+01	8.9000E+01	8.9000E+01

Pathway 5:

0					
0					
0					
0					
0					
1					
2					
0.0000E+00	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	1.2100E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway 6:

0					
0					
0					
0					
0					
1					
1					
0.0000E+00	5.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Pathway 7:

0			
0			
1			
2			
0.0000E+00	1.0000E+00	1.3370E+00	
2.4000E+01	1.0000E+00	6.6850E-01	
1			
2			
0.0000E+00	1.0000E+00	1.3370E+00	



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D8 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

2.4000E+01	1.0000E+00	6.6850E-01
1		
2		
0.0000E+00	1.0000E+00	1.3370E+00
2.4000E+01	1.0000E+00	6.6850E-01
0		
0		
0		
0		
0		
0		

Dose Locations:

3

Location 1:

Exclusion Area Boundary

3

1

2

0.0000E+00	5.2000E-04
1.0000E+01	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 2:

Low Population Zone

3

1

4

0.0000E+00	2.9000E-04
8.0000E+00	7.3000E-05
2.4000E+01	2.5000E-05
9.6000E+01	5.2000E-06
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
------------	------------



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D9 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

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
5
0.0000E+00 8.6400E-04
2.0000E+00 4.6600E-04
8.0000E+00 2.3200E-04
2.4000E+01 1.5300E-04
9.6000E+01 1.2500E-04
Simulation Parameters:
2
0.0000E+00 1.0000E-01
2.4000E+01 0.0000E+00
Output Filename:
D:\RAD303NRC\Utility\Cooper\LOCA\LOCA_MSIV_condenser.o2
1
1
1
0
0
End of Scenario File

RADTRAD Version 3.03 (Spring 2001) run on 6/25/2008 at 14:48:58
#####

Plant Description
#####

Number of Nuclides = 60
Inventory Power = 1.0000E+00 MWth
Plant Power Level = 2.4286E+03 MWth

Number of compartments = 5


Compartment information

Compartment number 1 (Source term fraction = 1.0000E+00

)

Name: Drywell Free Volume

Compartment volume = 1.3225E+05 (Cubic feet)

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix D - Page: <u>D10</u> of <u>D16</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

Compartment type is Normal

Removal devices within compartment:

Deposition

Pathways into and out of compartment 1

Exit Pathway Number 1: Failed MSIV Drywell to Condenser

Exit Pathway Number 7: Intact MSIV Drywell to Condenser

Compartment number 2

Name: Condenser

Compartment volume = 4.8000E+04 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 2

Inlet Pathway Number 1: Failed MSIV Drywell to Condenser

Inlet Pathway Number 7: Intact MSIV Drywell to Condenser

Exit Pathway Number 2: Condenser to Turbine Building

Compartment number 3

Name: Environment

Compartment type is Environment

Pathways into and out of compartment 3

Inlet Pathway Number 5: Exhaust Control Room to Environment

Inlet Pathway Number 6: Turbine Building to Environment

Exit Pathway Number 3: Unfiltered Environment to Control Room

Exit Pathway Number 4: Filtered Environment to Control Room

Compartment number 4

Name: Control Room

Compartment volume = 1.4190E+05 (Cubic feet)

Compartment type is Control Room

Pathways into and out of compartment 4

Inlet Pathway Number 3: Unfiltered Environment to Control Room

Inlet Pathway Number 4: Filtered Environment to Control Room

Exit Pathway Number 5: Exhaust Control Room to Environment

Compartment number 5

Name: Turbine Building

Compartment volume = 1.0000E+02 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 5

Inlet Pathway Number 2: Condenser to Turbine Building

Exit Pathway Number 6: Turbine Building to Environment

Total number of pathways = 7

 RADTRAD Version 3.03 (Spring 2001) run on 6/25/2008 at 14:48:58
 #####

 Scenario Description
 #####

Radioactive Decay is enabled
 Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.500000 hr	1.5000 hrs	0.0000 hrs	(gm)
NOBLES	5.0000E-02	9.5000E-01	0.0000E+00	2.972E+03
IODINE	5.0000E-02	2.5000E-01	0.0000E+00	2.104E+02
CESIUM	5.0000E-02	2.0000E-01	0.0000E+00	3.146E+04
TELLURIUM	0.0000E+00	5.0000E-02	0.0000E+00	2.823E+01
STRONTIUM	0.0000E+00	2.0000E-02	0.0000E+00	1.074E+03
BARIUM	0.0000E+00	2.0000E-02	0.0000E+00	3.140E+01
RUTHENIUM	0.0000E+00	2.5000E-03	0.0000E+00	4.161E+01
CERIUM	0.0000E+00	5.0000E-04	0.0000E+00	4.376E+02
LANTHANUM	0.0000E+00	2.0000E-04	0.0000E+00	4.442E+00

Inventory Power = 2429. 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)
Co-58	7	1.529E+02	6.117E+06	4.760E-14	8.720E-10	2.940E-09
Co-60	7	1.830E+02	1.663E+08	1.260E-13	1.620E-08	5.910E-08
Kr-85	1	3.660E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	6.810E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.300E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.830E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Rb-86	3	6.990E+01	1.612E+06	4.810E-15	1.330E-09	1.790E-09
Sr-89	5	2.440E+04	4.363E+06	7.730E-17	7.960E-12	1.120E-08
Sr-90	5	2.900E+03	9.190E+08	7.530E-18	2.690E-10	3.510E-07
Sr-91	5	3.100E+04	3.420E+04	4.924E-14	9.930E-12	4.547E-10
Sr-92	5	3.380E+04	9.756E+03	6.790E-14	3.920E-12	2.180E-10
Y-90	9	3.000E+03	2.304E+05	1.900E-16	5.170E-13	2.280E-09
Y-91	9	3.170E+04	5.055E+06	2.600E-16	8.500E-12	1.320E-08
Y-92	9	3.390E+04	1.274E+04	1.300E-14	1.050E-12	2.110E-10
Y-93	9	3.960E+04	3.636E+04	4.800E-15	9.260E-13	5.820E-10
Zr-95	9	4.450E+04	5.528E+06	3.600E-14	1.440E-09	6.390E-09
Zr-97	9	4.510E+04	6.084E+04	4.432E-14	2.315E-11	1.171E-09
Nb-95	9	4.480E+04	3.037E+06	3.740E-14	3.580E-10	1.570E-09
Mo-99	7	5.120E+04	2.376E+05	7.280E-15	1.520E-11	1.070E-09
Tc-99m	7	4.520E+04	2.167E+04	5.890E-15	5.010E-11	8.800E-12
Ru-103	7	4.300E+04	3.394E+06	2.251E-14	2.570E-10	2.421E-09



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D12 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Ru-105	7	3.030E+04	1.598E+04	3.810E-14	4.150E-12	1.230E-10
Ru-106	7	1.740E+04	3.181E+07	1.040E-14	1.720E-09	1.290E-07
Rh-105	7	2.770E+04	1.273E+05	3.720E-15	2.880E-12	2.580E-10
Sb-127	4	3.020E+03	3.326E+05	3.330E-14	6.150E-11	1.630E-09
Sb-129	4	8.930E+03	1.555E+04	7.140E-14	9.720E-12	1.740E-10
Te-127	4	3.050E+03	3.366E+04	2.420E-16	1.840E-12	8.600E-11
Te-127m	4	4.060E+02	9.418E+06	1.470E-16	9.660E-11	5.810E-09
Te-129	4	8.790E+03	4.176E+03	2.750E-15	5.090E-13	2.090E-11
Te-129m	4	1.300E+03	2.903E+06	3.337E-15	1.563E-10	6.484E-09
Te-131m	4	3.960E+03	1.080E+05	7.463E-14	3.669E-08	1.758E-09
Te-132	4	3.850E+04	2.815E+05	1.030E-14	6.280E-08	2.550E-09
I-131	2	2.720E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.930E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.510E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-133	1	5.260E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-135	1	1.860E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Cs-134	3	6.750E+03	6.507E+07	7.570E-14	1.110E-08	1.250E-08
Cs-136	3	2.160E+03	1.132E+06	1.060E-13	1.730E-09	1.980E-09
Cs-137	3	4.050E+03	9.467E+08	2.725E-14	7.930E-09	8.630E-09
Ba-139	6	4.900E+04	4.962E+03	2.170E-15	2.400E-12	4.640E-11
Ba-140	6	4.710E+04	1.101E+06	8.580E-15	2.560E-10	1.010E-09
La-140	9	4.870E+04	1.450E+05	1.170E-13	6.870E-11	1.310E-09
La-141	9	4.460E+04	1.415E+04	2.390E-15	9.400E-12	1.570E-10
La-142	9	4.300E+04	5.550E+03	1.440E-13	8.740E-12	6.840E-11
Ce-141	8	4.470E+04	2.808E+06	3.430E-15	2.550E-11	2.420E-09
Ce-143	8	4.110E+04	1.188E+05	1.290E-14	6.230E-12	9.160E-10
Ce-144	8	3.660E+04	2.456E+07	2.773E-15	2.920E-10	1.010E-07
Pr-143	9	4.020E+04	1.172E+06	2.100E-17	1.680E-18	2.190E-09
Nd-147	8	1.800E+04	9.487E+05	6.190E-15	1.820E-11	1.850E-09
Np-239	8	5.860E+05	2.035E+05	7.690E-15	7.620E-12	6.780E-10
Pu-238	8	1.280E+02	2.769E+09	4.880E-18	3.860E-10	7.790E-05
Pu-239	8	1.290E+01	7.594E+11	4.240E-18	3.750E-10	8.330E-05
Pu-240	8	1.770E+01	2.063E+11	4.750E-18	3.760E-10	8.330E-05
Pu-241	8	5.340E+03	4.544E+08	7.250E-20	9.150E-12	1.340E-06
Am-241	9	6.870E+00	1.364E+10	8.180E-16	1.600E-09	1.200E-04
Cm-242	9	1.730E+03	1.407E+07	5.690E-18	9.410E-10	4.670E-06
Cm-244	9	1.110E+02	5.715E+08	4.910E-18	1.010E-09	6.700E-05

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
Sr-90	Y-90	1.00	none	0.00	none	0.00
Sr-91	Y-91m	0.58	Y-91	0.42	none	0.00
Sr-92	Y-92	1.00	none	0.00	none	0.00
Y-93	Zr-93	1.00	none	0.00	none	0.00
Zr-95	Nb-95m	0.01	Nb-95	0.99	none	0.00
Zr-97	Nb-97m	0.95	Nb-97	0.05	none	0.00
Mo-99	Tc-99m	0.88	Tc-99	0.12	none	0.00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D13 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	1.00	none	0.00	none	0.00

Iodine fractions

Aerosol = 9.5000E-01
 Elemental = 4.8500E-02
 Organic = 1.5000E-03

COMPARTMENT DATA

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

Natural Deposition: Elemental Removal Data
 Time (hr) Removal Coef. (hr⁻¹)
 0.0000E+00 0.0000E+00

Compartment number 2: Condenser

Compartment number 3: Environment

Compartment number 4: Control Room



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D14 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Compartment number 5: Turbine Building

PATHWAY DATA

Pathway number 1: Failed MSIV Drywell to Condenser

Piping: Removal Data

Time (hr)	Flow Rate (cfm)	DF		
		Aerosol	Elemental	Organic
0.0000E+00	1.3370E+00	1.0000E+00	1.0000E+00	1.0000E+00
2.4000E+01	6.6850E-01	1.0000E+00	1.0000E+00	1.0000E+00

Pathway number 2: Condenser to Turbine Building

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	5.4500E+00	9.4900E+01	9.4900E+01	0.0000E+00
2.4000E+01	2.7260E+00	9.7400E+01	9.7400E+01	0.0000E+00

Pathway number 3: Unfiltered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
8.3330E+00	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.2000E+01	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.9444E+01	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 4: Filtered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	8.1000E+02	9.8000E+01	8.9000E+01	8.9000E+01

Pathway number 5: Exhaust Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D15 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

1.6700E-02 1.2100E+03 0.0000E+00 0.0000E+00 0.0000E+00

Pathway number 6: Turbine Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	5.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 7: Intact MSIV Drywell to Condenser

Piping: Removal Data

Time (hr)	Flow Rate (cfm)	DF		
		Aerosol	Elemental	Organic
0.0000E+00	1.3370E+00	1.0000E+00	1.0000E+00	1.0000E+00
2.4000E+01	6.6850E-01	1.0000E+00	1.0000E+00	1.0000E+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	5.2000E-04
1.0000E+01	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 Low Population Zone is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m^-3)
0.0000E+00	2.9000E-04
8.0000E+00	7.3000E-05
2.4000E+01	2.5000E-05
9.6000E+01	5.2000E-06

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



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix D - Page: D16 of D16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	8.6400E-04
2.0000E+00	4.6600E-04
8.0000E+00	2.3200E-04
2.4000E+01	1.5300E-04
9.6000E+01	1.2500E-04

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
2.4000E+01	0.0000E+00

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix E - Page: <u>E1</u> of <u>E10</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX E
RADTRAD 3.03 Plant Specific Output
MSIV Pathway



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E2 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

RADTRAD Version 3.03 (Spring 2001) run on 7/21/2008 at 14:32:52
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Dose Output
#####

Exclusion Area Boundary Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.7076E-09	3.6616E-07	2.2087E-08
Accumulated dose (rem)		6.7076E-09	3.6616E-07	2.2087E-08

Low Population Zone Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.7408E-09	2.0420E-07	1.2318E-08
Accumulated dose (rem)		3.7408E-09	2.0420E-07	1.2318E-08

Control room Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.2393E-12	7.2474E-09	3.1064E-10
Accumulated dose (rem)		6.2393E-12	7.2474E-09	3.1064E-10

Exclusion Area Boundary Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.6693E-04	1.5230E-02	9.0585E-04
Accumulated dose (rem)		2.6694E-04	1.5230E-02	9.0587E-04

Low Population Zone Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.4887E-04	8.4934E-03	5.0518E-04
Accumulated dose (rem)		1.4887E-04	8.4936E-03	5.0520E-04

Control room Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.0881E-06	5.5994E-04	2.4504E-05



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E3 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Accumulated dose (rem) 1.0881E-06 5.5995E-04 2.4505E-05

Exclusion Area Boundary Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		7.5301E-03	2.8231E-01	2.0948E-02
Accumulated dose (rem)		7.7971E-03	2.9754E-01	2.1854E-02

Low Population Zone Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		4.1995E-03	1.5744E-01	1.1682E-02
Accumulated dose (rem)		4.3484E-03	1.6593E-01	1.2188E-02

Control room Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.4387E-05	2.3737E-02	1.1435E-03
Accumulated dose (rem)		6.5475E-05	2.4297E-02	1.1680E-03

Exclusion Area Boundary Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.7145E-02	8.7431E-01	7.2276E-02
Accumulated dose (rem)		3.4942E-02	1.1718E+00	9.4129E-02

Low Population Zone Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.5139E-02	4.8760E-01	4.0308E-02
Accumulated dose (rem)		1.9487E-02	6.5353E-01	5.2495E-02

Control room Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.8452E-04	1.1379E-01	6.0229E-03
Accumulated dose (rem)		4.4999E-04	1.3809E-01	7.1909E-03

Exclusion Area Boundary Doses:

Time (h) =	3.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.1299E-01	3.5615E+00	3.0245E-01
Accumulated dose (rem)		1.4793E-01	4.7334E+00	3.9658E-01

Low Population Zone Doses:

Time (h) =	3.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.3012E-02	1.9862E+00	1.6868E-01
Accumulated dose (rem)		8.2499E-02	2.6398E+00	2.2117E-01

Control room Doses:



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E4 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (h) =	3.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.8157E-03	5.3403E-01	2.9507E-02
Accumulated dose (rem)		2.2657E-03	6.7212E-01	3.6698E-02

Exclusion Area Boundary Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.4265E-01	1.9387E+01	1.6565E+00
Accumulated dose (rem)		7.9058E-01	2.4121E+01	2.0531E+00

Low Population Zone Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.5840E-01	1.0812E+01	9.2381E-01
Accumulated dose (rem)		4.4090E-01	1.3452E+01	1.1450E+00

Control room Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.5906E-02	4.6642E+00	2.5984E-01
Accumulated dose (rem)		1.8171E-02	5.3363E+00	2.9654E-01

Exclusion Area Boundary Doses:

Time (h) =	8.3330	Whole Body	Thyroid	TEDE
Delta dose (rem)		4.7365E-02	7.7503E-01	8.7009E-02
Accumulated dose (rem)		8.3795E-01	2.4896E+01	2.1401E+00

Low Population Zone Doses:

Time (h) =	8.3330	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.6493E-03	1.0880E-01	1.2215E-02
Accumulated dose (rem)		4.4755E-01	1.3561E+01	1.1572E+00

Control room Doses:

Time (h) =	8.3330	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.3407E-03	4.0869E-01	2.2404E-02
Accumulated dose (rem)		1.9512E-02	5.7450E+00	3.1894E-01

Exclusion Area Boundary Doses:

Time (h) =	10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.3221E-01	3.9591E+00	4.3290E-01
Accumulated dose (rem)		1.0702E+00	2.8855E+01	2.5730E+00

Low Population Zone Doses:

Time (h) =	10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.2599E-02	5.5579E-01	6.0772E-02



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E5 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Accumulated dose (rem) 4.8015E-01 1.4116E+01 1.2180E+00

Control room Doses:

Time (h) =	Whole Body	Thyroid	TEDE
10.0000	5.3294E-03	1.7169E+00	9.3354E-02
Delta dose (rem)			
Accumulated dose (rem)	2.4841E-02	7.4619E+00	4.1230E-01

Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
12.0000	0.0000E+00	0.0000E+00	0.0000E+00
Delta dose (rem)			
Accumulated dose (rem)	1.0702E+00	2.8855E+01	2.5730E+00

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
12.0000	3.7283E-02	6.8844E-01	7.1628E-02
Delta dose (rem)			
Accumulated dose (rem)	5.1743E-01	1.4805E+01	1.2896E+00

Control room Doses:

Time (h) =	Whole Body	Thyroid	TEDE
12.0000	5.0051E-03	1.7101E+00	9.1261E-02
Delta dose (rem)			
Accumulated dose (rem)	2.9847E-02	9.1720E+00	5.0356E-01

Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
19.4440	0.0000E+00	0.0000E+00	0.0000E+00
Delta dose (rem)			
Accumulated dose (rem)	1.0702E+00	2.8855E+01	2.5730E+00

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
19.4440	1.2422E-01	2.7337E+00	2.5571E-01
Delta dose (rem)			
Accumulated dose (rem)	6.4165E-01	1.7539E+01	1.5453E+00

Control room Doses:

Time (h) =	Whole Body	Thyroid	TEDE
19.4440	1.5906E-02	6.0469E+00	3.0680E-01
Delta dose (rem)			
Accumulated dose (rem)	4.5753E-02	1.5219E+01	8.1036E-01

Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
24.0000	0.0000E+00	0.0000E+00	0.0000E+00
Delta dose (rem)			
Accumulated dose (rem)	1.0702E+00	2.8855E+01	2.5730E+00

Low Population Zone Doses:



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E6 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.9965E-02	1.7882E+00	1.5268E-01
Accumulated dose (rem)	7.1162E-01	1.9327E+01	1.6980E+00

Control room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.2725E-03	3.9616E+00	1.9087E-01
Accumulated dose (rem)	5.5025E-02	1.9181E+01	1.0012E+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)	1.0702E+00	2.8855E+01	2.5730E+00

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.5519E-01	4.0821E+00	3.2234E-01
Accumulated dose (rem)	8.6681E-01	2.3409E+01	2.0203E+00

Control room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.7358E-02	9.5520E+00	4.1426E-01
Accumulated dose (rem)	8.2383E-02	2.8733E+01	1.4155E+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)	1.0702E+00	2.8855E+01	2.5730E+00

Low Population Zone Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2767E-01	4.4538E+00	2.9018E-01
Accumulated dose (rem)	9.9448E-01	2.7863E+01	2.3105E+00

Control room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.7051E-02	2.6009E+01	9.8550E-01
Accumulated dose (rem)	1.3943E-01	5.4741E+01	2.4010E+00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E7 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

I-131 Summary
#####

Time (hr)	Drywell Free Volume I-131 (Curies)	Condenser I-131 (Curies)	Environment I-131 (Curies)
0.000	3.6694E+03	1.2366E-03	3.2973E-12
0.017	1.0984E+05	1.1142E+00	1.3145E-06
0.400	2.3872E+06	5.9826E+02	2.8315E-02
0.500	2.9111E+06	9.1913E+02	5.4895E-02
0.800	5.7820E+06	2.5014E+03	2.2744E-01
1.100	8.4930E+06	5.0924E+03	6.2372E-01
1.300	1.0216E+07	7.3508E+03	1.0645E+00
1.600	1.2681E+07	1.1493E+04	2.0652E+00
1.900	1.5008E+07	1.6492E+04	3.5576E+00
2.000	1.5754E+07	1.8340E+04	4.1802E+00
2.300	1.2467E+07	2.3386E+04	6.4324E+00
2.600	9.9110E+06	2.7360E+04	9.1740E+00
2.900	7.9230E+06	3.0500E+04	1.2306E+01
3.200	6.3769E+06	3.2992E+04	1.5751E+01
3.300	5.9420E+06	3.3704E+04	1.6958E+01
3.600	4.8362E+06	3.5549E+04	2.0730E+01
3.900	3.9760E+06	3.7034E+04	2.4694E+01
4.200	3.3068E+06	3.8237E+04	2.8819E+01
4.500	2.7862E+06	3.9221E+04	3.3077E+01
4.800	2.3811E+06	4.0036E+04	3.7449E+01
5.100	2.0983E+06	4.0719E+04	4.1918E+01
5.400	1.9259E+06	4.1323E+04	4.6474E+01
5.700	1.7794E+06	4.1867E+04	5.1109E+01
6.000	1.6548E+06	4.2361E+04	5.5818E+01
6.300	1.5489E+06	4.2811E+04	6.0595E+01
6.600	1.4589E+06	4.3224E+04	6.5437E+01
6.900	1.3822E+06	4.3606E+04	7.0339E+01
7.200	1.3170E+06	4.3961E+04	7.5299E+01
7.500	1.2614E+06	4.4293E+04	8.0313E+01
7.800	1.2140E+06	4.4605E+04	8.5380E+01
8.000	1.1864E+06	4.4804E+04	8.8787E+01
8.300	1.1500E+06	4.5089E+04	9.3937E+01
8.333	1.1463E+06	4.5120E+04	9.4506E+01
8.700	1.1148E+06	4.5451E+04	1.0088E+02
9.000	1.0925E+06	4.5711E+04	1.0614E+02
9.300	1.0729E+06	4.5962E+04	1.1144E+02
9.600	1.0557E+06	4.6206E+04	1.1679E+02
9.900	1.0404E+06	4.6444E+04	1.2218E+02
10.000	1.0358E+06	4.6521E+04	1.2399E+02
10.300	1.0229E+06	4.6751E+04	1.2944E+02
12.000	9.7289E+05	4.7969E+04	1.6109E+02
19.444	9.0572E+05	5.2498E+04	3.1377E+02
24.000	8.8479E+05	5.4905E+04	4.1745E+02
96.000	6.5376E+05	5.9060E+04	1.0227E+03
720.000	4.7594E+04	9.2611E+03	4.4389E+03



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E8 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (hr)	Control Room	Turbine Building
	I-131 (Curies)	I-131 (Curies)
0.000	4.8864E-15	7.8488E-11
0.017	1.9374E-09	9.0228E-07
0.400	4.6331E-06	7.0211E-04
0.500	8.8687E-06	1.0828E-03
0.800	3.5481E-05	2.9594E-03
1.100	9.4222E-05	6.0435E-03
1.300	1.5740E-04	8.7361E-03
1.600	2.9555E-04	1.3681E-02
1.900	4.9269E-04	1.9658E-02
2.000	5.7260E-04	2.1869E-02
2.300	6.8530E-04	2.7956E-02
2.600	8.2411E-04	3.2798E-02
2.900	9.7690E-04	3.6670E-02
3.200	1.1351E-03	3.9789E-02
3.300	1.1880E-03	4.0691E-02
3.600	1.3448E-03	4.3057E-02
3.900	1.4963E-03	4.5004E-02
4.200	1.6404E-03	4.6622E-02
4.500	1.7761E-03	4.7986E-02
4.800	1.9027E-03	4.9151E-02
5.100	2.0203E-03	5.0163E-02
5.400	2.1292E-03	5.1082E-02
5.700	2.2301E-03	5.1930E-02
6.000	2.3235E-03	5.2718E-02
6.300	2.4102E-03	5.3455E-02
6.600	2.4907E-03	5.4148E-02
6.900	2.5656E-03	5.4803E-02
7.200	2.6355E-03	5.5427E-02
7.500	2.7008E-03	5.6022E-02
7.800	2.7619E-03	5.6594E-02
8.000	2.8006E-03	5.6964E-02
8.300	2.6267E-03	5.7503E-02
8.333	2.6094E-03	5.7561E-02
8.700	2.4367E-03	5.8198E-02
9.000	2.3204E-03	5.8705E-02
9.300	2.2231E-03	5.9202E-02
9.600	2.1420E-03	5.9689E-02
9.900	2.0747E-03	6.0167E-02
10.000	2.0549E-03	6.0324E-02
10.300	2.0030E-03	6.0792E-02
12.000	1.8535E-03	6.3329E-02
19.444	2.0249E-03	7.3163E-02
24.000	2.2029E-03	7.8498E-02
96.000	6.1116E-04	3.0651E-02
720.000	9.6766E-05	5.7275E-03



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E9 of E10

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Cumulative Dose Summary
#####

Time (hr)	Exclusion Area Bounda		Low Population Zone		Control room	
	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
0.017	3.6616E-07	2.2087E-08	2.0420E-07	1.2318E-08	7.2474E-09	3.1064E-10
0.400	7.8636E-03	4.6937E-04	4.3855E-03	2.6176E-04	2.3768E-04	1.0409E-05
0.500	1.5230E-02	9.0587E-04	8.4936E-03	5.0520E-04	5.5995E-04	2.4505E-05
0.800	6.3156E-02	3.9773E-03	3.5222E-02	2.2181E-03	3.4670E-03	1.5396E-04
1.100	1.7394E-01	1.2142E-02	9.7003E-02	6.7716E-03	1.2359E-02	5.7514E-04
1.300	2.9754E-01	2.1854E-02	1.6593E-01	1.2188E-02	2.4297E-02	1.1680E-03
1.600	5.7839E-01	4.4713E-02	3.2257E-01	2.4936E-02	5.6336E-02	2.8209E-03
1.900	9.9724E-01	7.9520E-02	5.5616E-01	4.4348E-02	1.1249E-01	5.8089E-03
2.000	1.1718E+00	9.4129E-02	6.5353E-01	5.2495E-02	1.3809E-01	7.1909E-03
2.300	1.8028E+00	1.4714E-01	1.0054E+00	8.2061E-02	2.2831E-01	1.2101E-02
2.600	2.5691E+00	2.1191E-01	1.4327E+00	1.1818E-01	3.3660E-01	1.8050E-02
2.900	3.4418E+00	2.8611E-01	1.9195E+00	1.5956E-01	4.6568E-01	2.5196E-02
3.200	4.3987E+00	3.6790E-01	2.4531E+00	2.0518E-01	6.1680E-01	3.3609E-02
3.300	4.7334E+00	3.9658E-01	2.6398E+00	2.2117E-01	6.7212E-01	3.6698E-02
3.600	5.7765E+00	4.8624E-01	3.2215E+00	2.7117E-01	8.5278E-01	4.6807E-02
3.900	6.8695E+00	5.8047E-01	3.8311E+00	3.2372E-01	1.0549E+00	5.8140E-02
4.200	8.0028E+00	6.7839E-01	4.4631E+00	3.7834E-01	1.2774E+00	7.0633E-02
4.500	9.1691E+00	7.7929E-01	5.1135E+00	4.3461E-01	1.5191E+00	8.4206E-02
4.800	1.0362E+01	8.8258E-01	5.7791E+00	4.9221E-01	1.7785E+00	9.8776E-02
5.100	1.1579E+01	9.8778E-01	6.4573E+00	5.5088E-01	2.0543E+00	1.1426E-01
5.400	1.2814E+01	1.0945E+00	7.1464E+00	6.1041E-01	2.3452E+00	1.3056E-01
5.700	1.4067E+01	1.2025E+00	7.8453E+00	6.7065E-01	2.6498E+00	1.4762E-01
6.000	1.5337E+01	1.3116E+00	8.5531E+00	7.3147E-01	2.9671E+00	1.6535E-01
6.300	1.6620E+01	1.4215E+00	9.2691E+00	7.9276E-01	3.2959E+00	1.8369E-01
6.600	1.7917E+01	1.5321E+00	9.9924E+00	8.5442E-01	3.6354E+00	2.0258E-01
6.900	1.9227E+01	1.6431E+00	1.0723E+01	9.1637E-01	3.9846E+00	2.2196E-01
7.200	2.0548E+01	1.7546E+00	1.1459E+01	9.7854E-01	4.3427E+00	2.4180E-01
7.500	2.1879E+01	1.8664E+00	1.2202E+01	1.0409E+00	4.7090E+00	2.6203E-01
7.800	2.3221E+01	1.9783E+00	1.2950E+01	1.1033E+00	5.0830E+00	2.8263E-01
8.000	2.4121E+01	2.0531E+00	1.3452E+01	1.1450E+00	5.3363E+00	2.9654E-01
8.300	2.4818E+01	2.1315E+00	1.3550E+01	1.1560E+00	5.7058E+00	3.1680E-01
8.333	2.4896E+01	2.1401E+00	1.3561E+01	1.1572E+00	5.7450E+00	3.1894E-01
8.700	2.5756E+01	2.2358E+00	1.3681E+01	1.1706E+00	6.1638E+00	3.4184E-01
9.000	2.6464E+01	2.3139E+00	1.3781E+01	1.1816E+00	6.4857E+00	3.5939E-01
9.300	2.7177E+01	2.3919E+00	1.3881E+01	1.1925E+00	6.7924E+00	3.7607E-01
9.600	2.7893E+01	2.4696E+00	1.3981E+01	1.2035E+00	7.0863E+00	3.9200E-01
9.900	2.8614E+01	2.5472E+00	1.4083E+01	1.2143E+00	7.3695E+00	4.0732E-01
10.000	2.8855E+01	2.5730E+00	1.4116E+01	1.2180E+00	7.4619E+00	4.1230E-01
10.300	2.8855E+01	2.5730E+00	1.4218E+01	1.2288E+00	7.7335E+00	4.2692E-01
12.000	2.8855E+01	2.5730E+00	1.4805E+01	1.2896E+00	9.1720E+00	5.0356E-01
19.444	2.8855E+01	2.5730E+00	1.7539E+01	1.5453E+00	1.5219E+01	8.1036E-01
24.000	2.8855E+01	2.5730E+00	1.9327E+01	1.6980E+00	1.9181E+01	1.0012E+00
96.000	2.8855E+01	2.5730E+00	2.3409E+01	2.0203E+00	2.8733E+01	1.4155E+00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix E - Page: E10 of E10

Calc. No.: ALION-CAL-NPPD-3236-002


Rev. Number: 1

720.000 2.8855E+01 2.5730E+00 2.7863E+01 2.3105E+00 5.4741E+01 2.4010E+00

Worst Two-Hour Doses
#####

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
6.0	2.8732E-01	8.7838E+00	7.4147E-01

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix F - Page: <u>F1</u> of <u>F16</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX F

RADTRAD 3.03 Plant Specific Input Engineered Safety Features Pathway



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F2 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

RADTRAD Version 3.03 (Spring 2001) run on 7/06/2007 at 15:54:16
#####

File information
#####

Plant file =
D:\Rad_303\Utility_cases\Cooper\LOCA\LOCA_ESF_A100_CRflt.psf
Inventory file = d:\rad_303\defaults\cooper\cooper_60.nif
Release file = d:\rad_303\defaults\cooper\bwr_eccs.rft
Dose Conversion file = d:\rad_303\defaults\fgr11&12.inp

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

Radtrad 3.03 4/15/2001
LOCA_ESF AST 400 unfiltered
Nuclide Inventory File:
d:\rad_303\defaults\cooper\cooper_60.nif
Plant Power Level:
2.4286E+03
Compartments:
4
Compartment 1:
Suppression Pool
3
9.6445E+04
0
0
0
0
0
Compartment 2:
Reactor Building
3
2.0000E+02
0
0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F3 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0

Compartment 3:
Environment

2
0.0000E+00

0
0
0
0
0

Compartment 4:
Control Room

1
1.4190E+05

0
0
0
0
0

Pathways:

6

Pathway 1:

Suppression Pool-ESF to Reactor Building

1
2
2

Pathway 2:

(SGTS_Active) Reactor Building to Environment

2
3
2

Pathway 3:

(SGTS Idle) Reactor Building to Environment

2
3
2

Pathway 4:

Unfiltered Environment to Control Room

3
4
2

Pathway 5:

Filtered Environment to Control Room

3
4
2

Pathway 6:

Exhaust Control Room to Environment

4



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F4 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

3
2
End of Plant Model File
Scenario Description Name:

Plant Model Filename:

Source Term:
1
1 1.0000E+00
d:\rad_303\defaults\fgr11&12.inp
d:\rad_303\defaults\cooper\bwr_eccs.rft
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
0
Compartment 2:
0
1
0
0
0
0
0
0
0
0
Compartment 3:
0
1
0
0
0
0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F5 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0
Compartment 4:

0
1
0
0
0
0
0
0
0
0

Pathways:
6

Pathway 1:

0
0
0
0
0
1
1
0.0000E+00 1.5900E-01 1.0000E+02 0.0000E+00 0.0000E+00
0
0
0
0
0

Pathway 2:

0
0
0
0
0
1
3
0.0000E+00 0.0000E+00 9.8000E+01 9.4000E+01 9.4000E+01
1.6600E-02 1.4920E+03 9.8000E+01 9.4000E+01 9.4000E+01
2.0000E+00 1.4920E+03 9.8000E+01 9.4000E+01 9.4000E+01
0
0
0
0
0
0

Pathway 3:

0
0
0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F6 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
1
3
0.0000E+00 0.0000E+00 9.8000E+01 8.9000E+01 2.9000E+01
1.6600E-02 1.4920E+03 9.8000E+01 8.9000E+01 2.9000E+01
1.0000E+00 2.8800E+02 9.8000E+01 8.9000E+01 2.9000E+01

0
0
0
0
0
0

Pathway 4:

0
0
0
0
0
1
2
0.0000E+00 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00
1.6700E-02 4.0000E+02 0.0000E+00 0.0000E+00 0.0000E+00

0
0
0
0
0
0

Pathway 5:

0
0
0
0
0
1
2
0.0000E+00 3.2350E+03 0.0000E+00 0.0000E+00 0.0000E+00
1.6600E-02 8.1000E+02 9.8000E+01 8.9000E+01 8.9000E+01

0
0
0
0
0
0

Pathway 6:

0
0
0
0
0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F7 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

```

1
2
0.0000E+00  3.6350E+03  0.0000E+00  0.0000E+00  0.0000E+00
1.6600E-02  1.2100E+03  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
4
0.0000E+00  1.6000E-05
1.3000E+00  1.2000E-04
1.8000E+00  1.6000E-05
1.0000E+01  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 2:
Low Population Zone

```

3
1
6
0.0000E+00  4.0000E-05
1.3000E+00  1.4000E-04
1.8000E+00  4.0000E-05
8.0000E+00  1.6000E-05
2.4000E+01  5.8000E-06
9.6000E+01  1.7000E-06
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

```



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

Appendix F - Page: F8 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 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
7
0.0000E+00 1.0000E-10
1.3000E+00 3.0300E-04
1.8000E+00 1.0000E-10
2.0000E+00 8.5800E-10
8.0000E+00 1.4100E-08
2.4000E+01 5.6200E-09
9.6000E+01 5.6900E-09

Simulation Parameters:

2
0.0000E+00 1.0000E-01
2.4000E+01 0.0000E+00

Output Filename:

D:\Rad_303\Utility_cases\Cooper\LOCA\LOCA_ESF_A100_CRflt.ol

1
1
1
0
0

End of Scenario File

#####
RADTRAD Version 3.03 (Spring 2001) run on 7/06/2007 at 15:54:16
#####

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

Number of Nuclides = 60

Inventory Power = 1.0000E+00 MWth
Plant Power Level = 2.4286E+03 MWth

Number of compartments = 4

Compartment information

Compartment number 1 (Source term fraction = 1.0000E+00)
Name: Suppression Pool



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F9 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Compartment volume = 9.6445E+04 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment 1
Exit Pathway Number 1: Suppression Pool-ESF to Reactor Building

Compartment number 2
Name: Reactor Building
Compartment volume = 2.0000E+02 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment 2
Inlet Pathway Number 1: Suppression Pool-ESF to Reactor Building
Exit Pathway Number 2: (SGTS_Active) Reactor Building to Environment
Exit Pathway Number 3: (SGTS Idle) Reactor Building to Environment

Compartment number 3
Name: Environment
Compartment type is Environment
Pathways into and out of compartment 3
Inlet Pathway Number 2: (SGTS_Active) Reactor Building to Environment
Inlet Pathway Number 3: (SGTS Idle) Reactor Building to Environment
Inlet Pathway Number 6: Exhaust Control Room to Environment
Exit Pathway Number 4: Unfiltered Environment to Control Room
Exit Pathway Number 5: Filtered Environment to Control Room

Compartment number 4
Name: Control Room
Compartment volume = 1.4190E+05 (Cubic feet)
Compartment type is Control Room
Pathways into and out of compartment 4
Inlet Pathway Number 4: Unfiltered Environment to Control Room
Inlet Pathway Number 5: Filtered Environment to Control Room
Exit Pathway Number 6: Exhaust Control Room to Environment

Total number of pathways = 6



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F10 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

 RADTRAD Version 3.03 (Spring 2001) run on 7/06/2007 at 15:54:16
 #####

 Scenario Description
 #####

Radioactive Decay is enabled
 Calculation of Daughters is enabled

Release Fractions and Timings

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.500000 hr	1.5000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00
IODINE	5.0000E-02	2.5000E-01	0.0000E+00	2.104E+02
CESIUM	5.0000E-02	2.0000E-01	0.0000E+00	3.146E+04
TELLURIUM	0.0000E+00	5.0000E-02	0.0000E+00	2.823E+01
STRONTIUM	0.0000E+00	2.0000E-02	0.0000E+00	1.074E+03
BARIUM	0.0000E+00	2.0000E-02	0.0000E+00	3.140E+01
RUTHENIUM	0.0000E+00	2.5000E-03	0.0000E+00	4.161E+01
CERIUM	0.0000E+00	5.0000E-04	0.0000E+00	4.376E+02
LANTHANUM	0.0000E+00	2.0000E-04	0.0000E+00	4.442E+00

Inventory Power = 2429. MWt

Nuclide Name	Group	Specific Inventory Effective (Ci/MWt) (Sv/Bq)	half life	Whole Body DCF	Skin DCF	Inhaled Thyroid
			(s)	(Sv-m3/Bq-s)	(Sv-m3/Bq-s)	(Sv/Bq)
Co-58	7	1.529E+02 2.940E-09	6.117E+06	4.760E-14	5.580E-14	8.720E-10
Co-60	7	1.830E+02 5.910E-08	1.663E+08	1.260E-13	1.450E-13	1.620E-08
Rb-86	3	6.990E+01 1.790E-09	1.612E+06	4.810E-15	4.850E-14	1.330E-09
Sr-89	5	2.440E+04 1.120E-08	4.363E+06	7.730E-17	3.690E-14	7.960E-12
Sr-90	5	2.900E+03 3.510E-07	9.190E+08	7.530E-18	9.200E-15	2.690E-10
Sr-91	5	3.100E+04 4.547E-10	3.420E+04	4.924E-14	9.938E-14	9.930E-12
Sr-92	5	3.380E+04 2.180E-10	9.756E+03	6.790E-14	8.560E-14	3.920E-12
Y-90	9	3.000E+03 2.280E-09	2.304E+05	1.900E-16	6.240E-14	5.170E-13
Y-91	9	3.170E+04 1.320E-08	5.055E+06	2.600E-16	3.850E-14	8.500E-12



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F11 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Y-92	9	3.390E+04	1.274E+04	1.300E-14	1.140E-13	1.050E-12
		2.110E-10				
Y-93	9	3.960E+04	3.636E+04	4.800E-15	8.500E-14	9.260E-13
		5.820E-10				
Zr-95	9	4.450E+04	5.528E+06	3.600E-14	4.500E-14	1.440E-09
		6.390E-09				
Zr-97	9	4.510E+04	6.084E+04	4.432E-14	9.835E-14	2.315E-11
		1.171E-09				
Nb-95	9	4.480E+04	3.037E+06	3.740E-14	4.300E-14	3.580E-10
		1.570E-09				
Mo-99	7	5.120E+04	2.376E+05	7.280E-15	3.140E-14	1.520E-11
		1.070E-09				
Tc-99m	7	4.520E+04	2.167E+04	5.890E-15	7.140E-15	5.010E-11
		8.800E-12				
Ru-103	7	4.300E+04	3.394E+06	2.251E-14	2.774E-14	2.570E-10
		2.421E-09				
Ru-105	7	3.030E+04	1.598E+04	3.810E-14	6.730E-14	4.150E-12
		1.230E-10				
Ru-106	7	1.740E+04	3.181E+07	1.040E-14	1.090E-13	1.720E-09
		1.290E-07				
Rh-105	7	2.770E+04	1.273E+05	3.720E-15	1.070E-14	2.880E-12
		2.580E-10				
Sb-127	4	3.020E+03	3.326E+05	3.330E-14	5.580E-14	6.150E-11
		1.630E-09				
Sb-129	4	8.930E+03	1.555E+04	7.140E-14	1.050E-13	9.720E-12
		1.740E-10				
Te-127	4	3.050E+03	3.366E+04	2.420E-16	1.140E-14	1.840E-12
		8.600E-11				
Te-127m	4	4.060E+02	9.418E+06	1.470E-16	8.490E-16	9.660E-11
		5.810E-09				
Te-129	4	8.790E+03	4.176E+03	2.750E-15	3.570E-14	5.090E-13
		2.090E-11				
Te-129m	4	1.300E+03	2.903E+06	3.337E-15	3.811E-14	1.563E-10
		6.484E-09				
Te-131m	4	3.960E+03	1.080E+05	7.463E-14	1.038E-13	3.669E-08
		1.758E-09				
Te-132	4	3.850E+04	2.815E+05	1.030E-14	1.390E-14	6.280E-08
		2.550E-09				
I-131	2	2.720E+04	6.947E+05	1.820E-14	2.980E-14	2.920E-07
		8.890E-09				
I-132	2	3.930E+04	8.280E+03	1.120E-13	1.580E-13	1.740E-09
		1.030E-10				
I-133	2	5.510E+04	7.488E+04	2.940E-14	5.830E-14	4.860E-08
		1.580E-09				
I-134	2	6.040E+04	3.156E+03	1.300E-13	1.870E-13	2.880E-10
		3.550E-11				
I-135	2	5.160E+04	2.380E+04	8.294E-14	1.156E-13	8.460E-09
		3.320E-10				
Cs-134	3	6.750E+03	6.507E+07	7.570E-14	9.450E-14	1.110E-08
		1.250E-08				



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Cs-136	3	2.160E+03	1.132E+06	1.060E-13	1.250E-13	1.730E-09
		1.980E-09				
Cs-137	3	4.050E+03	9.467E+08	2.725E-14	4.392E-14	7.930E-09
		8.630E-09				
Ba-139	6	4.900E+04	4.962E+03	2.170E-15	6.160E-14	2.400E-12
		4.640E-11				
Ba-140	6	4.710E+04	1.101E+06	8.580E-15	2.520E-14	2.560E-10
		1.010E-09				
La-140	9	4.870E+04	1.450E+05	1.170E-13	1.660E-13	6.870E-11
		1.310E-09				
La-141	9	4.460E+04	1.415E+04	2.390E-15	6.580E-14	9.400E-12
		1.570E-10				
La-142	9	4.300E+04	5.550E+03	1.440E-13	2.160E-13	8.740E-12
		6.840E-11				
Ce-141	8	4.470E+04	2.808E+06	3.430E-15	1.020E-14	2.550E-11
		2.420E-09				
Ce-143	8	4.110E+04	1.188E+05	1.290E-14	3.960E-14	6.230E-12
		9.160E-10				
Ce-144	8	3.660E+04	2.456E+07	2.773E-15	8.574E-14	2.920E-10
		1.010E-07				
Pr-143	9	4.020E+04	1.172E+06	2.100E-17	1.760E-14	1.680E-18
		2.190E-09				
Nd-147	8	1.800E+04	9.487E+05	6.190E-15	1.950E-14	1.820E-11
		1.850E-09				
Np-239	8	5.860E+05	2.035E+05	7.690E-15	1.600E-14	7.620E-12
		6.780E-10				
Pu-238	8	1.280E+02	2.769E+09	4.880E-18	4.090E-17	3.860E-10
		7.790E-05				
Pu-239	8	1.290E+01	7.594E+11	4.240E-18	1.860E-17	3.750E-10
		8.330E-05				
Pu-240	8	1.770E+01	2.063E+11	4.750E-18	3.920E-17	3.760E-10
		8.330E-05				
Pu-241	8	5.340E+03	4.544E+08	7.250E-20	1.170E-19	9.150E-12
		1.340E-06				
Am-241	9	6.870E+00	1.364E+10	8.180E-16	1.280E-15	1.600E-09
		1.200E-04				
Cm-242	9	1.730E+03	1.407E+07	5.690E-18	4.290E-17	9.410E-10
		4.670E-06				
Cm-244	9	1.110E+02	5.715E+08	4.910E-18	3.910E-17	1.010E-09
		6.700E-05				

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
Sr-90	Y-90	1.00	none	0.00	none	0.00
Sr-91	Y-91m	0.58	Y-91	0.42	none	0.00
Sr-92	Y-92	1.00	none	0.00	none	0.00
Y-93	Zr-93	1.00	none	0.00	none	0.00
Zr-95	Nb-95m	0.01	Nb-95	0.99	none	0.00
Zr-97	Nb-97m	0.95	Nb-97	0.05	none	0.00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Mo-99	Tc-99m	0.88	Tc-99	0.12	none	0.00
Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	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: Suppression Pool
 Compartment number 2: Reactor Building
 Compartment number 3: Environment
 Compartment number 4: Control Room

PATHWAY DATA

Pathway number 1: Suppression Pool-ESF to Reactor Building

Pathway Filter: Removal Data



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F14 of F16

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	1.5900E-01	1.0000E+02	0.0000E+00	0.0000E+00

Pathway number 2: (SGTS_Active) Reactor Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	9.8000E+01	9.4000E+01	9.4000E+01
1.6600E-02	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01
2.0000E+00	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01

Pathway number 3: (SGTS Idle) Reactor Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	9.8000E+01	8.9000E+01	2.9000E+01
1.6600E-02	1.4920E+03	9.8000E+01	8.9000E+01	2.9000E+01
1.0000E+00	2.8800E+02	9.8000E+01	8.9000E+01	2.9000E+01

Pathway number 4: Unfiltered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: Filtered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6600E-02	8.1000E+02	9.8000E+01	8.9000E+01	8.9000E+01

Pathway number 6: Exhaust Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6600E-02	1.2100E+03	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	1.6000E-05
1.3000E+00	1.2000E-04
1.8000E+00	1.6000E-05
1.0000E+01	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 Low Population Zone is in compartment 3

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	4.0000E-05
1.3000E+00	1.4000E-04
1.8000E+00	4.0000E-05
8.0000E+00	1.6000E-05
2.4000E+01	5.8000E-06
9.6000E+01	1.7000E-06

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	1.0000E-10
1.3000E+00	3.0300E-04
1.8000E+00	1.0000E-10
2.0000E+00	8.5800E-10
8.0000E+00	1.4100E-08
2.4000E+01	5.6200E-09
9.6000E+01	5.6900E-09

Location Breathing Rate Data

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



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix F - Page: F16 of F16

Calc. No.: ALION-CAL-NPPD-3236-002


Rev. Number: 1

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
2.4000E+01	0.0000E+00

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix G - Page: <u>G1</u> of <u>G9</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX G

RADTRAD 3.03 Plant Specific Output

Engineered Safety Features Pathway



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix G - Page: G2 of G9

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

RADTRAD Version 3.03 (Spring 2001) run on 7/11/2007 at 9:17:49
#####

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


Dose Output
#####

Exclusion Area Boundary Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)		0.0000E+00	0.0000E+00	0.0000E+00

Low Population Zone Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)		0.0000E+00	0.0000E+00	0.0000E+00

Control room Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)		0.0000E+00	0.0000E+00	0.0000E+00

Exclusion Area Boundary Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.9394E-08	6.1868E-06	2.2492E-07
Accumulated dose (rem)		2.9394E-08	6.1868E-06	2.2492E-07

Low Population Zone Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		7.3486E-08	1.5467E-05	5.6231E-07
Accumulated dose (rem)		7.3486E-08	1.5467E-05	5.6231E-07

Control room Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		8.9320E-20	3.9983E-16	1.2726E-17



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Accumulated dose (rem) 8.9320E-20 3.9983E-16 1.2726E-17

Exclusion Area Boundary Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.8002E-04	6.4570E-02	2.3179E-03
Accumulated dose (rem)		2.8005E-04	6.4576E-02	2.3182E-03

Low Population Zone Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		7.0006E-04	1.6142E-01	5.7949E-03
Accumulated dose (rem)		7.0013E-04	1.6144E-01	5.7954E-03

Control room Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.6646E-12	1.3249E-08	4.2071E-10
Accumulated dose (rem)		2.6646E-12	1.3249E-08	4.2071E-10

Exclusion Area Boundary Doses:

Time (h) =	1.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		8.9139E-04	2.3566E-01	8.3151E-03
Accumulated dose (rem)		1.1714E-03	3.0023E-01	1.0633E-02

Low Population Zone Doses:

Time (h) =	1.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.2285E-03	5.8914E-01	2.0788E-02
Accumulated dose (rem)		2.9286E-03	7.5058E-01	2.6583E-02

Control room Doses:

Time (h) =	1.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.6535E-11	9.3799E-08	2.9706E-09
Accumulated dose (rem)		1.9199E-11	1.0705E-07	3.3913E-09

Exclusion Area Boundary Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.3272E-04	1.8305E-01	6.3920E-03
Accumulated dose (rem)		1.8042E-03	4.8328E-01	1.7025E-02

Low Population Zone Doses:

Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.5818E-03	4.5763E-01	1.5980E-02
Accumulated dose (rem)		4.5104E-03	1.2082E+00	4.2563E-02

Control room Doses:



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

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Time (h) =	1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.9996E-11	1.2413E-07	3.9243E-09
Accumulated dose (rem)		3.9195E-11	2.3118E-07	7.3155E-09

Exclusion Area Boundary Doses:

Time (h) =	1.8000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.0290E-02	3.2406E+00	1.1213E-01
Accumulated dose (rem)		1.2094E-02	3.7238E+00	1.2915E-01

Low Population Zone Doses:

Time (h) =	1.8000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.2005E-02	3.7807E+00	1.3081E-01
Accumulated dose (rem)		1.6515E-02	4.9889E+00	1.7338E-01

Control room Doses:

Time (h) =	1.8000	Whole Body	Thyroid	TEDE
Delta dose (rem)		5.5506E-05	3.6610E-01	1.1557E-02
Accumulated dose (rem)		5.5506E-05	3.6610E-01	1.1557E-02

Exclusion Area Boundary Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		6.4705E-04	2.1663E-01	7.4487E-03
Accumulated dose (rem)		1.2741E-02	3.9405E+00	1.3660E-01

Low Population Zone Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.6176E-03	5.4156E-01	1.8622E-02
Accumulated dose (rem)		1.8133E-02	5.5304E+00	1.9200E-01

Control room Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		4.0777E-05	2.8465E-01	8.9759E-03
Accumulated dose (rem)		9.6283E-05	6.5075E-01	2.0533E-02

Exclusion Area Boundary Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.4784E-02	6.5995E+00	2.2078E-01
Accumulated dose (rem)		2.7524E-02	1.0540E+01	3.5738E-01

Low Population Zone Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)		3.6959E-02	1.6499E+01	5.5196E-01



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Accumulated dose (rem) 5.5092E-02 2.2029E+01 7.4396E-01

Control room Doses:

Time (h) =	8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6539E-04	2.4565E+00	7.7068E-02	
Accumulated dose (rem)	3.6168E-04	3.1072E+00	9.7600E-02	

Exclusion Area Boundary Doses:

Time (h) =	10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.8727E-03	1.0758E+00	3.7288E-02	
Accumulated dose (rem)	3.1397E-02	1.1616E+01	3.9467E-01	

Low Population Zone Doses:

Time (h) =	10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.8727E-03	1.0758E+00	3.7288E-02	
Accumulated dose (rem)	5.8964E-02	2.3105E+01	7.8125E-01	

Control room Doses:

Time (h) =	10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.3774E-06	7.2001E-02	2.2391E-03	
Accumulated dose (rem)	3.6606E-04	3.1792E+00	9.9839E-02	

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)	3.1397E-02	1.1616E+01	3.9467E-01	

Low Population Zone Doses:

Time (h) =	24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.0445E-02	6.9446E+00	2.3507E-01	
Accumulated dose (rem)	7.9409E-02	3.0050E+01	1.0163E+00	

Control room Doses:

Time (h) =	24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.4067E-06	4.3428E-02	1.3467E-03	
Accumulated dose (rem)	3.6846E-04	3.2227E+00	1.0119E-01	

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)	3.1397E-02	1.1616E+01	3.9467E-01	

Low Population Zone Doses:



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
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Calc. No.: ALION-CAL-NPPD-3236-002

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Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3551E-02	1.2523E+01	3.9703E-01
Accumulated dose (rem)	9.2959E-02	4.2572E+01	1.4134E+00

Control room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.1057E-07	4.7216E-03	1.4478E-04
Accumulated dose (rem)	3.6867E-04	3.2274E+00	1.0133E-01

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)	3.1397E-02	1.1616E+01	3.9467E-01

Low Population Zone Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.8423E-03	1.0145E+01	3.1390E-01
Accumulated dose (rem)	9.7802E-02	5.2718E+01	1.7273E+00

Control room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3847E-07	8.3542E-03	2.5460E-04
Accumulated dose (rem)	3.6881E-04	3.2358E+00	1.0159E-01

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 I-131 Summary
 #####

Time (hr)	Suppression Pool I-131 (Curies)	Reactor Building I-131 (Curies)	Environment I-131 (Curies)
0.000	3.6699E+03	1.0084E-04	0.0000E+00
0.017	1.0965E+05	9.0023E-02	0.0000E+00
0.017	1.1031E+05	8.3355E-02	7.2905E-04
0.400	2.6386E+06	2.9075E-01	4.8810E+00
0.500	3.2972E+06	3.6351E-01	7.6333E+00
0.800	6.5877E+06	7.2656E-01	2.1385E+01
1.000	8.7777E+06	9.6855E-01	3.5647E+01
1.300	1.2057E+07	2.2296E+00	5.7504E+01
1.600	1.5330E+07	2.8358E+00	8.6309E+01
1.800	1.7508E+07	3.2393E+00	1.0934E+02
2.000	1.9683E+07	3.6422E+00	1.3543E+02
2.300	1.9662E+07	3.6420E+00	1.7687E+02
2.600	1.9640E+07	3.6381E+00	2.1826E+02
2.900	1.9619E+07	3.6341E+00	2.5962E+02



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

3.200	1.9597E+07	3.6302E+00	3.0092E+02
3.500	1.9576E+07	3.6262E+00	3.4218E+02
3.800	1.9555E+07	3.6223E+00	3.8340E+02
4.100	1.9534E+07	3.6183E+00	4.2457E+02
4.400	1.9512E+07	3.6144E+00	4.6570E+02
4.700	1.9491E+07	3.6105E+00	5.0678E+02
5.000	1.9470E+07	3.6065E+00	5.4782E+02
5.300	1.9449E+07	3.6026E+00	5.8881E+02
5.600	1.9428E+07	3.5987E+00	6.2976E+02
5.900	1.9406E+07	3.5948E+00	6.7067E+02
6.200	1.9385E+07	3.5908E+00	7.1152E+02
6.500	1.9364E+07	3.5869E+00	7.5234E+02
6.800	1.9343E+07	3.5830E+00	7.9311E+02
7.100	1.9322E+07	3.5791E+00	8.3384E+02
7.400	1.9301E+07	3.5752E+00	8.7452E+02
7.700	1.9280E+07	3.5713E+00	9.1515E+02
8.000	1.9259E+07	3.5675E+00	9.5575E+02
8.300	1.9238E+07	3.5636E+00	9.9630E+02
8.600	1.9217E+07	3.5597E+00	1.0368E+03
8.900	1.9196E+07	3.5558E+00	1.0773E+03
9.200	1.9175E+07	3.5519E+00	1.1177E+03
9.500	1.9154E+07	3.5481E+00	1.1581E+03
9.800	1.9133E+07	3.5442E+00	1.1984E+03
10.000	1.9119E+07	3.5416E+00	1.2252E+03
10.300	1.9099E+07	3.5378E+00	1.2655E+03
24.000	1.8169E+07	3.3656E+00	3.0578E+03
96.000	1.3952E+07	2.5844E+00	1.1119E+04
720.000	1.3950E+06	2.5841E-01	3.4981E+04

Control Room	
Time (hr)	I-131 (Curies)
0.000	0.0000E+00
0.017	0.0000E+00
0.017	1.6828E-14
0.400	1.0535E-10
0.500	1.6205E-10
0.800	4.3553E-10
1.000	7.0653E-10
1.300	1.0749E-09
1.600	1.8727E-03
1.800	3.2220E-03
2.000	2.9065E-03
2.300	2.4902E-03
2.600	2.1336E-03
2.900	1.8281E-03
3.200	1.5663E-03
3.500	1.3420E-03
3.800	1.1498E-03
4.100	9.8513E-04
4.400	8.4405E-04
4.700	7.2318E-04



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

5.000	6.1962E-04
5.300	5.3089E-04
5.600	4.5487E-04
5.900	3.8973E-04
6.200	3.3392E-04
6.500	2.8611E-04
6.800	2.4514E-04
7.100	2.1004E-04
7.400	1.7997E-04
7.700	1.5420E-04
8.000	1.3213E-04
8.300	1.1333E-04
8.600	9.7219E-05
8.900	8.3418E-05
9.200	7.1593E-05
9.500	6.1462E-05
9.800	5.2781E-05
10.000	4.7696E-05
10.300	4.0987E-05
24.000	8.4636E-07
96.000	2.4849E-07
720.000	2.5156E-08

Cumulative Dose Summary
#####

Time (hr)	Exclusion Area Bounda		Low Population Zone		Control room	
	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
0.017	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.017	6.1868E-06	2.2492E-07	1.5467E-05	5.6231E-07	3.9983E-16	1.2726E-17
0.400	4.1328E-02	1.4880E-03	1.0332E-01	3.7201E-03	6.9268E-09	2.2008E-10
0.500	6.4576E-02	2.3182E-03	1.6144E-01	5.7954E-03	1.3249E-08	4.2071E-10
0.800	1.8043E-01	6.4221E-03	4.5107E-01	1.6055E-02	5.3740E-08	1.7040E-09
1.000	3.0023E-01	1.0633E-02	7.5058E-01	2.6583E-02	1.0705E-07	3.3913E-09
1.300	4.8328E-01	1.7025E-02	1.2082E+00	4.2563E-02	2.3118E-07	7.3155E-09
1.600	2.2863E+00	7.9548E-02	3.3117E+00	1.1551E-01	1.2920E-01	4.0806E-03
1.800	3.7238E+00	1.2915E-01	4.9889E+00	1.7338E-01	3.6610E-01	1.1557E-02
2.000	3.9405E+00	1.3660E-01	5.5304E+00	1.9200E-01	6.5075E-01	2.0533E-02
2.300	4.2836E+00	1.4835E-01	6.3883E+00	2.2137E-01	1.0252E+00	3.2329E-02
2.600	4.6252E+00	1.5999E-01	7.2423E+00	2.5048E-01	1.3450E+00	4.2390E-02
2.900	4.9653E+00	1.7154E-01	8.0925E+00	2.7935E-01	1.6180E+00	5.0972E-02
3.200	5.3039E+00	1.8300E-01	8.9391E+00	3.0799E-01	1.8511E+00	5.8294E-02
3.500	5.6411E+00	1.9437E-01	9.7820E+00	3.3642E-01	2.0502E+00	6.4542E-02
3.800	5.9768E+00	2.0567E-01	1.0621E+01	3.6466E-01	2.2203E+00	6.9874E-02
4.100	6.3111E+00	2.1689E-01	1.1457E+01	3.9272E-01	2.3655E+00	7.4425E-02
4.400	6.6441E+00	2.2804E-01	1.2290E+01	4.2060E-01	2.4896E+00	7.8309E-02
4.700	6.9757E+00	2.3913E-01	1.3119E+01	4.4832E-01	2.5955E+00	8.1625E-02
5.000	7.3060E+00	2.5016E-01	1.3944E+01	4.7589E-01	2.6861E+00	8.4457E-02



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002


Rev. Number: 1

5.300	7.6350E+00	2.6112E-01	1.4767E+01	5.0330E-01	2.7634E+00	8.6874E-02
5.600	7.9626E+00	2.7203E-01	1.5586E+01	5.3057E-01	2.8295E+00	8.8938E-02
5.900	8.2890E+00	2.8288E-01	1.6402E+01	5.5769E-01	2.8860E+00	9.0701E-02
6.200	8.6142E+00	2.9367E-01	1.7215E+01	5.8468E-01	2.9342E+00	9.2207E-02
6.500	8.9381E+00	3.0442E-01	1.8025E+01	6.1154E-01	2.9754E+00	9.3493E-02
6.800	9.2609E+00	3.1511E-01	1.8831E+01	6.3827E-01	3.0106E+00	9.4591E-02
7.100	9.5824E+00	3.2575E-01	1.9635E+01	6.6487E-01	3.0407E+00	9.5529E-02
7.400	9.9027E+00	3.3634E-01	2.0436E+01	6.9135E-01	3.0665E+00	9.6331E-02
7.700	1.0222E+01	3.4689E-01	2.1234E+01	7.1772E-01	3.0885E+00	9.7015E-02
8.000	1.0540E+01	3.5738E-01	2.2029E+01	7.4396E-01	3.1072E+00	9.7600E-02
8.300	1.0703E+01	3.6305E-01	2.2192E+01	7.4963E-01	3.1233E+00	9.8100E-02
8.600	1.0865E+01	3.6869E-01	2.2354E+01	7.5527E-01	3.1371E+00	9.8528E-02
8.900	1.1027E+01	3.7431E-01	2.2516E+01	7.6088E-01	3.1488E+00	9.8894E-02
9.200	1.1188E+01	3.7989E-01	2.2678E+01	7.6647E-01	3.1589E+00	9.9207E-02
9.500	1.1349E+01	3.8546E-01	2.2838E+01	7.7203E-01	3.1675E+00	9.9475E-02
9.800	1.1509E+01	3.9099E-01	2.2998E+01	7.7757E-01	3.1749E+00	9.9705E-02
10.000	1.1616E+01	3.9467E-01	2.3105E+01	7.8125E-01	3.1792E+00	9.9839E-02
10.300	1.1616E+01	3.9467E-01	2.3264E+01	7.8675E-01	3.1850E+00	1.0002E-01
24.000	1.1616E+01	3.9467E-01	3.0050E+01	1.0163E+00	3.2227E+00	1.0119E-01
96.000	1.1616E+01	3.9467E-01	4.2572E+01	1.4134E+00	3.2274E+00	1.0133E-01
720.000	1.1616E+01	3.9467E-01	5.2718E+01	1.7273E+00	3.2358E+00	1.0159E-01

Worst Two-Hour Doses
#####

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
1.3	1.4875E-02	4.9330E+00	1.6976E-01

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix H - Page: <u>H1</u> of <u>H25</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX H

Alion-RADTRAD 3.10 Plant Specific Input

Leakage-MSIV-ESF Pathway



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

1.3225E+05

0

0

0

1

0

Compartment 2:

Reactor Building

3

2.00E+02

0

0

0

0

0

Compartment 3:

Environment

2

0.00E+00

0

0

0

0

0

Compartment 4:

Control Room

1

1.419E+05

0

0

0

0

0

Compartment 5:

Condenser

3

4.8E+04

0

0

0

0

0

Compartment 6:

Turbine Building

3

1.00E+02

0

0

0

0

0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Compartment 7:

Suppression Pool

3

9.6445E+04

0

0

0

0

0

Number of Pathways:

12

Pathway 1:

Primary to Reactor Building

1

2

4

Pathway 2:

(SGTS_Active) Reactor Building to Environment

2

3

2

Pathway 3:

(SGTS Idle) Reactor Building to Environment

2

3

2

Pathway 4:

Unfiltered Environment to Control Room

3

4

2

Pathway 5:

Filtered Environment to Control Room

3

4

2

Pathway 6:

Exhaust Control Room to Environment

4

3

2

Pathway 7:

Drywell Free Volume to Environment

1

3

4

Pathway 8:

Failed MSIV--Drywell to Condenser

1

5

1



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H5 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Pathway 9:

Intact MSIV-- Drywell to Condenser

1
5
1

Pathway 10:

Condenser to Turbine Building

5
6
2

Pathway 11:

Turbine Building to Environment

6
3
2

Pathway 12:

Suppression Pool leakage to Reactor Building

7
2
2

End of Plant Model

Source Term Input:

2

1 1 1 1

7 1 2 1

0.00E+00

0.00E+00 7.2E+02

1

3 9.5E-01 4.85E-02 1.5E-03

3 0.00E+00 9.7E-01 3.00E-02

Overlying Pool:

0

0.00E+00

0

0

0

0

Compartments:

7

Compartment 1:

1

1

0

0

0

0

0

0

3

3

1.00E+01

1



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H6 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

1
0.00E+00 0.00E+00
Compartment 2:

1
1
0
0
0
0
0
0
0
0

Compartment 3:

1
1
0
0
0
0
0
0
0
0

Compartment 4:

0
1
0
0
0
0
0
0
0
0

Compartment 5:

0
1
0
0
0
0
0
0
0
0

Compartment 6:

0
1
0
0
0
0
0
0
0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H7 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
Compartment 7:

1
1
0
0
0
0
0
0
0
0

Pathways:

12
Pathway 1:

0
0
0
0
0
0
0
0
0
0
0
1
3

0.00E+00	0.00E+00
8.33E-02	6.35E-01
2.4E+01	3.175E-01

Pathway 2:

0
0
0
0
0
1
3

0.00E+00	0.00E+00	9.8E+01	9.4E+01	9.4E+01
1.66E-02	1.492E+03	9.8E+01	9.4E+01	9.4E+01
2.00E+00	1.492E+03	9.8E+01	9.4E+01	9.4E+01

0
7.2E+02 0.00E+00 0.00E+00 0.00E+00 0.00E+00
7.2E+02

0
0
0
0
0

Pathway 3:



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H8 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0
0
1
3
0.00E+00 0.00E+00 9.8E+01 8.9E+01 2.9E+01
1.66E-02 1.492E+03 9.8E+01 8.9E+01 2.9E+01
1.00E+00 2.88E+02 9.8E+01 8.9E+01 2.9E+01
0
7.2E+02 0.00E+00 0.00E+00 0.00E+00 0.00E+00
7.2E+02

Pathway 4:

0
0
0
0
0
1
2
0.00E+00 4.00E+02 0.00E+00 0.00E+00 0.00E+00
1.67E-02 4.00E+02 0.00E+00 0.00E+00 0.00E+00
0
0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
0.00E+00

Pathway 5:

2
0
0
0
0
1
2
0.00E+00 3.235E+03 0.00E+00 0.00E+00 0.00E+00
1.66E-02 8.1E+02 9.8E+01 8.9E+01 8.9E+01
0
7.2E+02 0.00E+00 0.00E+00 0.00E+00 0.00E+00
7.2E+02



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H9 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
0
0
0
0

Pathway 6:

0
0
0
0
0
1
2

0.00E+00	3.635E+03	0.00E+00	0.00E+00	0.00E+00
1.66E-02	1.21E+03	0.00E+00	0.00E+00	0.00E+00
0				
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0.00E+00				

0
0
0
0
0
0

Pathway 7:

0
0
0
0
0
0
0
0
0
0
1
2

0.00E+00	6.35E-01
8.33E-02	0.00E+00

Pathway 8:

0
0
1
2

0.00E+00	1.00E+00	1.337E+00
2.4E+01	1.00E+00	6.685E-01

1
2

0.00E+00	1.00E+00	1.337E+00
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**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H10 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

2.4E+01 1.00E+00 6.685E-01

1

2

0.00E+00 1.00E+00 1.337E+00

2.4E+01 1.00E+00 6.685E-01

0

0

0

0

0

0

0

Pathway 9:

0

0

1

2

0.00E+00 1.00E+00 1.337E+00

2.4E+01 1.00E+00 6.685E-01

1

2

0.00E+00 1.00E+00 1.337E+00

2.4E+01 1.00E+00 6.685E-01

1

2

0.00E+00 1.00E+00 1.337E+00

2.4E+01 1.00E+00 6.685E-01

0

0

0

0

0

0

Pathway 10:

0

0

0

0

0

1

2

0.00E+00 5.45E+00 9.49E+01 9.49E+01 0.00E+00

2.4E+01 2.726E+00 9.74E+01 9.74E+01 0.00E+00

0

7.2E+02 0.00E+00 0.00E+00 0.00E+00 0.00E+00

7.2E+02

0

0

0

0



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H11 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

0
0
Pathway 11:
0
0
0
0
0
1
1
0.00E+00 5.00E+02 0.00E+00 0.00E+00 0.00E+00
0
7.2E+02 0.00E+00 0.00E+00 0.00E+00 0.00E+00
7.2E+02
0
0
0
0
0
0

Pathway 12:
0
0
0
0
0
1
1
0.00E+00 1.59E-01 1.00E+02 0.00E+00 0.00E+00
0
7.2E+02 0.00E+00 0.00E+00 0.00E+00 0.00E+00
7.2E+02
0
0
0
0
0
0

Dose Locations:

3
Location 1:
Exclusion Area Boundary
3
1
4
0.00E+00 3.5E-04
8.00E+00 1.8E-04
2.4E+01 2.3E-04
7.2E+02 0.00E+00
0

Location 2:



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H12 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Low Population Zone

3

1

4

0.00E+00 3.5E-04

8.00E+00 1.8E-04

2.4E+01 2.3E-04

7.2E+02 0.00E+00

0

Location 3:

Control Room

4

1

2

0.00E+00 3.5E-04

7.2E+02 0.00E+00

1

4

0.00E+00 1.00E+00

2.4E+01 6.00E-01

9.6E+01 4.00E-01

7.2E+02 0.00E+00

X/Q Tables:

5

Exclusion Area Boundary

4

0.00E+00 1.6E-05

1.3E+00 1.2E-04

1.8E+00 1.6E-05

1.00E+01 0.00E+00

Low Population Zone

6

0.00E+00 4.00E-05

1.3E+00 1.4E-04

1.8E+00 4.00E-05

8.00E+00 1.6E-05

2.4E+01 5.8E-06

9.6E+01 1.7E-06

Control room

7

0.00E+00 1.00E-10

1.3E+00 3.03E-04

1.8E+00 1.00E-10

2.00E+00 8.58E-10

8.00E+00 1.41E-08

2.4E+01 5.62E-09

9.6E+01 5.69E-09

Turbine building to CRoom

5

0.00E+00 8.64E-04

2.00E+00 4.66E-04



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

Appendix H - Page: H13 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

8.00E+00 2.32E-04
2.4E+01 1.53E-04
9.6E+01 1.25E-04
RB walls to C_Room
2
0.00E+00 4.15E-03
8.33E-02 0.00E+00

Inflow Pathways:

2 4 5

Exhaust Pathways:

5 2 3 6 7 11

X/Q table ID for Exhaust-Inflow paths:

3 3
3 3
-1 -1
5 5
4 4

Simulation Parameters:

2
0.00E+00 1.00E-01
2.4E+01 0.00E+00

Output Filename:

D:\RAD_310\Utility_cases\Cooper\LOCA\LOCA_Leak-MSIV-ESF_Condenser.o2
1
1
0
0
0
End of Scenario File

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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LOCA_leak-msiv-esf (err only 1 path offsite X/Q)

Plant Description

Number of Nuclides = 60

Inventory Power = 1.0000E+00 MWth

Plant Power Level = 2.4286E+03 MWth

Number of compartments = 7



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H14 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Compartment information

Compartment number 1

Name: Drywell Free Volume

Compartment volume = 1.3225E+05 (Cubic feet)

Compartment type is Normal

Removal devices within compartment:

Deposition

Pathways into and out of compartment 1

Exit Pathway Number 1: Primary to Reactor Building

Exit Pathway Number 7: Drywell Free Volume to Environment

Exit Pathway Number 8: Failed MSIV--Drywell to Condenser

Exit Pathway Number 9: Intact MSIV-- Drywell to Condenser

Compartment number 2

Name: Reactor Building

Compartment volume = 2.0000E+02 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 2

Inlet Pathway Number 1: Primary to Reactor Building

Inlet Pathway Number 12: Suppression Pool leakage to Reactor Building

Exit Pathway Number 2: (SGTS_Active) Reactor Building to Environment

Exit Pathway Number 3: (SGTS Idle) Reactor Building to Environment

Compartment number 3

Name: Environment

Compartment type is Environment

Pathways into and out of compartment 3

Inlet Pathway Number 2: (SGTS_Active) Reactor Building to Environment

Inlet Pathway Number 3: (SGTS Idle) Reactor Building to Environment

Inlet Pathway Number 6: Exhaust Control Room to Environment

Inlet Pathway Number 7: Drywell Free Volume to Environment

Inlet Pathway Number 11: Turbine Building to Environment

Exit Pathway Number 4: Unfiltered Environment to Control Room

Exit Pathway Number 5: Filtered Environment to Control Room

Compartment number 4

Name: Control Room

Compartment volume = 1.4190E+05 (Cubic feet)

Compartment type is Control Room

Pathways into and out of compartment 4

Inlet Pathway Number 4: Unfiltered Environment to Control Room

Inlet Pathway Number 5: Filtered Environment to Control Room

Exit Pathway Number 6: Exhaust Control Room to Environment

Compartment number 5

Name: Condenser

Compartment volume = 4.8000E+04 (Cubic feet)

Compartment type is Normal

Pathways into and out of compartment 5

Inlet Pathway Number 8: Failed MSIV--Drywell to Condenser



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

Appendix H - Page: H15 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Inlet Pathway Number 9: Intact MSIV-- Drywell to Condenser
Exit Pathway Number 10: Condenser to Turbine Building

Compartment number 6
Name: Turbine Building
Compartment volume = 1.0000E+02 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment 6
Inlet Pathway Number 10: Condenser to Turbine Building
Exit Pathway Number 11: Turbine Building to Environment

Compartment number 7
Name: Suppression Pool
Compartment volume = 9.6445E+04 (Cubic feet)
Compartment type is Normal
Pathways into and out of compartment 7
Exit Pathway Number 12: Suppression Pool leakage to Reactor Building

Total number of pathways = 12

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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LOCA_leak-msiv-esf (err only 1 path offsite X/Q)

Scenario Description

Power Ratio = 2.4286E+03
End Time = 7.2000E+02 (Hours)

Radioactive Decay is enabled
Calculation of Daughters is enabled

Source Number 1 is used in Compartment 1 Drywell Free Volume
Nuclide Distribution given in Ci/Mwt
Fraction of Nuclide Distribution in this Compartment 1.00000

Iodine fractions for source number 1
Aerosol = 9.5000E-01
Elemental = 4.8500E-02
Organic = 1.5000E-03

Inventory file = d:\rad_310\jonathan\defaults\cooper\cooper_60.nif



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H16 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Release from file = d:\rad_310\jonathan\defaults\bwr_dba.rft
Dose Conversion file = d:\rad_310\jonathan\defaults\fgr11&12.inp

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)
Co-58	7	1.529E+02	6.117E+06	4.760E-14	8.720E-10	2.940E-09
Co-60	7	1.830E+02	1.663E+08	1.260E-13	1.620E-08	5.910E-08
Kr-85	1	3.660E+02	3.383E+08	1.190E-16	0.000E+00	0.000E+00
Kr-85m	1	6.810E+03	1.613E+04	7.480E-15	0.000E+00	0.000E+00
Kr-87	1	1.300E+04	4.578E+03	4.120E-14	0.000E+00	0.000E+00
Kr-88	1	1.830E+04	1.022E+04	1.020E-13	0.000E+00	0.000E+00
Rb-86	3	6.990E+01	1.612E+06	4.810E-15	1.330E-09	1.790E-09
Sr-89	5	2.440E+04	4.363E+06	7.730E-17	7.960E-12	1.120E-08
Sr-90	5	2.900E+03	9.190E+08	7.530E-18	2.690E-10	3.510E-07
Sr-91	5	3.100E+04	3.420E+04	4.924E-14	9.930E-12	4.547E-10
Sr-92	5	3.380E+04	9.756E+03	6.790E-14	3.920E-12	2.180E-10
Y-90	9	3.000E+03	2.304E+05	1.900E-16	5.170E-13	2.280E-09
Y-91	9	3.170E+04	5.055E+06	2.600E-16	8.500E-12	1.320E-08
Y-92	9	3.390E+04	1.274E+04	1.300E-14	1.050E-12	2.110E-10
Y-93	9	3.960E+04	3.636E+04	4.800E-15	9.260E-13	5.820E-10
Zr-95	9	4.450E+04	5.528E+06	3.600E-14	1.440E-09	6.390E-09
Zr-97	9	4.510E+04	6.084E+04	4.432E-14	2.315E-11	1.171E-09
Nb-95	9	4.480E+04	3.037E+06	3.740E-14	3.580E-10	1.570E-09
Mo-99	7	5.120E+04	2.376E+05	7.280E-15	1.520E-11	1.070E-09
Tc-99m	7	4.520E+04	2.167E+04	5.890E-15	5.010E-11	8.800E-12
Ru-103	7	4.300E+04	3.394E+06	2.251E-14	2.570E-10	2.421E-09
Ru-105	7	3.030E+04	1.598E+04	3.810E-14	4.150E-12	1.230E-10
Ru-106	7	1.740E+04	3.181E+07	1.040E-14	1.720E-09	1.290E-07
Rh-105	7	2.770E+04	1.273E+05	3.720E-15	2.880E-12	2.580E-10
Sb-127	4	3.020E+03	3.326E+05	3.330E-14	6.150E-11	1.630E-09
Sb-129	4	8.930E+03	1.555E+04	7.140E-14	9.720E-12	1.740E-10
Te-127	4	3.050E+03	3.366E+04	2.420E-16	1.840E-12	8.600E-11
Te-127m	4	4.060E+02	9.418E+06	1.470E-16	9.660E-11	5.810E-09
Te-129	4	8.790E+03	4.176E+03	2.750E-15	5.090E-13	2.090E-11
Te-129m	4	1.300E+03	2.903E+06	3.337E-15	1.563E-10	6.484E-09
Te-131m	4	3.960E+03	1.080E+05	7.463E-14	3.669E-08	1.758E-09
Te-132	4	3.850E+04	2.815E+05	1.030E-14	6.280E-08	2.550E-09
I-131	2	2.720E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.930E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.510E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Xe-133	1	5.260E+04	4.532E+05	1.560E-15	0.000E+00	0.000E+00
Xe-135	1	1.860E+04	3.272E+04	1.190E-14	0.000E+00	0.000E+00
Cs-134	3	6.750E+03	6.507E+07	7.570E-14	1.110E-08	1.250E-08
Cs-136	3	2.160E+03	1.132E+06	1.060E-13	1.730E-09	1.980E-09
Cs-137	3	4.050E+03	9.467E+08	2.725E-14	7.930E-09	8.630E-09
Ba-139	6	4.900E+04	4.962E+03	2.170E-15	2.400E-12	4.640E-11
Ba-140	6	4.710E+04	1.101E+06	8.580E-15	2.560E-10	1.010E-09



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

Appendix H - Page: H17 of H25

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

La-140	9	4.870E+04	1.450E+05	1.170E-13	6.870E-11	1.310E-09
La-141	9	4.460E+04	1.415E+04	2.390E-15	9.400E-12	1.570E-10
La-142	9	4.300E+04	5.550E+03	1.440E-13	8.740E-12	6.840E-11
Ce-141	8	4.470E+04	2.808E+06	3.430E-15	2.550E-11	2.420E-09
Ce-143	8	4.110E+04	1.188E+05	1.290E-14	6.230E-12	9.160E-10
Ce-144	8	3.660E+04	2.456E+07	2.773E-15	2.920E-10	1.010E-07
Pr-143	9	4.020E+04	1.172E+06	2.100E-17	1.680E-18	2.190E-09
Nd-147	8	1.800E+04	9.487E+05	6.190E-15	1.820E-11	1.850E-09
Np-239	8	5.860E+05	2.035E+05	7.690E-15	7.620E-12	6.780E-10
Pu-238	8	1.280E+02	2.769E+09	4.880E-18	3.860E-10	7.790E-05
Pu-239	8	1.290E+01	7.594E+11	4.240E-18	3.750E-10	8.330E-05
Pu-240	8	1.770E+01	2.063E+11	4.750E-18	3.760E-10	8.330E-05
Pu-241	8	5.340E+03	4.544E+08	7.250E-20	9.150E-12	1.340E-06
Am-241	9	6.870E+00	1.364E+10	8.180E-16	1.600E-09	1.200E-04
Cm-242	9	1.730E+03	1.407E+07	5.690E-18	9.410E-10	4.670E-06
Cm-244	9	1.110E+02	5.715E+08	4.910E-18	1.010E-09	6.700E-05

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
Sr-90	Y-90	1.00	none	0.00	none	0.00
Sr-91	Y-91m	0.58	Y-91	0.42	none	0.00
Sr-92	Y-92	1.00	none	0.00	none	0.00
Y-93	Zr-93	1.00	none	0.00	none	0.00
Zr-95	Nb-95m	0.01	Nb-95	0.99	none	0.00
Zr-97	Nb-97m	0.95	Nb-97	0.05	none	0.00
Mo-99	Tc-99m	0.88	Tc-99	0.12	none	0.00
Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129m	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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-135	Cs-135	1.00	none	0.00	none	0.00
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00

Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	1.00	none	0.00	none	0.00

Release Fractions and Timings

BWR, RG 1.183, Table 1 Section 3.2

Duration (h): Design Basis Accident

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.500000 hr	1.5000 hrs	0.0000 hrs	(gm)
NOBLES	5.0000E-02	9.5000E-01	0.0000E+00	2.972E+03
IODINE	5.0000E-02	2.5000E-01	0.0000E+00	2.104E+02
CESIUM	5.0000E-02	2.0000E-01	0.0000E+00	3.146E+04
TELLURIUM	0.0000E+00	5.0000E-02	0.0000E+00	2.823E+01
STRONTIUM	0.0000E+00	2.0000E-02	0.0000E+00	1.074E+03
BARIUM	0.0000E+00	2.0000E-02	0.0000E+00	3.140E+01
RUTHENIUM	0.0000E+00	2.5000E-03	0.0000E+00	4.161E+01
CERIUM	0.0000E+00	5.0000E-04	0.0000E+00	4.376E+02
LANTHANUM	0.0000E+00	2.0000E-04	0.0000E+00	4.442E+00
AEROSOL	0.0000E+00	0.0000E+00	0.0000E+00	0.000E+00

Source Number 2 is used in Compartment 7 Suppression Pool

Nuclide Distribution given in Ci/MWt

Fraction of Nuclide Distribution in this Compartment 1.00000

Iodine fractions for source number 2

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

Inventory file = d:\rad_310\jonathan\defaults\cooper\cooper_60.nif

Release from file = d:\rad_310\jonathan\defaults\bwr_eccs.rft

Dose Conversion file = d:\rad_310\jonathan\defaults\fgr11&12.inp

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)
Co-58	7	1.529E+02	6.117E+06	4.760E-14	8.720E-10	2.940E-09
Co-60	7	1.830E+02	1.663E+08	1.260E-13	1.620E-08	5.910E-08
Rb-86	3	6.990E+01	1.612E+06	4.810E-15	1.330E-09	1.790E-09
Sr-89	5	2.440E+04	4.363E+06	7.730E-17	7.960E-12	1.120E-08
Sr-90	5	2.900E+03	9.190E+08	7.530E-18	2.690E-10	3.510E-07
Sr-91	5	3.100E+04	3.420E+04	4.924E-14	9.930E-12	4.547E-10
Sr-92	5	3.380E+04	9.756E+03	6.790E-14	3.920E-12	2.180E-10
Y-90	9	3.000E+03	2.304E+05	1.900E-16	5.170E-13	2.280E-09
Y-91	9	3.170E+04	5.055E+06	2.600E-16	8.500E-12	1.320E-08
Y-92	9	3.390E+04	1.274E+04	1.300E-14	1.050E-12	2.110E-10
Y-93	9	3.960E+04	3.636E+04	4.800E-15	9.260E-13	5.820E-10



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
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Zr-95	9	4.450E+04	5.528E+06	3.600E-14	1.440E-09	6.390E-09
Zr-97	9	4.510E+04	6.084E+04	4.432E-14	2.315E-11	1.171E-09
Nb-95	9	4.480E+04	3.037E+06	3.740E-14	3.580E-10	1.570E-09
Mo-99	7	5.120E+04	2.376E+05	7.280E-15	1.520E-11	1.070E-09
Tc-99m	7	4.520E+04	2.167E+04	5.890E-15	5.010E-11	8.800E-12
Ru-103	7	4.300E+04	3.394E+06	2.251E-14	2.570E-10	2.421E-09
Ru-105	7	3.030E+04	1.598E+04	3.810E-14	4.150E-12	1.230E-10
Ru-106	7	1.740E+04	3.181E+07	1.040E-14	1.720E-09	1.290E-07
Rh-105	7	2.770E+04	1.273E+05	3.720E-15	2.880E-12	2.580E-10
Sb-127	4	3.020E+03	3.326E+05	3.330E-14	6.150E-11	1.630E-09
Sb-129	4	8.930E+03	1.555E+04	7.140E-14	9.720E-12	1.740E-10
Te-127	4	3.050E+03	3.366E+04	2.420E-16	1.840E-12	8.600E-11
Te-127m	4	4.060E+02	9.418E+06	1.470E-16	9.660E-11	5.810E-09
Te-129	4	8.790E+03	4.176E+03	2.750E-15	5.090E-13	2.090E-11
Te-129m	4	1.300E+03	2.903E+06	3.337E-15	1.563E-10	6.484E-09
Te-131m	4	3.960E+03	1.080E+05	7.463E-14	3.669E-08	1.758E-09
Te-132	4	3.850E+04	2.815E+05	1.030E-14	6.280E-08	2.550E-09
I-131	2	2.720E+04	6.947E+05	1.820E-14	2.920E-07	8.890E-09
I-132	2	3.930E+04	8.280E+03	1.120E-13	1.740E-09	1.030E-10
I-133	2	5.510E+04	7.488E+04	2.940E-14	4.860E-08	1.580E-09
I-134	2	6.040E+04	3.156E+03	1.300E-13	2.880E-10	3.550E-11
I-135	2	5.160E+04	2.380E+04	8.294E-14	8.460E-09	3.320E-10
Cs-134	3	6.750E+03	6.507E+07	7.570E-14	1.110E-08	1.250E-08
Cs-136	3	2.160E+03	1.132E+06	1.060E-13	1.730E-09	1.980E-09
Cs-137	3	4.050E+03	9.467E+08	2.725E-14	7.930E-09	8.630E-09
Ba-139	6	4.900E+04	4.962E+03	2.170E-15	2.400E-12	4.640E-11
Ba-140	6	4.710E+04	1.101E+06	8.580E-15	2.560E-10	1.010E-09
La-140	9	4.870E+04	1.450E+05	1.170E-13	6.870E-11	1.310E-09
La-141	9	4.460E+04	1.415E+04	2.390E-15	9.400E-12	1.570E-10
La-142	9	4.300E+04	5.550E+03	1.440E-13	8.740E-12	6.840E-11
Ce-141	8	4.470E+04	2.808E+06	3.430E-15	2.550E-11	2.420E-09
Ce-143	8	4.110E+04	1.188E+05	1.290E-14	6.230E-12	9.160E-10
Ce-144	8	3.660E+04	2.456E+07	2.773E-15	2.920E-10	1.010E-07
Pr-143	9	4.020E+04	1.172E+06	2.100E-17	1.680E-18	2.190E-09
Nd-147	8	1.800E+04	9.487E+05	6.190E-15	1.820E-11	1.850E-09
Np-239	8	5.860E+05	2.035E+05	7.690E-15	7.620E-12	6.780E-10
Pu-238	8	1.280E+02	2.769E+09	4.880E-18	3.860E-10	7.790E-05
Pu-239	8	1.290E+01	7.594E+11	4.240E-18	3.750E-10	8.330E-05
Pu-240	8	1.770E+01	2.063E+11	4.750E-18	3.760E-10	8.330E-05
Pu-241	8	5.340E+03	4.544E+08	7.250E-20	9.150E-12	1.340E-06
Am-241	9	6.870E+00	1.364E+10	8.180E-16	1.600E-09	1.200E-04
Cm-242	9	1.730E+03	1.407E+07	5.690E-18	9.410E-10	4.670E-06
Cm-244	9	1.110E+02	5.715E+08	4.910E-18	1.010E-09	6.700E-05

Nuclide	Daughter	Fraction	Daughter	Fraction	Daughter	Fraction
Sr-90	Y-90	1.00	none	0.00	none	0.00
Sr-91	Y-91m	0.58	Y-91	0.42	none	0.00
Sr-92	Y-92	1.00	none	0.00	none	0.00
Y-93	Zr-93	1.00	none	0.00	none	0.00
Zr-95	Nb-95m	0.01	Nb-95	0.99	none	0.00
Zr-97	Nb-97m	0.95	Nb-97	0.05	none	0.00



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
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Mo-99	Tc-99m	0.88	Tc-99	0.12	none	0.00
Tc-99m	Tc-99	1.00	none	0.00	none	0.00
Ru-103	Rh-103m	1.00	none	0.00	none	0.00
Ru-105	Rh-105	1.00	none	0.00	none	0.00
Ru-106	Rh-106	1.00	none	0.00	none	0.00
Sb-127	Te-127m	0.18	Te-127	0.82	none	0.00
Sb-129	Te-129m	0.22	Te-129	0.77	none	0.00
Te-127m	Te-127	0.98	none	0.00	none	0.00
Te-129	I-129	1.00	none	0.00	none	0.00
Te-129m	Te-129	0.65	I-129	0.35	none	0.00
Te-131m	Te-131	0.22	I-131	0.78	none	0.00
Te-132	I-132	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
Cs-137	Ba-137m	0.95	none	0.00	none	0.00
Ba-140	La-140	1.00	none	0.00	none	0.00
La-141	Ce-141	1.00	none	0.00	none	0.00
Ce-143	Pr-143	1.00	none	0.00	none	0.00
Ce-144	Pr-144m	0.02	Pr-144	0.98	none	0.00
Nd-147	Pm-147	1.00	none	0.00	none	0.00
Np-239	Pu-239	1.00	none	0.00	none	0.00
Pu-238	U-234	1.00	none	0.00	none	0.00
Pu-239	U-235	1.00	none	0.00	none	0.00
Pu-240	U-236	1.00	none	0.00	none	0.00
Pu-241	U-237	0.00	Am-241	1.00	none	0.00
Am-241	Np-237	1.00	none	0.00	none	0.00
Cm-242	Pu-238	1.00	none	0.00	none	0.00
Cm-244	Pu-240	1.00	none	0.00	none	0.00

Release Fractions and Timings

BWR, RG 1.183, Table 1 Section 3.2

Duration (h): Design Basis Accident ECCS

	GAP	EARLY IN-VESSEL	LATE RELEASE	RELEASE MASS
	0.500000 hr	1.5000 hrs	0.0000 hrs	(gm)
NOBLES	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
IODINE	5.0000E-02	2.5000E-01	0.0000E+00	2.104E+02
CESIUM	5.0000E-02	2.0000E-01	0.0000E+00	3.146E+04
TELLURIUM	0.0000E+00	5.0000E-02	0.0000E+00	2.823E+01
STRONTIUM	0.0000E+00	2.0000E-02	0.0000E+00	1.074E+03
BARIUM	0.0000E+00	2.0000E-02	0.0000E+00	3.140E+01
RUTHENIUM	0.0000E+00	2.5000E-03	0.0000E+00	4.161E+01
CERIUM	0.0000E+00	5.0000E-04	0.0000E+00	4.376E+02
LANTHANUM	0.0000E+00	2.0000E-04	0.0000E+00	4.442E+00
AEROSOL	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

COMPARTMENT DATA

Compartment number 1: Drywell Free Volume

Natural Deposition (Powers' model): Aerosol data



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Reactor type: BWRDBA
Percentile = 10 (%)

Natural Deposition: Elemental Removal Data
Time (hr) Removal Coef. (hr⁻¹)
0.0000E+00 0.0000E+00

Compartment number 2: Reactor Building
Compartment number 3: Environment
Compartment number 4: Control Room
Compartment number 5: Condenser
Compartment number 6: Turbine Building
Compartment number 7: Suppression Pool

PATHWAY DATA

Pathway number 1: Primary to Reactor Building

Convection Data
Time (hr) Flow Rate (% / day)
0.0000E+00 0.0000E+00
8.3300E-02 6.3500E-01
2.4000E+01 3.1750E-01

Pathway number 2: (SGTS_Active) Reactor Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	9.8000E+01	9.4000E+01	9.4000E+01
1.6600E-02	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01
2.0000E+00	1.4920E+03	9.8000E+01	9.4000E+01	9.4000E+01

Pathway number 3: (SGTS Idle) Reactor Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	0.0000E+00	9.8000E+01	8.9000E+01	2.9000E+01
1.6600E-02	1.4920E+03	9.8000E+01	8.9000E+01	2.9000E+01
1.0000E+00	2.8800E+02	9.8000E+01	8.9000E+01	2.9000E+01

Pathway number 4: Unfiltered Environment to Control Room



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
Cooper Nuclear Station**

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Rev. Number: 1

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00
1.6700E-02	4.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 5: Filtered Environment to Control Room

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.2350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6600E-02	8.1000E+02	9.8000E+01	8.9000E+01	8.9000E+01

Pathway number 6: Exhaust Control Room to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	3.6350E+03	0.0000E+00	0.0000E+00	0.0000E+00
1.6600E-02	1.2100E+03	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 7: Drywell Free Volume to Environment

Convection Data

Time (hr)	Flow Rate (% / day)
0.0000E+00	6.3500E-01
8.3300E-02	0.0000E+00

Pathway number 8: Failed MSIV--Drywell to Condenser

Piping: Removal Data

Time (hr)	Flow Rate (cfm)	DF		
		Aerosol	Elemental	Organic
0.0000E+00	1.3370E+00	1.0000E+00	1.0000E+00	1.0000E+00
2.4000E+01	6.6850E-01	1.0000E+00	1.0000E+00	1.0000E+00

Pathway number 9: Intact MSIV-- Drywell to Condenser

Piping: Removal Data

Time (hr)	Flow Rate (cfm)	DF		
		Aerosol	Elemental	Organic
0.0000E+00	1.3370E+00	1.0000E+00	1.0000E+00	1.0000E+00
2.4000E+01	6.6850E-01	1.0000E+00	1.0000E+00	1.0000E+00

Pathway number 10: Condenser to Turbine Building



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Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	5.4500E+00	9.4900E+01	9.4900E+01	0.0000E+00
2.4000E+01	2.7260E+00	9.7400E+01	9.7400E+01	0.0000E+00

Pathway number 11: Turbine Building to Environment

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	5.0000E+02	0.0000E+00	0.0000E+00	0.0000E+00

Pathway number 12: Suppression Pool leakage to Reactor Building

Pathway Filter: Removal Data

Time (hr)	Flow Rate (cfm)	Filter Efficiencies (%)		
		Aerosol	Elemental	Organic
0.0000E+00	1.5900E-01	1.0000E+02	0.0000E+00	0.0000E+00

DOSE INFORMATION

Number_Dose_Locations = 3

Dose Location Name = Exclusion Area Boundary
Located in compartment 3 the Environment

Exclusion Area Boundary 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


Dose Location Name = Low Population Zone
Located in compartment 3 the Environment

Low Population Zone 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

Dose Location Name = Control Room
Located in compartment 4 the Control Room

Control Room Breathing Rate Data

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

Control Room 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

X/Q, ATMOSPHERIC DISPERSION INFORMATION

X/Q Table Name = Exclusion Area Boundary

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	1.6000E-05
1.3000E+00	1.2000E-04
1.8000E+00	1.6000E-05
1.0000E+01	0.0000E+00

X/Q Table Name = Low Population Zone

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	4.0000E-05
1.3000E+00	1.4000E-04
1.8000E+00	4.0000E-05
8.0000E+00	1.6000E-05
2.4000E+01	5.8000E-06
9.6000E+01	1.7000E-06

X/Q Table Name = Control room

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	1.0000E-10
1.3000E+00	3.0300E-04
1.8000E+00	1.0000E-10
2.0000E+00	8.5800E-10
8.0000E+00	1.4100E-08
2.4000E+01	5.6200E-09
9.6000E+01	5.6900E-09

This X/Q Table is used for these connected pathways

- Path 2 (SGTS_Active) Reactor Building to Environment and Path 4 Unfiltered Environment to Control Room
- Path 3 (SGTS_Idle) Reactor Building to Environment and Path 4 Unfiltered Environment to Control Room



**Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at
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Path 2 (SGTS_Active) Reactor Building to Environment and Path 5 Filtered
Environment to Control Room
Path 3 (SGTS Idle) Reactor Building to Environment and Path 5 Filtered
Environment to Control Room

X/Q Table Name = Turbine building to CRoom

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	8.6400E-04
2.0000E+00	4.6600E-04
8.0000E+00	2.3200E-04
2.4000E+01	1.5300E-04
9.6000E+01	1.2500E-04

This X/Q Table is used for these connected pathways

Path 11 Turbine Building to Environment and Path 4 Unfiltered Environment to
Control Room
Path 11 Turbine Building to Environment and Path 5 Filtered Environment to
Control Room

X/Q Table Name = RB walls to C_Room

Location X/Q Data

Time (hr)	X/Q (s * m ⁻³)
0.0000E+00	4.1500E-03
8.3300E-02	0.0000E+00

This X/Q Table is used for these connected pathways

Path 7 Drywell Free Volume to Environment and Path 4 Unfiltered Environment to
Control Room
Path 7 Drywell Free Volume to Environment and Path 5 Filtered Environment to
Control Room

USER SPECIFIED TIME STEP DATA - SUPPLEMENTAL TIME STEPS

Time (hr)	Time step (hr)
0.0000E+00	1.0000E-01
2.4000E+01	0.0000E+00

EDIT EACH MAJOR TIME STEP

DO NOT EDIT SUPPLEMENTAL TIME STEPS

DO NOT EDIT MODEL DECONTAMINATION

Masses in Atoms and kg in detailed output



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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APPENDIX I

RADTRAD 3.10 Plant Specific Output File (o0)

Leakage-MSIV-ESF Pathway



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ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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LOCA_leak-msiv-esf (err only 1 path offsite X/Q)

Dose, Detailed model and Detailed Inventory Output

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) = 0.0006 Whole Body Thyroid TEDE
Delta dose (rem) 1.3064E-08 2.3119E-06 1.1084E-07
Accumulated dose (rem) 1.3064E-08 2.3119E-06 1.1084E-07

Low Population Zone Doses:

Time (h) = 0.0006 Whole Body Thyroid TEDE
Delta dose (rem) 3.2659E-08 5.7799E-06 2.7709E-07
Accumulated dose (rem) 3.2659E-08 5.7799E-06 2.7709E-07

Control Room Doses:

Time (h) = 0.0006 Whole Body Thyroid TEDE Skin
Delta dose (rem) 6.7966E-11 2.5595E-07 1.0892E-08 2.1985E-09
Accumulated dose (rem) 6.7966E-11 2.5595E-07 1.0892E-08 2.1985E-09

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 0.0006

Table with 6 columns: Nuclide, Compartment, Dose Fract, Exposure (Ci-hr), Decays (Bq-s), Compartment Dep Surfaces. Rows include Kr-85, Kr-85m, Kr-87, Kr-88, Rb-86, I-131, I-132, I-133, I-134, I-135, Xe-133, Xe-135, Cs-134, Cs-136, Cs-137, and Total.

Dose Effective (Ci/cc) I-131 (Thyroid) 1.3746E-06
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.7531E-06
Total I (Ci) 3.1508E+04



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Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 0.0006	Atmosphere	Sump
Noble gases (atoms)	1.0704E+21	0.0000E+00
Elemental I (atoms)	8.6502E+18	0.0000E+00
Organic I (atoms)	2.6753E+17	0.0000E+00
Aerosol I (atoms)	1.6941E+20	0.0000E+00
All Aerosols (kg)	7.0261E-03	0.0000E+00

Time (h) = 0.0006	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
Aerosol I (atoms)	2.5272E+16	0.0000E+00
All Aerosols (kg)	1.0481E-06	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 0.0006

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)
I-131	1.0084E-04	5.9988E-01	5.6020E-08	7.4619E+06
I-132	1.4567E-04	4.0994E-02	8.0928E-08	1.0780E+07
I-133	2.0426E-04	2.2613E-01	1.1348E-07	1.5116E+07
I-134	2.2382E-04	6.0593E-02	1.2434E-07	1.6566E+07
I-135	1.9128E-04	7.2406E-02	1.0627E-07	1.4155E+07
Total	8.6588E-04	1.0000E+00	0.0000E+00	0.0000E+00

Dose Effective (Ci/cc) I-131 (Thyroid)	2.4979E-11
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	3.1858E-11
Total I (Ci)	8.6587E-04

Reactor Building Compartment Group Inventory Distribution:

Time (h) = 0.0006	Atmosphere	Sump
Noble gases (atoms)	2.6694E+07	0.0000E+00
Elemental I (atoms)	4.7536E+12	0.0000E+00
Organic I (atoms)	1.4702E+11	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	0.0000E+00	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 0.0006

Nuclide	Compartment Atmosphere	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Kr-85	3.6293E-06	2.0163E-09	0.00000	0.00000	0.00000	0.00000
Kr-85m	6.7523E-05	3.7513E-08	0.00000	0.00000	0.00027	0.00000
Kr-87	1.2887E-04	7.1595E-08	0.00000	0.00000	0.00284	0.00000
Kr-88	1.8144E-04	1.0080E-07	0.00000	0.00000	0.00989	0.00000
I-131	2.6969E-04	1.4983E-07	0.00000	0.00000	0.45083	0.00000
I-132	3.8960E-04	2.1645E-07	0.00000	0.00000	0.03081	0.00000
I-133	5.4632E-04	3.0351E-07	0.00000	0.00000	0.16995	0.00000
I-134	5.9862E-04	3.3256E-07	0.00000	0.00000	0.04556	0.00000
I-135	5.1160E-04	2.8422E-07	0.00000	0.00000	0.05442	0.00000
Xe-133	5.2159E-04	2.8977E-07	0.00000	0.00000	0.00043	0.00000
Xe-135	1.8445E-04	1.0247E-07	0.00000	0.00000	0.00117	0.00000
Cs-134	6.6927E-05	3.7182E-08	0.00000	0.00000	0.15910	0.00000
Cs-136	2.1417E-05	1.1898E-08	0.00000	0.00000	0.00914	0.00000
Cs-137	4.0156E-05	2.2309E-08	0.00000	0.00000	0.06537	0.00000

Environment Compartment Group Inventory Distribution:

Time (h) = 0.0006	Total Release	Release Rate/s
Noble gases (atoms)	7.8667E+13	3.9334E+13
Elemental I (atoms)	6.3575E+11	3.1787E+11
Organic I (atoms)	1.9662E+10	9.8311E+09
Aerosol I (atoms)	1.2452E+13	6.2258E+12
All Aerosols (kg)	5.1641E-10	2.5821E-10

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 0.0006

Nuclide	Compartment	Dose Fract	Exposure	Decays
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Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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	Atmosphere		(Ci-hr)		(Bq-s)
Rb-86	9.4311E+00	2.3717E-04	5.2395E-03	6.9790E+11	
I-131	3.6699E+03	4.5752E-01	2.0388E+00	2.7157E+14	
I-132	5.3016E+03	3.1266E-02	2.9453E+00	3.9235E+14	
I-133	7.4341E+03	1.7247E-01	4.1300E+00	5.5013E+14	
I-134	8.1457E+03	4.6214E-02	4.5254E+00	6.0292E+14	
I-135	6.9616E+03	5.5223E-02	3.8675E+00	5.1517E+14	
Xe-133	2.2060E-02	1.3708E-09	1.2255E-05	0.0000E+00	
Xe-135	2.5069E-01	1.1883E-07	1.3927E-04	0.0000E+00	
Cs-134	9.1072E+02	1.6146E-01	5.0596E-01	6.7394E+13	
Cs-136	2.9143E+02	9.2755E-03	1.6191E-01	2.1566E+13	
Cs-137	5.4643E+02	6.6339E-02	3.0357E-01	4.0436E+13	
Total	3.3271E+04	1.0000E+00	0.0000E+00	0.0000E+00	

Dose Effective (Ci/cc) I-131 (Thyroid) 1.8852E-06
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 2.4043E-06
 Total I (Ci) 3.1513E+04

Suppression Pool Compartment Group Inventory Distribution:

Time (h) =	0.0006	Atmosphere	Sump
Noble gases (atoms)		9.7152E+14	0.0000E+00
Elemental I (atoms)		1.7300E+20	0.0000E+00
Organic I (atoms)		5.3506E+18	0.0000E+00
Aerosol I (atoms)		0.0000E+00	0.0000E+00
All Aerosols (kg)		6.9902E-03	0.0000E+00

Filtered Environment to Control Room Transport Group Inventory:

Time (h) =	0.0006	Pathway	Filtered	Transported
Noble gases (atoms)			0.0000E+00	4.9844E+11
Elemental I (atoms)			0.0000E+00	4.0282E+09
Organic I (atoms)			0.0000E+00	1.2458E+08
Aerosol I (atoms)			0.0000E+00	7.8890E+10
All Aerosols (kg)			0.0000E+00	3.2718E-12

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Exclusion Area Boundary Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.1591E-05	2.0559E-03	9.8536E-05
Accumulated dose (rem)		1.1604E-05	2.0583E-03	9.8647E-05

Low Population Zone Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE
Delta dose (rem)		2.8978E-05	5.1399E-03	2.4634E-04
Accumulated dose (rem)		2.9011E-05	5.1456E-03	2.4662E-04

Control Room Doses:

Time (h) =	0.0166	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)		1.2988E-06	4.9045E-03	2.0871E-04	4.2019E-05
Accumulated dose (rem)		1.2989E-06	4.9048E-03	2.0872E-04	4.2021E-05

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 0.0166

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Kr-85	1.4755E+03	2.3164E-07	1.6857E+01	2.2453E+15	0.0000E+00	3.2403E-03	7.4286E-03	7.4286E-03
Kr-85m	2.7384E+04	2.7034E-04	3.1299E+02	4.1713E+16	0.0000E+00	6.0222E-02	1.3806E-01	1.3806E-01
Kr-87	5.1936E+04	2.8276E-03	5.9435E+02	7.9316E+16	0.0000E+00	1.1463E-01	2.6281E-01	2.6281E-01
Kr-88	7.3477E+04	9.8946E-03	8.4007E+02	1.1199E+17	0.0000E+00	1.6173E-01	3.7077E-01	3.7077E-01
Rb-86	2.8054E+02	2.3384E-04	3.2077E+00	4.2727E+14	1.2519E+00	6.1684E-04	1.4142E-03	1.4142E-03
I-131	1.0919E+05	4.5116E-01	1.2484E+03	1.6629E+17	4.6277E+02	2.4006E-01	5.5037E-01	5.5037E-01



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I-132	1.5722E+05	3.0745E-02	1.7984E+03	2.3979E+17	6.6594E+02	3.4641E-01	7.9418E-01	7.9418E-01
I-133	2.2107E+05	1.7000E-01	2.5279E+03	3.3675E+17	9.3699E+02	4.8620E-01	1.1147E+00	1.1147E+00
I-134	2.3931E+05	4.5110E-02	2.7429E+03	3.6634E+17	1.0143E+03	5.3003E-01	1.2151E+00	1.2151E+00
I-135	2.0678E+05	5.4385E-02	2.3650E+03	3.1514E+17	8.7643E+02	4.5508E-01	1.0433E+00	1.0433E+00
Xe-133	2.1205E+05	4.3640E-04	2.4226E+03	3.2268E+17	0.0000E+00	4.6568E-01	1.0676E+00	1.0676E+00
Xe-135	7.5113E+04	1.1788E-03	8.5786E+02	1.1416E+17	0.0000E+00	1.6479E-01	3.7780E-01	3.7780E-01
Cs-134	2.7091E+04	1.5920E-01	3.0976E+02	4.1260E+16	1.2090E+02	5.9567E-02	1.3656E-01	1.3656E-01
Cs-136	8.6689E+03	9.1452E-03	9.9121E+01	1.3203E+16	3.8685E+01	1.9061E-02	4.3699E-02	4.3699E-02
Cs-137	1.6255E+04	6.5409E-02	1.8586E+02	2.4756E+16	7.2538E+01	3.5740E-02	8.1937E-02	8.1937E-02
Total	1.4273E+06	1.0000E+00	0.0000E+00	0.0000E+00	4.1898E+03	3.1431E+00	7.2057E+00	7.2057E+00

Dose Effective (Ci/cc) I-131 (Thyroid) 4.0894E-05
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 5.2133E-05
 Total I (Ci) 9.3357E+05

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) =	0.0166	Atmosphere	Sump
Noble gases (atoms)		3.1982E+22	0.0000E+00
Elemental I (atoms)		2.5837E+20	0.0000E+00
Organic I (atoms)		7.9909E+18	0.0000E+00
Aerosol I (atoms)		5.0384E+21	0.0000E+00
All Aerosols (kg)		2.0904E-01	0.0000E+00

Time (h) =	0.0166	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
Aerosol I (atoms)		2.2495E+19	0.0000E+00
All Aerosols (kg)		9.3308E-04	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 0.0166

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Inflow
I-131	Atmosphere	9.0023E-02	6.0046E-01	8.3625E-04	1.1139E+11
I-132	Atmosphere	1.2954E-01	4.0898E-02	1.2041E-03	1.6054E+11
I-133	Atmosphere	1.8227E-01	2.2626E-01	1.6933E-03	2.2557E+11
I-134	Atmosphere	1.9731E-01	6.0005E-02	1.8363E-03	2.4525E+11
I-135	Atmosphere	1.7049E-01	7.2376E-02	1.5841E-03	2.1108E+11
Xe-133	Atmosphere	1.3204E-05	3.7707E-08	1.0535E-07	5.9654E+06
Xe-135	Atmosphere	1.4991E-04	3.2662E-06	1.1963E-06	6.7745E+07
Total	Atmosphere	7.6981E-01	1.0000E+00	0.0000E+00	7.7174E-01

Dose Effective (Ci/cc) I-131 (Thyroid) 2.2295E-08
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 2.8422E-08
 Total I (Ci) 7.6964E-01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	0.0166	Atmosphere	Sump
Noble gases (atoms)		5.8127E+11	0.0000E+00
Elemental I (atoms)		4.2425E+15	0.0000E+00
Organic I (atoms)		1.3121E+14	0.0000E+00
Aerosol I (atoms)		0.0000E+00	0.0000E+00
All Aerosols (kg)		0.0000E+00	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 0.0166

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Kr-85	Atmosphere	3.2406E-03	2.1216E-05	0.00000	0.00000	0.00000
Kr-85m	Atmosphere	6.0167E-02	3.9394E-04	0.00000	0.00000	0.00027
Kr-87	Atmosphere	1.1424E-01	7.4807E-04	0.00000	0.00000	0.00284
Kr-88	Atmosphere	1.6148E-01	1.0573E-03	0.00000	0.00000	0.00990
Rb-86	Atmosphere	6.1700E-04	4.0402E-06	0.00000	0.00000	0.00023
I-131	Atmosphere	2.4012E-01	1.5723E-03	0.00000	0.00000	0.45100
I-132	Atmosphere	3.4582E-01	2.2646E-03	0.00000	0.00000	0.03079
I-133	Atmosphere	4.8622E-01	3.1839E-03	0.00000	0.00000	0.16997
I-134	Atmosphere	5.2742E-01	3.4548E-03	0.00000	0.00000	0.04531
I-135	Atmosphere	4.5488E-01	2.9788E-03	0.00000	0.00000	0.05440
Xe-133	Atmosphere	4.6574E-01	3.0492E-03	0.00000	0.00000	0.00044



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Xe-135	1.6508E-01	1.0805E-03	0.00000	0.00000	0.00118	0.00000
Cs-134	5.9582E-02	3.9016E-04	0.00000	0.00000	0.15914	0.00000
Cs-136	1.9066E-02	1.2485E-04	0.00000	0.00000	0.00914	0.00000
Cs-137	3.5749E-02	2.3410E-04	0.00000	0.00000	0.06539	0.00000

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 0.0166		
Noble gases (atoms)	7.0242E+16	1.1754E+15
Elemental I (atoms)	5.6743E+14	9.4952E+12
Organic I (atoms)	1.7551E+13	2.9369E+11
Aerosol I (atoms)	1.1082E+16	1.8544E+14
All Aerosols (kg)	4.5974E-07	7.6931E-09

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 0.0166

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Rb-86	Atmosphere	2.3734E-04	3.2194E+00	4.2882E+14	0.0000E+00
I-131	1.0965E+05	4.5783E-01	1.2527E+03	1.6686E+17	9.0026E-02
I-132	1.5789E+05	3.1199E-02	1.8046E+03	2.4062E+17	1.2991E-01
I-133	2.2201E+05	1.7252E-01	2.5366E+03	3.3792E+17	1.8233E-01
I-134	2.4033E+05	4.5777E-02	2.7524E+03	3.6761E+17	1.9877E-01
I-135	2.0766E+05	5.5188E-02	2.3732E+03	3.1622E+17	1.7066E-01
Xe-133	1.3550E+01	2.4591E-08	1.3499E-01	5.6004E+12	4.1590E-06
Xe-135	1.5384E+02	2.1302E-06	1.5329E+00	6.3599E+13	4.7239E-05
Cs-134	2.7212E+04	1.6158E-01	3.1089E+02	4.1410E+16	0.0000E+00
Cs-136	8.7077E+03	9.2820E-03	9.9481E+01	1.3251E+16	0.0000E+00
Cs-137	1.6327E+04	6.6388E-02	1.8653E+02	2.4846E+16	0.0000E+00
Total	9.9023E+05	1.0000E+00	0.0000E+00	0.0000E+00	7.7174E-01

Dose Effective (Ci/cc) I-131 (Thyroid)	5.6314E-05
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	7.1791E-05
Total I (Ci)	9.3754E+05

Suppression Pool Compartment Group Inventory Distribution:

	Atmosphere	Sump
Time (h) = 0.0166		
Noble gases (atoms)	5.9650E+17	0.0000E+00
Elemental I (atoms)	5.1675E+21	0.0000E+00
Organic I (atoms)	1.5982E+20	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	2.0887E-01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 0.0166

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Kr-85m	0.0000E+00	0.00E+00	5.2528E-04	0.000E+00	0.000E+00	5.253E-04	1.214E-08
Kr-87	0.0000E+00	0.00E+00	1.0001E-03	0.000E+00	0.000E+00	1.000E-03	2.310E-08
Kr-88	0.0000E+00	0.00E+00	1.4107E-03	0.000E+00	0.000E+00	1.411E-03	3.260E-08
I-131	0.0000E+00	0.00E+00	2.0929E-03	0.000E+00	0.000E+00	2.093E-03	2.539E-09
I-132	0.0000E+00	0.00E+00	3.0211E-03	0.000E+00	0.000E+00	3.021E-03	3.663E-09
I-133	0.0000E+00	0.00E+00	4.2387E-03	0.000E+00	0.000E+00	4.239E-03	5.142E-09
I-134	0.0000E+00	0.00E+00	4.6232E-03	0.000E+00	0.000E+00	4.623E-03	5.603E-09
I-135	0.0000E+00	0.00E+00	3.9676E-03	0.000E+00	0.000E+00	3.968E-03	4.813E-09
Xe-133	0.0000E+00	0.00E+00	4.0614E-03	0.000E+00	0.000E+00	4.061E-03	9.389E-08
Xe-135	0.0000E+00	0.00E+00	1.4371E-03	0.000E+00	0.000E+00	1.437E-03	3.324E-08
Cs-134	0.0000E+00	0.00E+00	5.1929E-04	0.000E+00	0.000E+00	5.193E-04	6.129E-10
Cs-136	0.0000E+00	0.00E+00	1.6617E-04	0.000E+00	0.000E+00	1.662E-04	1.961E-10
Cs-137	0.0000E+00	0.00E+00	3.1157E-04	0.000E+00	0.000E+00	3.116E-04	3.677E-10

Filtered Environment to Control Room Transport Group Inventory:

	Pathway Filtered	Transported
Time (h) = 0.0166		
Noble gases (atoms)	0.0000E+00	4.4502E+14
Elemental I (atoms)	0.0000E+00	3.5958E+12
Organic I (atoms)	0.0000E+00	1.1121E+11
Aerosol I (atoms)	0.0000E+00	7.0206E+13
All Aerosols (kg)	0.0000E+00	2.9121E-09



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.6896E-07	3.1020E-05	1.4147E-06
Accumulated dose (rem)		1.1773E-05	2.0893E-03	1.0006E-04

Low Population Zone Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE
Delta dose (rem)		4.2241E-07	7.7551E-05	3.5367E-06
Accumulated dose (rem)		2.9433E-05	5.2232E-03	2.5015E-04

Control Room Doses:

Time (h) =	0.0167	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)		2.1496E-08	8.1402E-05	3.4639E-06	6.9551E-07
Accumulated dose (rem)		1.3204E-06	4.9862E-03	2.1218E-04	4.2717E-05

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 0.0167

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Kr-85	1.4844E+03	2.3164E-07	1.7005E+01	2.2651E+15	0.0000E+00	3.2794E-03	7.5184E-03	7.5184E-03
Kr-85m	2.7548E+04	2.7035E-04	3.1575E+02	4.2080E+16	0.0000E+00	6.0949E-02	1.3973E-01	1.3973E-01
Kr-87	5.2247E+04	2.8276E-03	5.9958E+02	8.0012E+16	0.0000E+00	1.1601E-01	2.6597E-01	2.6597E-01
Kr-88	7.3918E+04	9.8946E-03	8.4746E+02	1.1298E+17	0.0000E+00	1.6367E-01	3.7524E-01	3.7524E-01
Rb-86	2.8222E+02	2.3384E-04	3.2359E+00	4.3103E+14	1.2670E+00	6.2428E-04	1.4312E-03	1.4312E-03
I-131	1.0984E+05	4.5116E-01	1.2594E+03	1.6775E+17	4.6836E+02	2.4296E-01	5.5701E-01	5.5701E-01
I-132	1.5816E+05	3.0745E-02	1.8142E+03	2.4190E+17	6.7396E+02	3.5059E-01	8.0375E-01	8.0375E-01
I-133	2.2240E+05	1.7000E-01	2.5501E+03	3.3972E+17	9.4829E+02	4.9207E-01	1.1281E+00	1.1281E+00
I-134	2.4073E+05	4.5109E-02	2.7670E+03	3.6955E+17	1.0264E+03	5.3638E-01	1.2297E+00	1.2297E+00
I-135	2.0802E+05	5.4385E-02	2.3858E+03	3.1791E+17	8.8700E+02	4.6057E-01	1.0559E+00	1.0559E+00
Xe-133	2.1333E+05	4.3641E-04	2.4439E+03	3.2553E+17	0.0000E+00	4.7131E-01	1.0805E+00	1.0805E+00
Xe-135	7.5566E+04	1.1788E-03	8.6541E+02	1.1516E+17	0.0000E+00	1.6679E-01	3.8237E-01	3.8237E-01
Cs-134	2.7254E+04	1.5920E-01	3.1249E+02	4.1623E+16	1.2236E+02	6.0286E-02	1.3821E-01	1.3821E-01
Cs-136	8.7209E+03	9.1452E-03	9.9993E+01	1.3319E+16	3.9152E+01	1.9291E-02	4.4226E-02	4.4226E-02
Cs-137	1.6352E+04	6.5409E-02	1.8749E+02	2.4974E+16	7.3413E+01	3.6171E-02	8.2926E-02	8.2926E-02
Total	1.4358E+06	1.0000E+00	0.0000E+00	0.0000E+00	4.2402E+03	3.1809E+00	7.2926E+00	7.2926E+00

Dose Effective (Ci/cc)	I-131 (Thyroid)	4.1139E-05
Dose Effective (Ci/cc)	I-131 (ICRP2 Thyroid)	5.2445E-05
Total I (Ci)		9.3914E+05

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) =	0.0167	Atmosphere	Sump
Noble gases (atoms)		3.2175E+22	0.0000E+00
Elemental I (atoms)		2.5993E+20	0.0000E+00
Organic I (atoms)		8.0390E+18	0.0000E+00
Aerosol I (atoms)		5.0686E+21	0.0000E+00
All Aerosols (kg)		2.1029E-01	0.0000E+00
Time (h) =	0.0167	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
Aerosol I (atoms)		2.2766E+19	0.0000E+00
All Aerosols (kg)		9.4434E-04	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 0.0167

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 2 Outflow	Pathway 3 Outflow	Pathway 12 Inflow
I-131	8.3355E-02	6.0046E-01	8.4459E-04	1.1250E+11	2.3281E-04	4.9667E-04	9.1114E-02



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

I-132	1.1995E-01	4.0898E-02	1.2161E-03	1.6214E+11	3.3502E-04	7.1471E-04	1.3147E-01
I-133	1.6877E-01	2.2626E-01	1.7102E-03	2.2782E+11	4.7138E-04	1.0056E-03	1.8453E-01
I-134	1.8268E-01	6.0003E-02	1.8546E-03	2.4768E+11	5.1027E-04	1.0886E-03	2.0115E-01
I-135	1.5786E-01	7.2376E-02	1.5999E-03	2.1318E+11	4.4092E-04	9.4062E-04	1.7272E-01
Xe-133	1.2292E-05	3.7770E-08	1.0658E-07	6.1280E+06	5.6858E-07	5.6858E-07	4.2930E-06
Xe-135	1.3955E-04	3.2717E-06	1.2103E-06	6.9590E+07	6.4554E-06	6.4554E-06	4.8761E-05
Total	7.1277E-01	1.0000E+00	0.0000E+00	0.0000E+00	1.9974E-03	4.2532E-03	7.8104E-01

Dose Effective (Ci/cc) I-131 (Thyroid) 2.0644E-08
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 2.6317E-08
 Total I (Ci) 7.1262E-01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	0.0167	Atmosphere	Sump
Noble gases (atoms)	5.4111E+11	0.0000E+00	
Elemental I (atoms)	3.9283E+15	0.0000E+00	
Organic I (atoms)	1.2149E+14	0.0000E+00	
Aerosol I (atoms)	0.0000E+00	0.0000E+00	
All Aerosols (kg)	0.0000E+00	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 0.0167

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Kr-85	Atmosphere	3.2798E-03	0.00000	0.00000	0.00000	0.00000
Kr-85m	6.0894E-02	3.9401E-04	0.00000	0.00000	0.00027	0.00000
Kr-87	1.1562E-01	7.4821E-04	0.00000	0.00000	0.00283	0.00000
Kr-88	1.6343E-01	1.0575E-03	0.00000	0.00000	0.00988	0.00000
Rb-86	6.2444E-04	4.0410E-06	0.00000	0.00000	0.00023	0.00000
I-131	2.4375E-01	1.5727E-03	0.00043	0.00092	0.44999	0.00000
I-132	3.5104E-01	2.2651E-03	0.00003	0.00006	0.03072	0.00000
I-133	4.9356E-01	3.1846E-03	0.00016	0.00035	0.16959	0.00000
I-134	5.3537E-01	3.4556E-03	0.00004	0.00009	0.04521	0.00000
I-135	4.6175E-01	2.9795E-03	0.00005	0.00011	0.05428	0.00000
Xe-133	4.7137E-01	3.0497E-03	0.00000	0.00000	0.00044	0.00000
Xe-135	1.6709E-01	1.0807E-03	0.00000	0.00000	0.00117	0.00000
Cs-134	6.0301E-02	3.9023E-04	0.00000	0.00000	0.15878	0.00000
Cs-136	1.9296E-02	1.2487E-04	0.00000	0.00000	0.00912	0.00000
Cs-137	3.6181E-02	2.3414E-04	0.00000	0.00000	0.06524	0.00000

Environment Compartment Group Inventory Distribution:

Time (h) =	0.0167	Total Release	Release Rate/s
Noble gases (atoms)	7.1091E+16	1.1825E+15	
Elemental I (atoms)	6.0536E+14	1.0069E+13	
Organic I (atoms)	2.2115E+13	3.6786E+11	
Aerosol I (atoms)	1.1215E+16	1.8655E+14	
All Aerosols (kg)	4.6529E-07	7.7393E-09	

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 0.0167

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Rb-86	Atmosphere	2.8349E+02	3.2477E+00	4.3260E+14	0.0000E+00
I-131	1.1031E+05	4.5783E-01	1.2637E+03	1.6833E+17	9.1114E-02
I-132	1.5884E+05	3.1199E-02	1.8205E+03	2.4274E+17	1.3147E-01
I-133	2.2335E+05	1.7252E-01	2.5590E+03	3.4089E+17	1.8453E-01
I-134	2.4175E+05	4.5776E-02	2.7765E+03	3.7083E+17	2.0115E-01
I-135	2.0891E+05	5.5188E-02	2.3941E+03	3.1901E+17	1.7272E-01
Xe-133	1.3669E+01	2.4623E-08	1.3636E-01	5.7809E+12	4.2930E-06
Xe-135	1.5519E+02	2.1330E-06	1.5485E+00	6.5649E+13	4.8761E-05
Cs-134	2.7376E+04	1.6158E-01	3.1363E+02	4.1775E+16	0.0000E+00
Cs-136	8.7601E+03	9.2820E-03	1.0036E+02	1.3368E+16	0.0000E+00
Cs-137	1.6426E+04	6.6388E-02	1.8818E+02	2.5065E+16	0.0000E+00
Total	9.9618E+05	1.0000E+00	0.0000E+00	0.0000E+00	7.8104E-01

Dose Effective (Ci/cc) I-131 (Thyroid) 5.6653E-05
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 7.2223E-05
 Total I (Ci) 9.4316E+05

Suppression Pool Compartment Group Inventory Distribution:



Time (h) = 0.0167 Atmosphere Sump
 Noble gases (atoms) 6.0175E+17 0.0000E+00
 Elemental I (atoms) 5.1986E+21 0.0000E+00
 Organic I (atoms) 1.6078E+20 0.0000E+00
 Aerosol I (atoms) 0.0000E+00 0.0000E+00
 All Aerosols (kg) 2.1012E-01 0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 0.0167

Nuclide	Filter	Decays	Transported	Activity	Activity	Activity	Activity
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Kr-85m	0.0000E+00	0.00E+00	5.2643E-04	0.000E+00	0.000E+00	5.264E-04	1.218E-08
Kr-87	0.0000E+00	0.00E+00	1.0023E-03	0.000E+00	0.000E+00	1.002E-03	2.318E-08
Kr-88	0.0000E+00	0.00E+00	1.4138E-03	0.000E+00	0.000E+00	1.414E-03	3.271E-08
Rb-86	1.1609E-08	1.55E+02	5.3777E-06	0.000E+00	0.000E+00	5.389E-06	6.369E-12
I-131	4.4975E-06	5.99E+04	2.0930E-03	8.926E-15	1.904E-14	2.097E-03	2.548E-09
I-132	6.4760E-06	8.63E+04	3.0212E-03	1.285E-14	2.740E-14	3.028E-03	3.676E-09
I-133	9.1062E-06	1.21E+05	4.2390E-03	1.807E-14	3.856E-14	4.248E-03	5.160E-09
I-134	9.8567E-06	1.31E+05	4.6234E-03	1.956E-14	4.173E-14	4.633E-03	5.622E-09
I-135	8.5176E-06	1.13E+05	3.9678E-03	1.691E-14	3.606E-14	3.976E-03	4.830E-09
Xe-133	0.0000E+00	0.00E+00	4.0703E-03	2.180E-17	2.180E-17	4.070E-03	9.422E-08
Xe-135	0.0000E+00	0.00E+00	1.4403E-03	2.475E-16	2.475E-16	1.440E-03	3.336E-08
Cs-134	1.1211E-06	1.49E+04	5.1931E-04	0.000E+00	0.000E+00	5.204E-04	6.150E-10
Cs-136	3.5874E-07	4.78E+03	1.6618E-04	0.000E+00	0.000E+00	1.665E-04	1.968E-10
Cs-137	6.7265E-07	8.96E+03	3.1159E-04	0.000E+00	0.000E+00	3.123E-04	3.690E-10

Filtered Environment to Control Room Transport Group Inventory:

Time (h) =	Pathway	
	Filtered	Transported
0.0167		
Noble gases (atoms)	0.0000E+00	4.4636E+14
Elemental I (atoms)	9.6813E+09	3.5970E+12
Organic I (atoms)	2.9943E+08	1.1125E+11
Aerosol I (atoms)	2.0788E+11	7.0210E+13
All Aerosols (kg)	8.6246E-12	2.9123E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
0.0833			
Delta dose (rem)	2.8232E-04	5.0889E-02	2.4153E-03
Accumulated dose (rem)	2.9409E-04	5.2978E-02	2.5154E-03

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
0.0833			
Delta dose (rem)	7.0580E-04	1.2722E-01	6.0383E-03
Accumulated dose (rem)	7.3524E-04	1.3245E-01	6.2884E-03

Control Room Doses:

Time (h) =	Whole Body	Thyroid	TEDE	Skin
0.0833				
Delta dose (rem)	3.3723E-05	1.1439E-01	4.8653E-03	1.1222E-03
Accumulated dose (rem)	3.5043E-05	1.1938E-01	5.0775E-03	1.1649E-03

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 0.0833

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment	Pathway 7	Pathway 8	Pathway 9
					Dep Surfaces	Outflow	Outflow	Outflow
Kr-85	7.4038E+03	2.3546E-07	3.8867E+02	5.1771E+16	0.0000E+00	8.1591E-02	1.8705E-01	1.8705E-01
Kr-85m	1.3600E+05	2.7258E-04	7.1581E+03	9.5539E+17	0.0000E+00	1.5084E+00	3.4581E+00	3.4581E+00
Kr-87	2.5130E+05	2.7930E-03	1.3316E+04	1.7865E+18	0.0000E+00	2.8333E+00	6.4955E+00	6.4955E+00
Kr-88	3.6274E+05	9.9295E-03	1.9122E+04	2.5552E+18	0.0000E+00	4.0384E+00	9.2584E+00	9.2584E+00
Rb-86	1.3827E+03	2.3435E-04	7.2918E+01	9.7129E+15	3.1135E+01	1.5341E-02	3.5171E-02	3.5171E-02
I-131	5.3856E+05	4.5244E-01	2.8396E+04	3.7826E+18	1.1506E+04	5.9740E+00	1.3696E+01	1.3696E+01



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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

I-132	7.6608E+05	3.0528E-02	4.0503E+04	5.4164E+18	1.6314E+04	8.5765E+00	1.9662E+01	1.9662E+01
I-133	1.0883E+06	1.7022E-01	5.7410E+04	7.6503E+18	2.3251E+04	1.2087E+01	2.7710E+01	2.7710E+01
I-134	1.1200E+06	4.3405E-02	5.9863E+04	8.0570E+18	2.3929E+04	1.2841E+01	2.9439E+01	2.9439E+01
I-135	1.0131E+06	5.4248E-02	5.3509E+04	7.1372E+18	2.1645E+04	1.1285E+01	2.5873E+01	2.5873E+01
Xe-133	1.0641E+06	4.4361E-04	5.5858E+04	7.4397E+18	0.0000E+00	1.1726E+01	2.6883E+01	2.6883E+01
Xe-135	3.7947E+05	1.2048E-03	1.9886E+04	2.6392E+18	0.0000E+00	4.1642E+00	9.5467E+00	9.5467E+00
Cs-134	1.3354E+05	1.5956E-01	7.0422E+03	9.3802E+17	3.0070E+03	1.4816E+00	3.3966E+00	3.3966E+00
Cs-136	4.2724E+04	9.1651E-03	2.2532E+03	3.0013E+17	9.6205E+02	4.7405E-01	1.0868E+00	1.0868E+00
Cs-137	8.0122E+04	6.5559E-02	4.2253E+03	5.6281E+17	1.8042E+03	8.8893E-01	2.0380E+00	2.0380E+00
Total	6.9847E+06	1.0000E+00	0.0000E+00	0.0000E+00	1.0245E+05	7.7975E+01	1.7876E+02	1.7876E+02

Dose Effective (Ci/cc) I-131 (Thyroid) 2.0153E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 2.5647E-04
 Total I (Ci) 4.5260E+06

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) =	0.0833	Atmosphere	Sump
Noble gases (atoms)		1.6048E+23	0.0000E+00
Elemental I (atoms)		1.2946E+21	0.0000E+00
Organic I (atoms)		4.0039E+19	0.0000E+00
Aerosol I (atoms)		2.4799E+22	0.0000E+00
All Aerosols (kg)		1.0304E+00	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
Aerosol I (atoms)		5.5932E+20	0.0000E+00
All Aerosols (kg)		2.3218E-02	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 0.0833

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 2 Outflow	Pathway 3 Outflow	Pathway 12 Inflow
I-131	Atmosphere	6.0217E-01	3.8889E-03	5.1803E+11	6.6769E-02	1.4244E-01	2.2667E+00
I-132	Atmosphere	4.0699E-02	5.5564E-03	7.4260E+11	9.5832E-02	2.0444E-01	3.2540E+00
I-133	Atmosphere	1.2118E-01	7.8647E-03	1.0480E+12	1.3509E-01	2.8818E-01	4.5860E+00
I-134	Atmosphere	1.2471E-01	8.2631E-03	1.1104E+12	1.4346E-01	3.0605E-01	4.8719E+00
I-135	Atmosphere	1.1281E-01	7.2274E-02	7.3356E-03	9.7824E+11	2.6907E-01	4.2820E+00
Xe-133	Atmosphere	3.4305E-05	1.2170E-07	1.5768E-06	8.4810E+07	2.6705E-04	5.2663E-04
Xe-135	Atmosphere	3.8790E-04	1.0509E-05	1.7850E-05	9.6038E+08	3.0259E-03	5.9669E-03
Total	Atmosphere	5.0438E-01	1.0000E+00	0.0000E+00	5.7057E-01	1.2135E+00	1.9267E+01

Dose Effective (Ci/cc) I-131 (Thyroid) 1.4839E-08
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.8884E-08
 Total I (Ci) 5.0396E-01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	0.0833	Atmosphere	Sump
Noble gases (atoms)		1.5074E+12	0.0000E+00
Elemental I (atoms)		2.8228E+15	0.0000E+00
Organic I (atoms)		8.7302E+13	0.0000E+00
Aerosol I (atoms)		0.0000E+00	0.0000E+00
All Aerosols (kg)		0.0000E+00	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 0.0833

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Kr-85	Atmosphere	8.1654E-02	2.0748E-03	0.00000	0.00000	0.00000
Kr-85m	Atmosphere	1.5036E+00	3.8196E-02	0.00000	0.00000	0.00000
Kr-87	Atmosphere	2.7965E+00	7.0986E-02	0.00000	0.00000	0.00000
Kr-88	Atmosphere	4.0165E+00	1.0201E-01	0.00000	0.00000	0.00000
Rb-86	Atmosphere	1.5352E-02	3.9007E-04	0.00000	0.00000	0.00000
I-131	Atmosphere	6.1849E+00	1.5713E-01	0.00492	0.01050	0.44021
I-132	Atmosphere	8.8123E+00	2.2377E-01	0.00033	0.00071	0.02990
I-133	Atmosphere	1.2504E+01	3.1766E-01	0.00185	0.00395	0.16574
I-134	Atmosphere	1.3031E+01	3.3058E-01	0.00048	0.00103	0.04306
I-135	Atmosphere	1.1654E+01	2.9602E-01	0.00059	0.00126	0.05291
Xe-133	Atmosphere	1.1738E+01	2.9825E-01	0.00000	0.00000	0.00043



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Xe-135	4.2158E+00	1.0707E-01	0.00000	0.00000	0.00117	0.00000
Cs-134	1.4826E+00	3.7672E-02	0.00000	0.00000	0.15525	0.00001
Cs-136	4.7437E-01	1.2053E-02	0.00000	0.00000	0.00892	0.00000
Cs-137	8.8957E-01	2.2603E-02	0.00000	0.00000	0.06379	0.00000

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 0.0833		
Noble gases (atoms)	1.7700E+18	5.9024E+15
Elemental I (atoms)	2.3102E+16	7.7039E+13
Organic I (atoms)	1.6787E+15	5.5980E+12
Aerosol I (atoms)	2.7543E+17	9.1847E+14
All Aerosols (kg)	1.1440E-05	3.8148E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 0.0833

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Rb-86	1.4139E+03	2.3800E-04	7.4225E+01	9.8870E+15	0.0000E+00
I-131	5.5010E+05	4.5906E-01	2.8879E+04	3.8469E+18	2.2667E+00
I-132	7.8245E+05	3.0973E-02	4.1190E+04	5.5083E+18	3.2540E+00
I-133	1.1116E+06	1.7271E-01	5.8386E+04	7.7805E+18	4.5860E+00
I-134	1.1440E+06	4.4037E-02	6.0877E+04	8.1935E+18	4.8719E+00
I-135	1.0348E+06	5.5042E-02	5.4419E+04	7.2586E+18	4.2820E+00
Xe-133	3.1196E+02	1.0703E-07	1.3508E+01	7.0911E+14	5.2663E-04
Xe-135	3.5275E+03	9.2405E-06	1.5289E+02	8.0281E+15	5.9669E-03
Cs-134	1.3655E+05	1.6204E-01	7.1684E+03	9.5483E+17	0.0000E+00
Cs-136	4.3689E+04	9.3076E-03	2.2935E+03	3.0551E+17	0.0000E+00
Cs-137	8.1932E+04	6.6578E-02	4.3010E+03	5.7290E+17	0.0000E+00
Total	4.8904E+06	1.0000E+00	0.0000E+00	0.0000E+00	1.9267E+01

Dose Effective (Ci/cc) I-131 (Thyroid)	2.8227E-04
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	3.5922E-04
Total I (Ci)	4.6230E+06

Suppression Pool Compartment Group Inventory Distribution:

	Atmosphere	Sump
Time (h) = 0.0833		
Noble gases (atoms)	1.3708E+19	0.0000E+00
Elemental I (atoms)	2.5893E+22	0.0000E+00
Organic I (atoms)	8.0083E+20	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	1.0481E+00	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 0.0833

Nuclide	Filter	Decays	Transported	Activity Pathway 2	Activity Pathway 3	Activity Pathway 7	Activity Pathway 11
Kr-85	0.0000E+00	0.00E+00	1.8436E-04	0.000E+00	0.000E+00	1.843E-04	2.758E-08
Kr-85m	0.0000E+00	0.00E+00	3.4112E-03	0.000E+00	0.000E+00	3.411E-03	5.096E-07
Kr-87	0.0000E+00	0.00E+00	6.4208E-03	0.000E+00	0.000E+00	6.420E-03	9.560E-07
Kr-88	0.0000E+00	0.00E+00	9.1370E-03	0.000E+00	0.000E+00	9.136E-03	1.364E-06
Rb-86	2.8675E-05	1.60E+08	5.9627E-06	0.000E+00	0.000E+00	3.464E-05	2.650E-10
I-131	1.1115E-02	6.19E+10	2.3730E-03	3.174E-12	6.771E-12	1.349E-02	1.061E-07
I-132	1.5777E-02	8.85E+10	3.4237E-03	4.508E-12	9.617E-12	1.920E-02	1.502E-07
I-133	2.2460E-02	1.25E+11	4.8055E-03	6.414E-12	1.368E-11	2.726E-02	2.143E-07
I-134	2.3115E-02	1.31E+11	5.2253E-03	6.616E-12	1.412E-11	2.834E-02	2.199E-07
I-135	2.0908E-02	1.17E+11	4.4968E-03	5.972E-12	1.274E-11	2.540E-02	1.995E-07
Xe-133	0.0000E+00	0.00E+00	2.6495E-02	1.211E-14	1.211E-14	2.649E-02	3.965E-06
Xe-135	0.0000E+00	0.00E+00	9.4040E-03	1.373E-13	1.373E-13	9.403E-03	1.419E-06
Cs-134	2.7694E-03	1.54E+10	5.7580E-04	0.000E+00	0.000E+00	3.345E-03	2.559E-08
Cs-136	8.8606E-04	4.94E+09	1.8425E-04	0.000E+00	0.000E+00	1.070E-03	8.188E-09
Cs-137	1.6617E-03	9.26E+09	3.4548E-04	0.000E+00	0.000E+00	2.007E-03	1.535E-08

Filtered Environment to Control Room Transport Group Inventory:

	Pathway Filtered	Transported
Time (h) = 0.0833		
Noble gases (atoms)	0.0000E+00	3.1397E+15
Elemental I (atoms)	1.9361E+13	5.9887E+12
Organic I (atoms)	5.9889E+11	1.8523E+11
Aerosol I (atoms)	4.1094E+14	7.8593E+13



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

All Aerosols (kg) 1.7059E-08 3.2603E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		1.6208E-03	1.0298E-01	5.2295E-03
Accumulated dose (rem)		1.9149E-03	1.5596E-01	7.7449E-03

Low Population Zone Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE
Delta dose (rem)		4.0521E-03	2.5745E-01	1.3074E-02
Accumulated dose (rem)		4.7874E-03	3.8990E-01	1.9362E-02

Control Room Doses:

Time (h) =	0.5000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)		3.2394E-04	1.1295E+00	4.8007E-02	1.0898E-02
Accumulated dose (rem)		3.5898E-04	1.2489E+00	5.3085E-02	1.2063E-02

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 0.5000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Kr-85	4.4427E+04	2.5647E-07	1.2051E+04	1.6052E+18	0.0000E+00	2.8574E+00	8.1591E-02	6.7380E+00	6.7380E+00
Kr-85m	7.6510E+05	2.8406E-04	2.1235E+05	2.8390E+19	0.0000E+00	5.0635E+01	1.5084E+00	1.1954E+02	1.1954E+02
Kr-87	1.2016E+06	2.6078E-03	3.5392E+05	4.7761E+19	0.0000E+00	8.5573E+01	2.8333E+00	2.0268E+02	2.0268E+02
Kr-88	1.9662E+06	1.0089E-02	5.5306E+05	7.4101E+19	0.0000E+00	1.3231E+02	4.0384E+00	3.1258E+02	3.1258E+02
Rb-86	7.4356E+03	2.3675E-04	2.0969E+03	2.7932E+17	1.0426E+03	4.9852E-01	1.5341E-02	1.1781E+00	1.1781E+00
I-131	2.9110E+06	4.5862E-01	8.1938E+05	1.0915E+20	3.8493E+05	1.9479E+02	5.9740E+00	4.6026E+02	4.6026E+02
I-132	3.8932E+06	2.9651E-02	1.1199E+06	1.5025E+20	5.0160E+05	2.6866E+02	8.5765E+00	6.3558E+02	6.3558E+02
I-133	5.8093E+06	1.7109E-01	1.6426E+06	2.1897E+20	7.6822E+05	3.9091E+02	1.2087E+01	9.2389E+02	9.2389E+02
I-134	4.3607E+06	3.5373E-02	1.3887E+06	1.8850E+20	5.7665E+05	3.3924E+02	1.2841E+01	8.0718E+02	8.0718E+02
I-135	5.2491E+06	5.3437E-02	1.5004E+06	2.0036E+20	6.9414E+05	3.5798E+02	1.1285E+01	8.4658E+02	8.4658E+02
Xe-133	6.3850E+06	4.8319E-04	1.7319E+06	2.3066E+20	0.0000E+00	4.1066E+02	1.1726E+01	9.6836E+02	9.6836E+02
Xe-135	2.3676E+06	1.3487E-03	6.3373E+05	8.3887E+19	0.0000E+00	1.4977E+02	4.1642E+00	3.5290E+02	3.5290E+02
Cs-134	7.1857E+05	1.6126E-01	2.0260E+05	2.6986E+19	1.0076E+05	4.8163E+01	1.4816E+00	1.1381E+02	1.1381E+02
Cs-136	2.2969E+05	9.2569E-03	6.4782E+04	8.6294E+18	3.2207E+04	1.5402E+01	4.7405E-01	3.6396E+01	3.6396E+01
Cs-137	4.3115E+05	6.6258E-02	1.2156E+05	1.6192E+19	6.0455E+04	2.8898E+01	8.8893E-01	6.8289E+01	6.8289E+01
Total	3.6340E+07	1.0000E+00	0.0000E+00	0.0000E+00	3.1200E+06	2.4763E+03	7.7975E+01	5.8560E+03	5.8560E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 1.0835E-03
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.3659E-03
Total I (Ci) 2.2223E+07

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) =	0.5000	Atmosphere	Sump
Noble gases (atoms)		9.6289E+23	0.0000E+00
Elemental I (atoms)		7.7035E+21	0.0000E+00
Organic I (atoms)		2.3825E+20	0.0000E+00
Aerosol I (atoms)		1.3234E+23	0.0000E+00
All Aerosols (kg)		5.5443E+00	0.0000E+00

Time (h) =	0.5000	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
Aerosol I (atoms)		1.8635E+22	0.0000E+00
All Aerosols (kg)		7.7770E-01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 0.5000

Nuclide	Compartment	Dose Fract	Exposure	Decays	Pathway 1	Pathway 2	Pathway 3	Pathway 12
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Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

	Atmosphere	(Ci-hr)	(Bq-s)	Inflow	Outflow	Outflow	Inflow
Kr-85	1.3102E-02	1.9502E-07	3.4346E-03	4.5749E+11	2.8574E+00	1.4152E+00	0.0000E+00
Kr-85m	2.2562E-01	2.1567E-04	6.0429E-02	8.0795E+12	5.0635E+01	2.5072E+01	0.0000E+00
Kr-87	3.5434E-01	1.9717E-03	1.0030E-01	1.3539E+13	8.5573E+01	4.2345E+01	0.0000E+00
Kr-88	5.7982E-01	7.6528E-03	1.5724E-01	2.1070E+13	1.3231E+02	6.5501E+01	0.0000E+00
Rb-86	2.1934E-03	1.7960E-04	5.9623E-04	7.9420E+10	4.9852E-01	4.9371E-03	0.0000E+00
I-131	1.2222E+00	4.9612E-01	3.3223E-01	4.4257E+13	1.9479E+02	4.5775E+00	7.6985E+00
I-132	1.6329E+00	3.2018E-02	4.5325E-01	6.0816E+13	2.6866E+02	6.3111E+00	1.0615E+01
I-133	2.4391E+00	1.8504E-01	6.6587E-01	8.8765E+13	3.9091E+02	9.1866E+00	1.5450E+01
I-134	1.8309E+00	3.8015E-02	5.5940E-01	7.5948E+13	3.3924E+02	7.9812E+00	1.3430E+01
I-135	2.2039E+00	5.7761E-02	6.0789E-01	8.1177E+13	3.5798E+02	8.4135E+00	1.4151E+01
Xe-133	1.8839E+00	3.6756E-04	4.9381E-01	6.5762E+13	4.1066E+02	2.0345E+02	2.0345E+02
Xe-135	7.0916E-01	1.0388E-03	1.8295E-01	2.4159E+13	1.4977E+02	7.4939E+01	7.4939E+01
Cs-134	2.1196E-01	1.2233E-01	5.7607E-02	7.6732E+12	4.8163E+01	4.7699E-01	0.0000E+00
Cs-136	6.7755E-02	7.0223E-03	1.8420E-02	2.4537E+12	1.5402E+01	1.5253E-01	0.0000E+00
Cs-137	1.2718E-01	5.0264E-02	3.4565E-02	4.6040E+12	2.8898E+01	2.8619E-01	0.0000E+00
Total	1.3504E+01	1.0000E+00	0.0000E+00	0.0000E+00	2.4763E+03	4.5012E+02	4.7499E+02

Dose Effective (Ci/cc) I-131 (Thyroid) 3.0080E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 3.7921E-07
 Total I (Ci) 9.3288E+00

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	0.5000	Atmosphere	Sump
Noble gases (atoms)		2.8400E+17	0.0000E+00
Elemental I (atoms)		1.9264E+16	0.0000E+00
Organic I (atoms)		5.9579E+14	0.0000E+00
Aerosol I (atoms)		3.9038E+16	0.0000E+00
All Aerosols (kg)		1.6355E-06	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 0.5000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Kr-85	Atmosphere	1.4174E-01	0.00000	0.00000	0.00000	0.00000
Kr-85m	Atmosphere	2.4919E+00	0.00144	0.00144	0.00009	0.00002
Kr-87	Atmosphere	4.1285E+00	0.01336	0.01336	0.00089	0.00014
Kr-88	Atmosphere	6.4816E+00	0.05117	0.05117	0.00316	0.00054
Rb-86	Atmosphere	8.8102E-04	0.00002	0.00002	0.00007	0.00000
I-131	Atmosphere	7.4972E-01	0.10973	0.18455	0.14321	0.00132
I-132	Atmosphere	1.0272E+00	0.00716	0.01204	0.00973	0.00008
I-133	Atmosphere	1.5049E+00	0.04098	0.06892	0.05392	0.00049
I-134	Atmosphere	1.3167E+00	0.00871	0.01465	0.01401	0.00010
I-135	Atmosphere	1.3788E+00	0.01283	0.02158	0.01721	0.00015
Xe-133	Atmosphere	2.0401E+01	0.00243	0.00243	0.00014	0.00003
Xe-135	Atmosphere	7.7990E+00	0.00683	0.00683	0.00038	0.00008
Cs-134	Atmosphere	8.5108E-02	0.01626	0.01626	0.05051	0.00045
Cs-136	Atmosphere	2.7221E-02	0.00093	0.00093	0.00290	0.00003
Cs-137	Atmosphere	5.1065E-02	0.00668	0.00668	0.02075	0.00019

Environment Compartment Group Inventory Distribution:

Time (h) =	0.5000	Total Release	Release Rate/s
Noble gases (atoms)		6.3769E+19	3.5427E+16
Elemental I (atoms)		3.7985E+17	2.1103E+14
Organic I (atoms)		5.1715E+16	2.8731E+13
Aerosol I (atoms)		4.5501E+17	2.5278E+14
All Aerosols (kg)		1.8943E-05	1.0524E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 0.5000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Rb-86	Atmosphere	2.4123E-04	2.3008E+03	3.0648E+17	0.0000E+00
I-131	Atmosphere	4.6505E-01	8.9472E+05	1.1919E+20	8.1591E+01
I-132	Atmosphere	3.0002E-02	1.2202E+06	1.6371E+20	1.1245E+02
I-133	Atmosphere	1.7347E-01	1.7934E+06	2.3908E+20	1.6376E+02
I-134	Atmosphere	3.5763E-02	1.5119E+06	2.0523E+20	1.4270E+02
I-135	Atmosphere	5.4166E-02	1.6378E+06	2.1870E+20	1.5002E+02
Xe-133	Atmosphere	4.8570E-07	1.8747E+03	1.8836E+17	1.3990E-01
Xe-135	Atmosphere	4.1012E-05	2.0752E+04	2.0872E+18	1.5529E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Cs-134	8.1962E+05	1.6432E-01	2.2230E+05	2.9610E+19	0.0000E+00
Cs-136	2.6199E+05	9.4323E-03	7.1081E+04	9.4685E+18	0.0000E+00
Cs-137	4.9178E+05	6.7513E-02	1.3338E+05	1.7766E+19	0.0000E+00
Total	2.6855E+07	1.0000E+00	0.0000E+00	0.0000E+00	6.5222E+02

Dose Effective (Ci/cc) I-131 (Thyroid) 1.6828E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 2.1213E-03
 Total I (Ci) 2.5159E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 0.5000	Atmosphere	Sump
Noble gases (atoms)	4.1552E+20	0.0000E+00
Elemental I (atoms)	1.5412E+23	0.0000E+00
Organic I (atoms)	4.7667E+21	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	6.2910E+00	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 0.5000

Nuclide	Filter	Decays	Transported	Activity	Activity	Activity	Activity
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Kr-85	0.0000E+00	0.00E+00	1.9002E-04	6.275E-11	6.275E-11	1.843E-04	5.687E-06
Kr-85m	0.0000E+00	0.00E+00	3.5110E-03	1.113E-09	1.113E-09	3.411E-03	1.003E-04
Kr-87	0.0000E+00	0.00E+00	6.5874E-03	1.883E-09	1.883E-09	6.420E-03	1.675E-04
Kr-88	0.0000E+00	0.00E+00	9.3971E-03	2.908E-09	2.908E-09	9.136E-03	2.614E-04
Rb-86	2.8707E-05	1.75E+09	5.9637E-06	1.477E-13	1.477E-13	3.464E-05	3.666E-08
I-131	1.1118E-02	6.79E+11	2.3735E-03	1.529E-10	2.566E-10	1.349E-02	1.216E-05
I-132	1.3941E-02	9.12E+11	3.4244E-03	2.545E-08	4.243E-08	1.920E-02	1.837E-03
I-133	2.2190E-02	1.36E+12	4.8066E-03	3.797E-09	6.331E-09	2.726E-02	2.710E-04
I-134	1.6657E-02	1.23E+12	5.2263E-03	9.058E-08	1.510E-07	2.834E-02	6.459E-03
I-135	2.0050E-02	1.25E+12	4.4978E-03	1.174E-08	1.957E-08	2.540E-02	8.589E-04
Xe-133	0.0000E+00	0.00E+00	2.7309E-02	8.992E-09	8.992E-09	2.649E-02	8.173E-04
Xe-135	0.0000E+00	0.00E+00	9.7012E-03	3.024E-09	3.024E-09	9.403E-03	2.986E-04
Cs-134	2.7742E-03	1.69E+11	5.7590E-04	2.084E-11	2.084E-11	3.345E-03	4.949E-06
Cs-136	8.8680E-04	5.41E+10	1.8429E-04	4.478E-12	4.478E-12	1.070E-03	1.026E-06
Cs-137	1.6646E-03	1.02E+11	3.4554E-04	1.265E-11	1.265E-11	2.007E-03	2.994E-06

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 0.5000	Pathway Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.2471E+15
Elemental I (atoms)	1.9400E+13	5.9936E+12
Organic I (atoms)	6.2258E+11	1.8816E+11
Aerosol I (atoms)	4.1173E+14	7.8609E+13
All Aerosols (kg)	1.7092E-08	3.2610E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) = 1.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0417E-02	3.8494E-01	2.4801E-02
Accumulated dose (rem)	1.2332E-02	5.4090E-01	3.2546E-02

Low Population Zone Doses:

Time (h) = 1.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.6043E-02	9.6236E-01	6.2002E-02
Accumulated dose (rem)	3.0830E-02	1.3523E+00	8.1364E-02

Control Room Doses:

Time (h) = 1.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	2.8185E-04	1.0721E+00	4.5561E-02	9.6027E-03
Accumulated dose (rem)	6.4083E-04	2.3210E+00	9.8646E-02	2.1665E-02



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 1.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	2.8665E+02	3.0883E-06	8.0436E+01	1.0714E+16	2.2554E+01	1.9386E-02	0.0000E+00	4.4445E-02	4.4445E-02
Co-60	3.4321E+02	7.1474E-05	9.6303E+01	1.2828E+16	2.7005E+01	2.3210E-02	0.0000E+00	5.3211E-02	5.3211E-02
Kr-85	3.2577E+05	4.7380E-07	1.1164E+05	1.4871E+19	0.0000E+00	2.7347E+01	8.1591E-02	6.2882E+01	6.2882E+01
Kr-85m	5.1925E+06	4.9125E-04	1.8416E+06	2.4624E+20	0.0000E+00	4.5409E+02	1.5084E+00	1.0445E+03	1.0445E+03
Kr-87	6.7088E+06	3.8288E-03	2.6058E+06	3.5184E+20	0.0000E+00	6.5319E+02	2.8333E+00	1.5040E+03	1.5040E+03
Kr-88	1.2761E+07	1.6800E-02	4.6183E+06	6.1891E+20	0.0000E+00	1.1431E+03	4.0384E+00	2.6299E+03	2.6299E+03
Rb-86	1.6768E+04	1.8942E-04	8.4134E+03	1.1207E+18	2.9945E+03	2.1081E+00	1.5341E-02	4.8681E+00	4.8681E+00
Sr-89	3.6589E+05	1.4354E-02	1.0268E+05	1.3677E+19	2.8789E+04	2.4746E+01	0.0000E+00	5.6733E+01	5.6733E+01
Sr-90	4.3512E+04	5.3490E-02	1.2209E+04	1.6262E+18	3.4236E+03	2.9425E+00	0.0000E+00	6.7459E+00	6.7459E+00
Sr-91	4.3240E+05	9.1176E-04	1.2269E+05	1.6372E+19	3.4022E+04	2.9660E+01	0.0000E+00	6.7998E+01	6.7998E+01
Sr-92	3.9269E+05	5.8941E-04	1.1461E+05	1.5364E+19	3.0898E+04	2.7922E+01	0.0000E+00	6.4014E+01	6.4014E+01
Y-90	5.7492E+02	4.3207E-06	1.5179E+02	1.9342E+16	4.8596E+01	3.5493E-02	0.0000E+00	8.1370E-02	8.1370E-02
Y-91	4.7790E+03	2.2066E-04	1.3392E+03	1.7821E+17	3.7668E+02	3.2255E-01	0.0000E+00	7.3948E-01	7.3948E-01
Y-92	2.5714E+04	1.7826E-05	5.7554E+03	6.1922E+17	2.5847E+03	1.2093E+00	0.0000E+00	2.7724E+00	2.7724E+00
Y-93	5.5475E+03	1.1696E-05	1.5730E+03	2.0988E+17	4.3650E+02	3.8021E-01	0.0000E+00	8.7165E-01	8.7165E-01
Zr-95	6.6738E+03	1.5177E-04	1.8727E+03	2.4945E+17	5.2512E+02	4.5136E-01	0.0000E+00	1.0348E+00	1.0348E+00
Zr-97	6.4949E+03	2.9703E-05	1.8339E+03	2.4452E+17	5.1104E+02	4.4274E-01	0.0000E+00	1.0150E+00	1.0150E+00
Nb-95	6.7217E+03	3.9477E-05	1.8861E+03	2.5122E+17	5.2889E+02	4.5456E-01	0.0000E+00	1.0421E+00	1.0421E+00
Mo-99	9.5023E+04	3.6360E-04	2.6705E+04	3.5581E+18	7.4767E+03	6.4391E+00	0.0000E+00	1.4762E+01	1.4762E+01
Tc-99m	8.4719E+04	7.6056E-06	2.3775E+04	3.1579E+18	6.6660E+03	5.7303E+00	0.0000E+00	1.3137E+01	1.3137E+01
Ru-103	8.0588E+04	7.0155E-04	2.2615E+04	3.0124E+18	6.3409E+03	5.4506E+00	0.0000E+00	1.2496E+01	1.2496E+01
Ru-105	4.8614E+04	4.0433E-05	1.3971E+04	1.8682E+18	3.8251E+03	3.3895E+00	0.0000E+00	7.7706E+00	7.7706E+00
Ru-106	3.2631E+04	1.4747E-02	9.1562E+03	1.2196E+18	2.5675E+03	2.2067E+00	0.0000E+00	5.0591E+00	5.0591E+00
Rh-105	5.1965E+04	4.8897E-05	1.4583E+04	1.9416E+18	4.0888E+03	3.5147E+00	0.0000E+00	8.0578E+00	8.0578E+00
Sb-127	1.1243E+05	6.8011E-04	3.1584E+04	4.2078E+18	8.8467E+03	7.6145E+00	0.0000E+00	1.7457E+01	1.7457E+01
Sb-129	2.8531E+05	3.8713E-04	8.2050E+04	1.0973E+19	2.2449E+04	1.9909E+01	0.0000E+00	4.5644E+01	4.5644E+01
Te-127	1.1392E+05	3.4612E-05	3.1987E+04	4.2537E+18	8.9639E+03	7.7105E+00	0.0000E+00	1.7677E+01	1.7677E+01
Te-127m	1.5230E+04	3.0994E-04	4.2735E+03	5.6923E+17	1.1984E+03	1.0300E+00	0.0000E+00	2.3613E+00	2.3613E+00
Te-129	3.0370E+05	3.1024E-05	8.6429E+04	1.1394E+19	2.3896E+04	2.0911E+01	0.0000E+00	4.7940E+01	4.7940E+01
Te-129m	4.8780E+04	1.1093E-03	1.3687E+04	1.8230E+18	3.8382E+03	3.2986E+00	0.0000E+00	7.5623E+00	7.5623E+00
Te-131m	1.4515E+05	1.0056E-03	4.0871E+04	5.4472E+18	1.1421E+04	9.8599E+00	0.0000E+00	2.2605E+01	2.2605E+01
Te-132	1.4314E+06	1.2949E-02	4.0218E+05	5.3583E+19	1.1263E+05	9.6966E+01	0.0000E+00	2.230E+02	2.230E+02
I-131	7.5920E+06	3.9957E-02	3.5800E+06	4.7689E+20	1.1807E+06	8.9429E+02	5.9740E+00	2.0639E+03	2.0639E+03
I-132	9.7853E+06	2.5006E-01	4.7361E+06	6.3476E+20	1.4155E+06	1.1929E+03	8.5765E+00	2.7545E+03	2.7545E+03
I-133	1.4925E+07	1.4748E-01	7.1008E+06	9.4660E+20	2.3214E+06	1.7759E+03	1.2087E+01	4.0992E+03	4.0992E+03
I-134	7.6718E+06	2.3612E-02	4.6486E+06	6.3141E+20	1.1932E+06	1.1972E+03	1.2841E+01	2.7742E+03	2.7742E+03
I-135	1.3012E+07	4.4917E-02	6.3246E+06	8.4463E+20	2.0239E+06	1.5864E+03	1.1285E+01	3.6628E+03	3.6628E+03
Xe-133	4.6773E+07	8.9214E-04	1.6036E+07	2.1360E+21	0.0000E+00	3.9284E+03	1.1726E+01	9.0330E+03	9.0330E+03
Xe-135	1.7591E+07	2.5426E-03	5.9912E+06	7.9647E+20	0.0000E+00	1.4669E+03	4.1642E+00	3.3725E+03	3.3725E+03
Cs-134	1.6216E+06	1.2909E-01	8.1330E+05	1.0833E+20	2.8961E+05	2.0377E+02	1.4816E+00	4.7056E+02	4.7056E+02
Cs-136	5.1780E+05	7.4048E-03	2.5987E+05	3.4616E+19	9.2473E+04	6.5115E+01	4.7405E-01	1.5037E+02	1.5037E+02
Cs-137	9.7302E+05	5.3040E-02	4.8799E+05	6.5000E+19	1.7377E+05	1.2227E+02	8.8893E-01	2.8234E+02	2.8234E+02
Ba-139	4.4464E+05	8.8596E-05	1.3494E+05	1.8202E+19	3.4985E+04	3.3216E+01	0.0000E+00	7.6151E+01	7.6151E+01
Ba-140	7.0509E+05	2.5556E-03	1.9791E+05	2.6363E+19	5.5479E+04	4.7703E+01	0.0000E+00	1.0936E+02	1.0936E+02
La-140	1.0519E+04	5.5548E-05	2.7065E+03	3.3796E+17	9.1409E+02	6.2426E-01	0.0000E+00	1.4312E+00	1.4312E+00
La-141	5.6098E+03	3.3071E-06	1.6172E+03	2.1637E+17	4.4140E+02	3.9269E-01	0.0000E+00	9.0026E-01	9.0026E-01
La-142	4.1154E+03	7.4171E-06	1.2384E+03	1.6682E+17	3.2382E+02	3.0417E-01	0.0000E+00	6.9732E-01	6.9732E-01
Ce-141	1.6764E+04	1.4267E-04	4.7040E+03	6.2658E+17	1.3190E+03	1.1337E+00	0.0000E+00	2.5992E+00	2.5992E+00
Ce-143	1.5096E+04	5.0541E-05	4.2495E+03	5.6633E+17	1.1878E+03	1.0251E+00	0.0000E+00	2.3501E+00	2.3501E+00
Ce-144	1.3727E+04	4.8563E-03	3.8519E+03	5.1307E+17	1.0801E+03	9.2834E-01	0.0000E+00	2.1283E+00	2.1283E+00
Pr-143	6.0370E+03	4.6295E-05	1.6935E+03	2.2553E+17	4.7515E+02	4.0811E-01	0.0000E+00	9.3563E-01	9.3563E-01
Nd-147	6.7341E+03	4.4067E-05	1.8903E+03	2.5180E+17	5.2986E+02	4.5563E-01	0.0000E+00	1.0446E+00	1.0446E+00
Np-239	2.1713E+05	5.3330E-04	6.1039E+04	8.1329E+18	1.7085E+04	1.4719E+01	0.0000E+00	3.3744E+01	3.3744E+01
Pu-238	4.8013E+01	1.3100E-02	1.3472E+01	1.7945E+15	3.7779E+00	3.2469E-03	0.0000E+00	7.4439E-03	7.4439E-03
Pu-239	4.8395E+00	1.4119E-03	1.3579E+00	1.8087E+14	3.8079E-01	3.2727E-04	0.0000E+00	7.5029E-04	7.5029E-04
Pu-240	6.6393E+00	1.9370E-03	1.8629E+00	2.4814E+14	5.2240E-01	4.4899E-04	0.0000E+00	1.0293E-03	1.0293E-03
Pu-241	2.0030E+03	9.4006E-03	5.6204E+02	7.4863E+16	1.5761E+02	1.3546E-01	0.0000E+00	3.1054E-01	3.1054E-01
Am-241	1.0310E+00	4.3329E-04	2.8928E-01	3.8531E+13	8.1123E-02	6.9717E-05	0.0000E+00	1.5983E-04	1.5983E-04
Cm-242	2.5952E+02	4.2449E-03	7.2823E+01	9.7000E+15	2.0420E+01	1.7551E-02	0.0000E+00	4.0237E-02	4.0237E-02
Cm-244	1.6654E+01	3.9081E-03	4.6731E+00	6.2246E+14	1.3104E+00	1.1263E-03	0.0000E+00	2.5821E-03	2.5821E-03
Total	1.5106E+08	1.0000E+00	0.0000E+00	0.0000E+00	9.1340E+06	1.5097E+04	7.7975E+01	3.4789E+04	3.4789E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 2.8089E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 3.5108E-03
 Total I (Ci) 5.2987E+07

Drywell Free Volume Compartment Group Inventory Distribution:



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (h) = 1.0000	Atmosphere	Sump
Noble gases (atoms)	7.0581E+24	0.0000E+00
Elemental I (atoms)	2.0359E+22	0.0000E+00
Organic I (atoms)	6.2965E+20	0.0000E+00
Aerosol I (atoms)	3.4233E+23	0.0000E+00
All Aerosols (kg)	1.3021E+01	0.0000E+00

Time (h) = 1.0000	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
Aerosol I (atoms)	5.6929E+22	0.0000E+00
All Aerosols (kg)	2.2751E+00	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 1.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	8.4544E-05	2.4389E-06	2.3680E-05	3.1542E+09	1.9386E-02	1.9306E-04	1.9306E-04	0.0000E+00
Co-60	1.0123E-04	5.6445E-05	2.8351E-05	3.7763E+09	2.3210E-02	2.3114E-04	2.3114E-04	0.0000E+00
Kr-85	9.6099E-02	3.7315E-07	3.2777E-02	4.3659E+12	2.7347E+01	1.3620E+01	1.3620E+01	0.0000E+00
Kr-85m	1.5317E+00	3.8673E-04	5.4043E-01	7.2263E+13	4.5409E+02	2.2614E+02	2.2614E+02	0.0000E+00
Kr-87	1.9790E+00	3.0102E-03	7.6370E-01	1.0312E+14	6.5319E+02	3.2520E+02	3.2520E+02	0.0000E+00
Kr-88	3.7643E+00	1.3221E-02	1.3549E+00	1.8158E+14	1.1431E+03	5.6923E+02	5.6923E+02	0.0000E+00
Rb-86	4.9499E-03	1.4858E-04	2.4600E-03	3.2769E+11	2.1081E+00	2.1006E-02	2.1006E-02	0.0000E+00
Sr-89	1.0792E-01	1.1336E-02	3.0227E-02	4.0262E+12	2.4746E+01	2.4644E-01	2.4644E-01	0.0000E+00
Sr-90	1.2833E-02	4.2243E-02	3.5942E-03	4.7875E+11	2.9425E+00	2.9304E-02	2.9304E-02	0.0000E+00
Sr-91	1.2753E-01	7.2002E-04	3.6117E-02	4.8196E+12	2.9660E+01	2.9537E-01	2.9537E-01	0.0000E+00
Sr-92	1.1582E-01	4.6543E-04	3.3738E-02	4.5228E+12	2.7922E+01	2.7805E-01	2.7805E-01	0.0000E+00
Y-90	1.6964E-04	3.4140E-06	4.4708E-05	5.6974E+09	3.5493E-02	3.5365E-04	3.5365E-04	0.0000E+00
Y-91	1.4095E-03	1.7426E-04	3.9425E-04	5.2465E+10	3.2255E-01	3.2122E-03	3.2122E-03	0.0000E+00
Y-92	7.5960E-03	1.4112E-05	1.6984E-03	1.8284E+11	1.2093E+00	1.2076E-02	1.2076E-02	0.0000E+00
Y-93	1.6362E-03	9.2366E-06	4.6306E-04	6.1786E+10	3.8021E-01	3.7863E-03	3.7863E-03	0.0000E+00
Zr-95	1.9684E-03	1.1986E-04	5.5132E-04	7.3437E+10	4.5136E-01	4.4949E-03	4.4949E-03	0.0000E+00
Zr-97	1.9156E-03	2.3457E-05	5.3986E-04	7.1983E+10	4.4274E-01	4.4091E-03	4.4091E-03	0.0000E+00
Nb-95	1.9825E-03	3.1176E-05	5.5524E-04	7.3957E+10	4.5456E-01	4.5268E-03	4.5268E-03	0.0000E+00
Mo-99	2.8026E-02	2.8715E-04	7.8618E-03	1.0475E+12	6.4391E+00	6.4125E-02	6.4125E-02	0.0000E+00
Tc-99m	2.4987E-02	6.0063E-06	6.9992E-03	9.2966E+11	5.7303E+00	5.7066E-02	5.7066E-02	0.0000E+00
Ru-103	2.3768E-02	5.5403E-04	6.6576E-03	8.8681E+11	5.4506E+00	5.4280E-02	5.4280E-02	0.0000E+00
Ru-105	1.4338E-02	3.1929E-05	4.1128E-03	5.4996E+11	3.3895E+00	3.3753E-02	3.3753E-02	0.0000E+00
Ru-106	9.6242E-03	1.1646E-02	2.6955E-03	3.5904E+11	2.2067E+00	2.1976E-02	2.1976E-02	0.0000E+00
Rh-105	1.5326E-02	3.8615E-05	4.2931E-03	5.7158E+11	3.5147E+00	3.5002E-02	3.5002E-02	0.0000E+00
Sb-127	3.3161E-02	5.3710E-04	9.2981E-03	1.2387E+12	7.6145E+00	7.5831E-02	7.5831E-02	0.0000E+00
Sb-129	8.4149E-02	3.0571E-04	2.4154E-02	3.2302E+12	1.9909E+01	1.9826E-01	1.9826E-01	0.0000E+00
Te-127	3.3600E-02	2.7334E-05	9.4166E-03	1.2522E+12	7.7105E+00	7.6787E-02	7.6787E-02	0.0000E+00
Te-127m	4.4921E-03	2.4477E-04	1.2581E-03	1.6757E+11	1.0300E+00	1.0257E-02	1.0257E-02	0.0000E+00
Te-129	8.9574E-02	2.4499E-05	2.5443E-02	3.3542E+12	2.0911E+01	2.0824E-01	2.0824E-01	0.0000E+00
Te-129m	1.4387E-02	8.7607E-04	4.0292E-03	5.3668E+11	3.2986E+00	3.2850E-02	3.2850E-02	0.0000E+00
Te-131m	4.2810E-02	7.9416E-04	1.2032E-02	1.6036E+12	9.8599E+00	9.8191E-02	9.8191E-02	0.0000E+00
Te-132	4.2218E-01	1.0226E-02	1.1840E-01	1.5774E+13	9.6966E+01	9.6565E-01	9.6565E-01	0.0000E+00
I-131	3.2095E+00	4.4754E-01	1.4947E+00	1.9911E+14	8.9429E+02	2.1304E+01	3.5925E+01	3.8030E+02
I-132	4.1217E+00	2.7926E-02	1.9717E+00	2.6436E+14	1.1929E+03	2.8357E+01	4.7817E+01	5.0438E+02
I-133	6.3096E+00	1.6516E-01	2.9643E+00	3.9517E+14	1.7759E+03	4.2306E+01	7.1338E+01	7.5520E+02
I-134	3.2432E+00	2.6321E-02	1.9318E+00	2.6241E+14	1.1972E+03	2.8488E+01	4.8031E+01	5.0884E+02
I-135	5.5009E+00	5.0282E-02	2.6393E+00	3.5247E+14	1.5864E+03	3.7786E+01	6.3716E+01	6.7454E+02
Xe-133	1.3802E+01	7.0285E-04	4.7094E+00	6.2728E+14	3.9284E+03	1.9571E+03	1.9571E+03	1.2389E+00
Xe-135	5.2373E+00	2.0217E-03	1.7758E+00	2.3586E+14	1.4669E+03	7.3712E+02	7.3712E+02	1.3384E+01
Cs-134	4.7872E-01	1.0126E-01	2.3781E-01	3.1676E+13	2.0377E+02	2.0305E+00	2.0305E+00	0.0000E+00
Cs-136	1.5286E-01	5.8081E-03	7.5984E-02	1.0122E+13	6.5115E+01	6.4883E-01	6.4883E-01	0.0000E+00
Cs-137	2.8724E-01	4.1604E-02	1.4269E-01	1.9006E+13	1.2227E+02	1.2183E+00	1.2183E+00	0.0000E+00
Ba-139	1.3114E-01	6.9955E-05	3.9719E-02	5.3576E+12	3.3216E+01	3.3074E-01	3.3074E-01	0.0000E+00
Ba-140	2.0796E-01	2.0182E-03	5.8263E-02	7.7611E+12	4.7703E+01	4.7506E-01	4.7506E-01	0.0000E+00
La-140	3.1044E-03	4.3901E-05	7.9738E-04	9.9574E+10	6.2426E-01	6.2218E-03	6.2218E-03	0.0000E+00
La-141	1.6545E-03	2.6116E-06	4.7608E-04	6.3694E+10	3.9269E-01	3.9104E-03	3.9104E-03	0.0000E+00
La-142	1.2138E-03	5.8566E-06	3.6452E-04	4.9104E+10	3.0417E-01	3.0287E-03	3.0287E-03	0.0000E+00
Ce-141	4.9443E-03	1.1267E-04	1.3848E-03	1.8446E+11	1.1337E+00	1.1291E-02	1.1291E-02	0.0000E+00
Ce-143	4.4525E-03	3.9913E-05	1.2510E-03	1.6672E+11	1.0251E+00	1.0208E-02	1.0208E-02	0.0000E+00
Ce-144	4.0487E-03	3.8352E-03	1.1339E-03	1.5104E+11	9.2834E-01	9.2450E-03	9.2450E-03	0.0000E+00
Pr-143	1.7805E-03	3.6560E-05	4.9856E-04	6.6394E+10	4.0811E-01	4.0643E-03	4.0643E-03	0.0000E+00
Nd-147	1.9861E-03	3.4801E-05	5.5648E-04	7.4129E+10	4.5563E-01	4.5375E-03	4.5375E-03	0.0000E+00
Np-239	6.4040E-02	4.2116E-04	1.7969E-02	2.3942E+12	1.4719E+01	1.4658E-01	1.4658E-01	0.0000E+00
Pu-238	1.4161E-05	1.0345E-02	3.9661E-06	5.2828E+08	3.2469E-03	3.2335E-05	3.2335E-05	0.0000E+00



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Pu-239	1.4274E-06	1.1150E-03	3.9976E-07	5.3247E+07	3.2727E-04	3.2591E-06	3.2591E-06	0.0000E+00
Pu-240	1.9582E-06	1.5297E-03	5.4843E-07	7.3051E+07	4.4899E-04	4.4713E-06	4.4713E-06	0.0000E+00
Pu-241	5.9077E-04	7.4239E-03	1.6546E-04	2.2039E+10	1.3546E-01	1.3490E-03	1.3490E-03	0.0000E+00
Cm-242	7.6544E-05	3.3523E-03	2.1438E-05	2.8556E+09	1.7551E-02	1.7479E-04	1.7479E-04	0.0000E+00
Cm-244	4.9120E-06	3.0863E-03	1.3757E-06	1.8325E+08	1.1263E-03	1.1216E-05	1.1216E-05	0.0000E+00
Total	5.1367E+01	1.0000E+00	0.0000E+00	0.0000E+00	1.5097E+04	3.9944E+03	4.1030E+03	2.8379E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 7.8518E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 9.8132E-07
 Total I (Ci) 2.2385E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	1.0000	Atmosphere	Sump
Noble gases (atoms)		2.0822E+18	0.0000E+00
Elemental I (atoms)		5.0964E+16	0.0000E+00
Organic I (atoms)		1.5762E+15	0.0000E+00
Aerosol I (atoms)		1.0105E+17	0.0000E+00
All Aerosols (kg)		3.8438E-06	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 1.0000

Nuclide	Compartment Atmosphere	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	3.9124E-04	1.9562E-05	0.00000	0.00000	0.00000	0.00000
Co-60	4.6841E-04	2.3421E-05	0.00001	0.00001	0.00000	0.00000
Kr-85	2.7533E+01	1.3714E+00	0.00000	0.00000	0.00000	0.00000
Kr-85m	4.5379E+02	2.2592E+01	0.00308	0.00308	0.00002	0.00005
Kr-87	6.4072E+02	3.1857E+01	0.02438	0.02438	0.00021	0.00035
Kr-88	1.1375E+03	5.6614E+01	0.10564	0.10564	0.00075	0.00155
Rb-86	5.8512E-02	2.5358E-03	0.00002	0.00002	0.00002	0.00000
Sr-89	4.9940E-01	2.4970E-02	0.00176	0.00176	0.00000	0.00005
Sr-90	5.9384E-02	2.9692E-03	0.00655	0.00655	0.00000	0.00017
Sr-91	5.9636E-01	2.9818E-02	0.00011	0.00011	0.00000	0.00000
Sr-92	5.5622E-01	2.7811E-02	0.00007	0.00007	0.00000	0.00000
Y-90	7.4922E-04	3.7461E-05	0.00000	0.00000	0.00000	0.00000
Y-91	6.5159E-03	3.2579E-04	0.00003	0.00003	0.00000	0.00000
Y-92	2.9844E-02	1.4922E-03	0.00000	0.00000	0.00000	0.00000
Y-93	7.6464E-03	3.8232E-04	0.00000	0.00000	0.00000	0.00000
Zr-95	9.1089E-03	4.5544E-04	0.00002	0.00002	0.00000	0.00000
Zr-97	8.9166E-03	4.4583E-04	0.00000	0.00000	0.00000	0.00000
Nb-95	9.1737E-03	4.5869E-04	0.00000	0.00000	0.00000	0.00000
Mo-99	1.2988E-01	6.4941E-03	0.00004	0.00004	0.00000	0.00000
Tc-99m	1.1564E-01	5.7820E-03	0.00000	0.00000	0.00000	0.00000
Ru-103	1.1000E-01	5.4998E-03	0.00009	0.00009	0.00000	0.00000
Ru-105	6.7863E-02	3.3931E-03	0.00000	0.00000	0.00000	0.00000
Ru-106	4.4535E-02	2.2268E-03	0.00181	0.00181	0.00000	0.00005
Rh-105	7.0930E-02	3.5465E-03	0.00001	0.00001	0.00000	0.00000
Sb-127	1.5361E-01	7.6807E-03	0.00008	0.00008	0.00000	0.00000
Sb-129	3.9853E-01	1.9926E-02	0.00005	0.00005	0.00000	0.00000
Te-127	1.5558E-01	7.7788E-03	0.00000	0.00000	0.00000	0.00000
Te-127m	2.0786E-02	1.0393E-03	0.00004	0.00004	0.00000	0.00000
Te-129	4.2006E-01	2.1003E-02	0.00000	0.00000	0.00000	0.00000
Te-129m	6.6571E-02	3.3286E-03	0.00014	0.00014	0.00000	0.00000
Te-131m	1.9875E-01	9.9377E-03	0.00012	0.00012	0.00000	0.00000
Te-132	1.9560E+00	9.7802E-02	0.00159	0.00159	0.00000	0.00004
I-131	6.3657E+01	3.0163E+00	0.12131	0.20456	0.03402	0.00262
I-132	8.4039E+01	3.9646E+00	0.00764	0.01288	0.00231	0.00016
I-133	1.2645E+02	5.9859E+00	0.04483	0.07559	0.01281	0.00097
I-134	8.6764E+01	3.9877E+00	0.00738	0.01245	0.00333	0.00015
I-135	1.1305E+02	5.3386E+00	0.01369	0.02308	0.00409	0.00029
Xe-133	3.9599E+03	1.9723E+02	0.00555	0.00555	0.00003	0.00008
Xe-135	1.5340E+03	7.6424E+01	0.01596	0.01596	0.00009	0.00027
Cs-134	5.6549E+00	2.4510E-01	0.01644	0.01644	0.01200	0.00086
Cs-136	1.8075E+00	7.8327E-02	0.00094	0.00094	0.00069	0.00005
Cs-137	3.3930E+00	1.4706E-01	0.00676	0.00676	0.00493	0.00035
Ba-139	6.5341E-01	3.2670E-02	0.00001	0.00001	0.00000	0.00000
Ba-140	9.6261E-01	4.8131E-02	0.00031	0.00031	0.00000	0.00001
La-140	1.3446E-02	6.7230E-04	0.00001	0.00001	0.00000	0.00000
La-141	7.8541E-03	3.9271E-04	0.00000	0.00000	0.00000	0.00000
La-142	5.9995E-03	2.9998E-04	0.00000	0.00000	0.00000	0.00000
Ce-141	2.2880E-02	1.1440E-03	0.00002	0.00002	0.00000	0.00000
Ce-143	2.0665E-02	1.0333E-03	0.00001	0.00001	0.00000	0.00000



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Ce-144	1.8735E-02	9.3676E-04	0.00059	0.00059	0.00000	0.00002
Pr-143	8.2377E-03	4.1188E-04	0.00001	0.00001	0.00000	0.00000
Nd-147	9.1941E-03	4.5970E-04	0.00001	0.00001	0.00000	0.00000
Np-239	2.9686E-01	1.4843E-02	0.00007	0.00007	0.00000	0.00000
Pu-238	6.5528E-05	3.2764E-06	0.00160	0.00160	0.00000	0.00004
Pu-239	6.6048E-06	3.3024E-07	0.00017	0.00017	0.00000	0.00000
Pu-240	9.0612E-06	4.5306E-07	0.00024	0.00024	0.00000	0.00001
Pu-241	2.7337E-03	1.3669E-04	0.00115	0.00115	0.00000	0.00003
Am-241	1.4070E-06	7.0351E-08	0.00005	0.00005	0.00000	0.00000
Cm-242	3.5420E-04	1.7710E-05	0.00052	0.00052	0.00000	0.00001
Cm-244	2.2730E-05	1.1365E-06	0.00048	0.00048	0.00000	0.00001

Environment Compartment Group Inventory Distribution:

Time (h) =	1.0000	Total Release	Release Rate/s
Noble gases (atoms)		5.9684E+20	1.6579E+17
Elemental I (atoms)		1.7173E+18	4.7704E+14
Organic I (atoms)		2.3955E+17	6.6542E+13
Aerosol I (atoms)		1.1044E+18	3.0677E+14
All Aerosols (kg)		4.4327E-05	1.2313E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 1.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	3.0931E+02	2.9809E-06	8.5066E+01	1.1331E+16	0.0000E+00
Co-60	3.7035E+02	6.8988E-05	1.0185E+02	1.3566E+16	0.0000E+00
Rb-86	1.9774E+04	1.9824E-04	9.6476E+03	1.2851E+18	0.0000E+00
Sr-89	3.9482E+05	1.3855E-02	1.0858E+05	1.4464E+19	0.0000E+00
Sr-90	4.6952E+04	5.1629E-02	1.2912E+04	1.7199E+18	0.0000E+00
Sr-91	4.6658E+05	8.7990E-04	1.2973E+05	1.7311E+19	0.0000E+00
Sr-92	4.2373E+05	5.6859E-04	1.2114E+05	1.6240E+19	0.0000E+00
Y-90	6.2375E+02	4.1876E-06	1.6118E+02	2.0544E+16	0.0000E+00
Y-91	5.1575E+03	2.1300E-04	1.4164E+03	1.8849E+17	0.0000E+00
Y-92	2.8310E+04	1.7520E-05	6.1978E+03	6.6983E+17	0.0000E+00
Y-93	5.9861E+03	1.1288E-05	1.6633E+03	2.2193E+17	0.0000E+00
Zr-95	7.2014E+03	1.4649E-04	1.9805E+03	2.6381E+17	0.0000E+00
Zr-97	7.0084E+03	2.8667E-05	1.9392E+03	2.5857E+17	0.0000E+00
Nb-95	7.2531E+03	3.8103E-05	1.9946E+03	2.6568E+17	0.0000E+00
Mo-99	1.0254E+05	3.5095E-04	2.8242E+04	3.7628E+18	0.0000E+00
Tc-99m	9.1417E+04	7.3410E-06	2.5144E+04	3.3397E+18	0.0000E+00
Ru-103	8.6959E+04	6.7714E-04	2.3916E+04	3.1857E+18	0.0000E+00
Ru-105	5.2457E+04	3.9014E-05	1.4770E+04	1.9751E+18	0.0000E+00
Ru-106	3.5211E+04	1.4234E-02	9.6832E+03	1.2898E+18	0.0000E+00
Rh-105	5.6073E+04	4.7196E-05	1.5422E+04	2.0533E+18	0.0000E+00
Sb-127	1.2132E+05	6.5644E-04	3.3402E+04	4.4499E+18	0.0000E+00
Sb-129	3.0787E+05	3.7353E-04	8.6743E+04	1.1601E+19	0.0000E+00
Te-127	1.2293E+05	3.3408E-05	3.3828E+04	4.4985E+18	0.0000E+00
Te-127m	1.6435E+04	2.9916E-04	4.5195E+03	6.0199E+17	0.0000E+00
Te-129	3.2771E+05	2.9939E-05	9.1387E+04	1.2047E+19	0.0000E+00
Te-129m	5.2636E+04	1.0707E-03	1.4474E+04	1.9279E+18	0.0000E+00
Te-131m	1.5662E+05	9.7059E-04	4.3221E+04	5.7604E+18	0.0000E+00
Te-132	1.5446E+06	1.2498E-02	4.2532E+05	5.6666E+19	0.0000E+00
I-131	8.7778E+06	4.1269E-01	4.0512E+06	5.3967E+20	3.8030E+02
I-132	1.1207E+07	2.5659E-02	5.3248E+06	7.1372E+20	5.0438E+02
I-133	1.7257E+07	1.5230E-01	8.0344E+06	1.0711E+21	7.5520E+02
I-134	8.8702E+06	2.4275E-02	5.2365E+06	7.1128E+20	5.0884E+02
I-135	1.5045E+07	4.6367E-02	7.1534E+06	9.5531E+20	6.7454E+02
Xe-133	4.2879E+04	7.4387E-07	1.4650E+04	1.6681E+18	1.2389E+00
Xe-135	4.5455E+05	6.1131E-05	1.5783E+05	1.7989E+19	1.3384E+01
Cs-134	1.9124E+06	1.3510E-01	9.3262E+05	1.2422E+20	0.0000E+00
Cs-136	6.1063E+05	7.7496E-03	2.9799E+05	3.9694E+19	0.0000E+00
Cs-137	1.1475E+06	5.5511E-02	5.5958E+05	7.4537E+19	0.0000E+00
Ba-139	4.7979E+05	8.5421E-05	1.4255E+05	1.9229E+19	0.0000E+00
Ba-140	7.6083E+05	2.4667E-03	2.0930E+05	2.7881E+19	0.0000E+00
La-140	1.1438E+04	5.3935E-05	2.8793E+03	3.5968E+17	0.0000E+00
La-141	6.0533E+03	3.1909E-06	1.7097E+03	2.2874E+17	0.0000E+00
La-142	4.4408E+03	7.1522E-06	1.3084E+03	1.7626E+17	0.0000E+00
Ce-141	1.8089E+04	1.3770E-04	4.9748E+03	6.6264E+17	0.0000E+00
Ce-143	1.6290E+04	4.8781E-05	4.4939E+03	5.9890E+17	0.0000E+00
Ce-144	1.4813E+04	4.6874E-03	4.0736E+03	5.4260E+17	0.0000E+00
Pr-143	6.5144E+03	4.4685E-05	1.7910E+03	2.3852E+17	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Nd-147	7.2665E+03	4.2534E-05	1.9991E+03	2.6630E+17	0.0000E+00
Np-239	2.3430E+05	5.1473E-04	6.4551E+04	8.6008E+18	0.0000E+00
Pu-238	5.1809E+01	1.2644E-02	1.4248E+01	1.8978E+15	0.0000E+00
Pu-239	5.2221E+00	1.3628E-03	1.4361E+00	1.9128E+14	0.0000E+00
Pu-240	7.1642E+00	1.8696E-03	1.9702E+00	2.6243E+14	0.0000E+00
Pu-241	2.1614E+03	9.0735E-03	5.9439E+02	7.9172E+16	0.0000E+00
Am-241	1.1125E+00	4.1822E-04	3.0593E-01	4.0749E+13	0.0000E+00
Cm-242	2.8004E+02	4.0972E-03	7.7014E+01	1.0258E+16	0.0000E+00
Cm-244	1.7971E+01	3.7721E-03	4.9421E+00	6.5829E+14	0.0000E+00
Total	7.1375E+07	1.0000E+00	0.0000E+00	0.0000E+00	2.8379E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 4.4531E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 5.5647E-03
 Total I (Ci) 6.1156E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) =	1.0000	Atmosphere	Sump
Noble gases (atoms)	1.8312E+21	0.0000E+00	
Elemental I (atoms)	4.0742E+23	0.0000E+00	
Organic I (atoms)	1.2601E+22	0.0000E+00	
Aerosol I (atoms)	0.0000E+00	0.0000E+00	
All Aerosols (kg)	1.5218E+01	0.0000E+00	

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 1.0000

Nuclide	Filter	Decays	Transported	Activity	Activity	Activity	Activity
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	1.9064E-09	4.00E+04	3.8909E-11	8.766E-15	8.766E-15	0.000E+00	1.945E-09
Co-60	2.2826E-09	4.78E+04	4.6584E-11	1.050E-14	1.050E-14	0.000E+00	2.329E-09
Kr-85	0.0000E+00	0.00E+00	2.5783E-04	5.780E-10	5.780E-10	1.843E-04	7.349E-05
Kr-85m	0.0000E+00	0.00E+00	4.6248E-03	9.604E-09	9.604E-09	3.411E-03	1.214E-03
Kr-87	0.0000E+00	0.00E+00	8.1426E-03	1.384E-08	1.384E-08	6.420E-03	1.723E-03
Kr-88	0.0000E+00	0.00E+00	1.2183E-02	2.419E-08	2.419E-08	9.136E-03	3.047E-03
Rb-86	2.9016E-05	3.67E+09	5.9705E-06	7.575E-13	7.575E-13	3.464E-05	3.520E-07
Sr-89	2.4334E-06	5.10E+07	4.9666E-08	1.119E-11	1.119E-11	0.000E+00	2.483E-06
Sr-90	2.8938E-07	6.06E+06	5.9057E-09	1.331E-12	1.331E-12	0.000E+00	2.953E-07
Sr-91	2.8757E-06	6.08E+07	5.9368E-08	1.329E-11	1.329E-11	0.000E+00	2.935E-06
Sr-92	2.6116E-06	5.63E+07	5.5505E-08	1.222E-11	1.222E-11	0.000E+00	2.667E-06
Y-90	4.2074E-09	8.08E+04	7.5936E-11	1.776E-14	1.776E-14	0.000E+00	4.283E-09
Y-91	3.1858E-08	6.66E+05	6.4829E-10	1.462E-13	1.462E-13	0.000E+00	3.251E-08
Y-92	2.3522E-07	3.76E+06	3.2236E-09	7.773E-13	7.773E-13	0.000E+00	2.384E-07
Y-93	3.6895E-08	7.79E+05	7.6114E-10	1.704E-13	1.704E-13	0.000E+00	3.766E-08
Zr-95	4.4385E-08	9.30E+05	9.0588E-10	2.041E-13	2.041E-13	0.000E+00	4.529E-08
Zr-97	4.3195E-08	9.09E+05	8.8725E-10	1.992E-13	1.992E-13	0.000E+00	4.408E-08
Nb-95	4.4704E-08	9.37E+05	9.1233E-10	2.055E-13	2.055E-13	0.000E+00	4.562E-08
Mo-99	6.3196E-07	1.33E+07	1.2919E-08	2.908E-12	2.908E-12	0.000E+00	6.449E-07
Tc-99m	5.6344E-07	1.18E+07	1.1501E-08	2.591E-12	2.591E-12	0.000E+00	5.749E-07
Ru-103	5.3596E-07	1.12E+07	1.0939E-08	2.464E-12	2.464E-12	0.000E+00	5.469E-07
Ru-105	3.2332E-07	6.90E+06	6.7632E-09	1.502E-12	1.502E-12	0.000E+00	3.301E-07
Ru-106	2.1702E-07	4.55E+06	4.4290E-09	9.979E-13	9.979E-13	0.000E+00	2.214E-07
Rh-105	3.4560E-07	7.24E+06	7.0541E-09	1.589E-12	1.589E-12	0.000E+00	3.526E-07
Sb-127	7.4776E-07	1.57E+07	1.5278E-08	3.440E-12	3.440E-12	0.000E+00	7.630E-07
Sb-129	1.8975E-06	4.05E+07	3.9720E-08	8.820E-12	8.820E-12	0.000E+00	1.937E-06
Te-127	7.5766E-07	1.59E+07	1.5473E-08	3.485E-12	3.485E-12	0.000E+00	7.731E-07
Te-127m	1.0129E-07	2.12E+06	2.0672E-09	4.657E-13	4.657E-13	0.000E+00	1.034E-07
Te-129	2.0198E-06	4.22E+07	4.1829E-08	9.345E-12	9.345E-12	0.000E+00	2.062E-06
Te-129m	3.2442E-07	6.80E+06	6.6205E-09	1.492E-12	1.492E-12	0.000E+00	3.310E-07
Te-131m	9.6533E-07	2.03E+07	1.9772E-08	4.445E-12	4.445E-12	0.000E+00	9.851E-07
Te-132	9.5197E-06	2.00E+08	1.9455E-07	4.380E-11	4.380E-11	0.000E+00	9.714E-06
I-131	1.1237E-02	1.42E+12	2.3775E-03	7.361E-10	1.241E-09	1.349E-02	1.354E-04
I-132	1.2156E-02	1.78E+12	3.4294E-03	3.510E-08	5.871E-08	1.920E-02	3.627E-03
I-133	2.2097E-02	2.84E+12	4.8144E-03	4.506E-09	7.527E-09	2.726E-02	3.995E-04
I-134	1.1358E-02	2.15E+12	5.2310E-03	1.182E-07	1.975E-07	2.834E-02	1.176E-02
I-135	1.9265E-02	2.56E+12	4.5047E-03	1.586E-08	2.653E-08	2.540E-02	1.651E-03
Xe-133	0.0000E+00	0.00E+00	3.7048E-02	8.265E-08	8.265E-08	2.649E-02	1.056E-02
Xe-135	0.0000E+00	0.00E+00	1.3346E-02	2.740E-08	2.740E-08	9.403E-03	3.943E-03
Cs-134	2.8062E-03	3.55E+11	5.7656E-04	8.417E-11	8.417E-11	3.345E-03	3.754E-05
Cs-136	8.9604E-04	1.13E+11	1.8449E-04	2.271E-11	2.271E-11	1.070E-03	1.047E-05
Cs-137	1.6838E-03	2.13E+11	3.4593E-04	5.071E-11	5.071E-11	2.007E-03	2.258E-05
Ba-139	2.9571E-06	6.56E+07	6.5403E-08	1.408E-11	1.408E-11	0.000E+00	3.022E-06
Ba-140	4.6893E-06	9.83E+07	9.5734E-08	2.156E-11	2.156E-11	0.000E+00	4.785E-06
La-140	7.9832E-08	1.48E+06	1.3739E-09	3.254E-13	3.254E-13	0.000E+00	8.121E-08



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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La-141	3.7309E-08	7.97E+05	7.8295E-10	1.736E-13	1.736E-13	0.000E+00	3.809E-08
La-142	2.7370E-08	6.03E+05	6.0015E-10	1.298E-13	1.298E-13	0.000E+00	2.797E-08
Ce-141	1.1148E-07	2.34E+06	2.2754E-09	5.126E-13	5.126E-13	0.000E+00	1.138E-07
Ce-143	1.0040E-07	2.11E+06	2.0558E-09	4.623E-13	4.623E-13	0.000E+00	1.025E-07
Ce-144	9.1296E-08	1.91E+06	1.8632E-09	4.198E-13	4.198E-13	0.000E+00	9.316E-08
Pr-143	4.0166E-08	8.41E+05	8.1930E-10	1.846E-13	1.846E-13	0.000E+00	4.098E-08
Nd-147	4.4786E-08	9.39E+05	9.1438E-10	2.060E-13	2.060E-13	0.000E+00	4.570E-08
Np-239	1.4441E-06	3.03E+07	2.9528E-08	6.645E-12	6.645E-12	0.000E+00	1.474E-06
Pu-238	3.1932E-10	6.69E+03	6.5167E-12	1.468E-15	1.468E-15	0.000E+00	3.258E-10
Pu-239	3.2186E-11	6.75E+02	6.5684E-13	1.480E-16	1.480E-16	0.000E+00	3.284E-11
Pu-240	4.4156E-11	9.25E+02	9.0114E-13	2.030E-16	2.030E-16	0.000E+00	4.506E-11
Pu-241	1.3321E-08	2.79E+05	2.7187E-10	6.125E-14	6.125E-14	0.000E+00	1.359E-08
Am-241	6.8569E-12	1.44E+02	1.3993E-13	3.153E-17	3.153E-17	0.000E+00	6.997E-12
Cm-242	1.7260E-09	3.62E+04	3.5226E-11	7.936E-15	7.936E-15	0.000E+00	1.761E-09
Cm-244	1.1076E-10	2.32E+03	2.2605E-12	5.093E-16	5.093E-16	0.000E+00	1.130E-10

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 1.0000	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	4.5831E+15
Elemental I (atoms)	1.9700E+13	6.0307E+12
Organic I (atoms)	8.0460E+11	2.1066E+11
Aerosol I (atoms)	4.1749E+14	7.8726E+13
All Aerosols (kg)	1.7326E-08	3.2657E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) = 1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.2094E-02	3.2864E-01	2.5210E-02
Accumulated dose (rem)	2.4427E-02	8.6954E-01	5.7755E-02

Low Population Zone Doses:

Time (h) = 1.3000	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.0236E-02	8.2160E-01	6.3024E-02
Accumulated dose (rem)	6.1066E-02	2.1739E+00	1.4439E-01

Control Room Doses:

Time (h) = 1.3000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.5984E-04	5.3187E-01	2.2693E-02	5.6526E-03
Accumulated dose (rem)	8.0067E-04	2.8528E+00	1.2134E-01	2.7318E-02

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 1.3000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	4.4277E+02	4.0390E-06	1.9400E+02	2.5841E+16	5.1795E+01	4.8401E-02	0.0000E+00	1.1096E-01	1.1096E-01
Co-60	5.3021E+02	9.3484E-05	2.3229E+02	3.0941E+16	6.2023E+01	5.7953E-02	0.0000E+00	1.3286E-01	1.3286E-01
Kr-85	4.9448E+05	5.4977E-07	2.3890E+05	3.1821E+19	0.0000E+00	5.9901E+01	8.1591E-02	1.3751E+02	1.3751E+02
Kr-85m	7.5241E+06	5.5155E-04	3.8130E+06	5.0985E+20	0.0000E+00	9.6229E+02	1.5084E+00	2.2096E+03	2.2096E+03
Kr-87	8.6470E+06	3.9662E-03	4.9781E+06	6.7217E+20	0.0000E+00	1.2767E+03	2.8333E+00	2.9335E+03	2.9335E+03
Kr-88	1.8002E+07	1.8511E-02	9.3844E+06	1.2576E+21	0.0000E+00	2.3772E+03	4.0384E+00	5.4592E+03	5.4592E+03
Rb-86	2.1975E+04	1.7534E-04	1.4362E+04	1.9131E+18	4.5462E+03	3.6477E+00	1.5341E-02	8.3977E+00	8.3977E+00
Sr-89	5.6515E+05	1.8772E-02	2.4763E+05	3.2985E+19	6.6110E+04	6.1781E+01	0.0000E+00	1.4164E+02	1.4164E+02
Sr-90	6.7219E+04	6.9962E-02	2.9449E+04	3.9226E+18	7.8632E+03	7.3471E+00	0.0000E+00	1.6844E+01	1.6844E+01
Sr-91	6.5353E+05	1.1756E-03	2.9171E+05	3.8927E+19	7.6449E+04	7.3001E+01	0.0000E+00	1.6736E+02	1.6736E+02
Sr-92	5.6183E+05	7.3352E-04	2.6305E+05	3.5263E+19	6.5722E+04	6.6329E+01	0.0000E+00	1.5206E+02	1.5206E+02
Y-90	9.8909E+02	6.1062E-06	3.9559E+02	5.0582E+16	1.2843E+02	9.6042E-02	0.0000E+00	2.2018E-01	2.2018E-01
Y-91	7.4008E+03	2.8909E-04	3.2356E+03	4.3058E+17	8.6819E+02	8.0673E-01	0.0000E+00	1.8495E+00	1.8495E+00
Y-92	5.3086E+04	3.0411E-05	1.8107E+04	2.0768E+18	8.2012E+03	4.1170E+00	0.0000E+00	9.4386E+00	9.4386E+00
Y-93	8.3954E+03	1.5093E-05	3.7433E+03	4.9946E+17	9.8209E+02	9.3658E-01	0.0000E+00	2.1472E+00	2.1472E+00
Zr-95	1.0309E+04	1.9850E-04	4.5168E+03	6.0164E+17	1.2059E+03	1.1269E+00	0.0000E+00	2.5835E+00	2.5835E+00
Zr-97	9.9109E+03	3.8537E-05	4.3878E+03	5.8505E+17	1.1594E+03	1.0966E+00	0.0000E+00	2.5140E+00	2.5140E+00



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Nb-95	1.0384E+04	5.1633E-05	4.5493E+03	6.0595E+17	1.2147E+03	1.1350E+00	0.0000E+00	2.6020E+00	2.6020E+00
Mo-99	1.4633E+05	4.7459E-04	6.4282E+04	8.5646E+18	1.7118E+04	1.6044E+01	0.0000E+00	3.6783E+01	3.6783E+01
Tc-99m	1.3083E+05	9.9454E-06	5.7334E+04	7.6154E+18	1.5304E+04	1.4305E+01	0.0000E+00	3.2795E+01	3.2795E+01
Ru-103	1.2447E+05	9.1745E-04	5.4540E+04	7.2649E+18	1.4560E+04	1.3607E+01	0.0000E+00	3.1196E+01	3.1196E+01
Ru-105	7.1665E+04	5.1294E-05	3.2686E+04	4.3708E+18	8.3833E+03	8.2080E+00	0.0000E+00	1.8818E+01	1.8818E+01
Ru-106	5.0409E+04	1.9287E-02	2.2085E+04	2.9417E+18	5.8968E+03	5.5099E+00	0.0000E+00	1.2632E+01	1.2632E+01
Rh-105	8.0237E+04	6.3938E-05	3.5166E+04	4.6821E+18	9.3860E+03	8.7739E+00	0.0000E+00	2.0115E+01	2.0115E+01
Sb-127	1.7330E+05	8.8823E-04	7.6070E+04	1.0134E+19	2.0273E+04	1.8984E+01	0.0000E+00	4.3523E+01	4.3523E+01
Sb-129	4.2005E+05	4.9071E-04	1.9180E+05	2.5650E+19	4.9137E+04	4.8172E+01	0.0000E+00	1.1044E+02	1.1044E+02
Te-127	1.7577E+05	4.5233E-05	7.7089E+04	1.0251E+19	2.0561E+04	1.9236E+01	0.0000E+00	4.4100E+01	4.4100E+01
Te-127m	2.3529E+04	4.0539E-04	1.0308E+04	1.3730E+18	2.7524E+03	2.5717E+00	0.0000E+00	5.8959E+00	5.8959E+00
Te-129	4.5549E+05	3.9824E-05	2.0461E+05	2.6979E+19	5.3283E+04	5.1252E+01	0.0000E+00	1.1750E+02	1.1750E+02
Te-129m	7.5362E+04	1.4510E-03	3.3015E+04	4.3974E+18	8.8158E+03	8.2366E+00	0.0000E+00	1.8883E+01	1.8883E+01
Te-131m	2.2268E+05	1.3093E-03	9.8135E+04	1.3079E+19	2.6049E+04	2.4507E+01	0.0000E+00	5.6184E+01	5.6184E+01
Te-132	2.2054E+06	1.6907E-02	9.6839E+05	1.2902E+20	2.5799E+05	2.4169E+02	0.0000E+00	5.5409E+02	5.5409E+02
I-131	1.0198E+07	3.8233E-01	6.3172E+06	8.4152E+20	1.8506E+06	1.6013E+03	5.9740E+00	3.6849E+03	3.6849E+03
I-132	1.2788E+07	2.3494E-02	8.2059E+06	1.0993E+21	2.1262E+06	2.0970E+03	8.5765E+00	4.8271E+03	4.8271E+03
I-133	1.9868E+07	1.4025E-01	1.2453E+07	1.6601E+21	3.6060E+06	3.1604E+03	1.2087E+01	7.2733E+03	7.2733E+03
I-134	8.1371E+06	1.9420E-02	7.0509E+06	9.5781E+20	1.4768E+06	1.8426E+03	1.2841E+01	4.2537E+03	4.2537E+03
I-135	1.6954E+07	4.2093E-02	1.0930E+07	1.4597E+21	3.0770E+06	2.7821E+03	1.1285E+01	6.4041E+03	6.4041E+03
Xe-133	7.0951E+07	1.0347E-03	3.4300E+07	4.5689E+21	0.0000E+00	8.6012E+03	1.1726E+01	1.9746E+04	1.9746E+04
Xe-135	2.6854E+07	2.9658E-03	1.2888E+07	1.7145E+21	0.0000E+00	3.2315E+03	4.1642E+00	7.4180E+03	7.4180E+03
Cs-134	2.1262E+06	1.1953E-01	1.3888E+06	1.8499E+20	4.3987E+05	3.5270E+02	1.4816E+00	8.1198E+02	8.1198E+02
Cs-136	6.7847E+05	6.8534E-03	4.4355E+05	5.9084E+19	1.4036E+05	1.1265E+02	4.7405E-01	2.5936E+02	2.5936E+02
Cs-137	1.2758E+06	4.9113E-02	8.3329E+05	1.1099E+20	2.6393E+05	2.1162E+02	8.8893E-01	4.8720E+02	4.8720E+02
Ba-139	5.9070E+05	1.0524E-04	2.9561E+05	3.9874E+19	6.9100E+04	7.5302E+01	0.0000E+00	1.7263E+02	1.7263E+02
Ba-140	1.0885E+06	3.3411E-03	4.7716E+05	6.3561E+19	1.2733E+05	1.1906E+02	0.0000E+00	2.7295E+02	2.7295E+02
La-140	1.8840E+04	8.1078E-05	7.2852E+03	9.1608E+17	2.5308E+03	1.7494E+00	0.0000E+00	4.0106E+00	4.0106E+00
La-141	8.2196E+03	4.1791E-06	3.7688E+03	5.0423E+17	9.6152E+02	9.4721E-01	0.0000E+00	2.1716E+00	2.1716E+00
La-142	5.5555E+03	8.8985E-06	2.7400E+03	3.6910E+17	6.4987E+02	6.9644E-01	0.0000E+00	1.5966E+00	1.5966E+00
Ce-141	2.5895E+04	1.8659E-04	1.1346E+04	1.5112E+18	3.0289E+03	2.8306E+00	0.0000E+00	6.4894E+00	6.4894E+00
Ce-143	2.3175E+04	6.5832E-05	1.0208E+04	1.3604E+18	2.7110E+03	2.5489E+00	0.0000E+00	5.8435E+00	5.8435E+00
Ce-144	2.1206E+04	6.3517E-03	9.2907E+03	1.2375E+18	2.4806E+03	2.3179E+00	0.0000E+00	5.3140E+00	5.3140E+00
Pr-143	9.3304E+03	6.0569E-05	4.0861E+03	5.4416E+17	1.0920E+03	1.0193E+00	0.0000E+00	2.3369E+00	2.3369E+00
Nd-147	1.0395E+04	5.7608E-05	4.5571E+03	6.0705E+17	1.2160E+03	1.1371E+00	0.0000E+00	2.6068E+00	2.6068E+00
Np-239	3.3420E+05	6.9584E-04	1.4687E+05	1.9570E+19	3.9094E+04	3.6662E+01	0.0000E+00	8.4050E+01	8.4050E+01
Pu-238	7.4174E+01	1.7134E-02	3.2496E+01	4.3284E+15	8.6767E+00	8.1072E-03	0.0000E+00	1.8586E-02	1.8586E-02
Pu-239	7.4767E+00	1.8467E-03	3.2754E+00	4.3629E+14	8.7461E-01	8.1717E-04	0.0000E+00	1.8734E-03	1.8734E-03
Pu-240	1.0257E+01	2.5335E-03	4.4935E+00	5.9854E+14	1.1998E+00	1.1211E-03	0.0000E+00	2.5701E-03	2.5701E-03
Pu-241	3.0944E+03	1.2295E-02	1.3557E+03	1.8057E+17	3.6198E+02	3.3822E-01	0.0000E+00	7.7539E-01	7.7539E-01
Am-241	1.5928E+00	5.6675E-04	6.9778E-01	9.2943E+13	1.8633E-01	1.7408E-04	0.0000E+00	3.9910E-04	3.9910E-04
Cm-242	4.0090E+02	5.5519E-03	1.7565E+02	2.3396E+16	4.6897E+01	4.3821E-02	0.0000E+00	1.0046E-01	1.0046E-01
Cm-244	2.5729E+01	5.1116E-03	1.1272E+01	1.5014E+15	3.0097E+00	2.8122E-03	0.0000E+00	6.4471E-03	6.4471E-03
Total	2.1296E+08	1.0000E+00	0.0000E+00	0.0000E+00	1.3975E+07	2.9617E+04	7.7975E+01	6.8077E+04	6.8077E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 3.7598E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 4.6780E-03
 Total I (Ci) 6.7945E+07

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 1.3000	Atmosphere	Sump
Noble gases (atoms)	1.0711E+25	0.0000E+00
Elemental I (atoms)	2.7849E+22	0.0000E+00
Organic I (atoms)	8.6131E+20	0.0000E+00
Aerosol I (atoms)	4.5740E+23	0.0000E+00
All Aerosols (kg)	1.7192E+01	0.0000E+00

Time (h) = 1.3000	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
Aerosol I (atoms)	8.9019E+22	0.0000E+00
All Aerosols (kg)	3.4865E+00	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 1.3000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	2.1892E-04	3.4268E-06	7.9804E-05	1.0630E+10	4.8401E-02	6.6542E-04	2.8424E-04	0.0000E+00
Co-60	2.6215E-04	7.9316E-05	9.5555E-05	1.2728E+10	5.7953E-02	7.9674E-04	3.4032E-04	0.0000E+00
Kr-85	2.4448E-01	4.5410E-07	9.5673E-02	1.2744E+13	5.9901E+01	4.0112E+01	1.8734E+01	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Kr-85m	3.7200E+00	4.5192E-04	1.5148E+00	2.0255E+14	9.6229E+02	6.3946E+02	3.0592E+02	0.0000E+00
Kr-87	4.2752E+00	3.1817E-03	1.9362E+00	2.6144E+14	1.2767E+03	8.3156E+02	4.2295E+02	0.0000E+00
Kr-88	8.9004E+00	1.5096E-02	3.7105E+00	4.9727E+14	2.3772E+03	1.5726E+03	7.6292E+02	0.0000E+00
Rb-86	1.0872E-02	1.3604E-04	5.4027E-03	7.1967E+11	3.6477E+00	4.6024E-02	2.5835E-02	0.0000E+00
Sr-89	2.7942E-01	1.5927E-02	1.0186E-01	1.3569E+13	6.1781E+01	8.4937E-01	3.6282E-01	0.0000E+00
Sr-90	3.3234E-02	5.9359E-02	1.2114E-02	1.6136E+12	7.3471E+00	1.0101E-01	4.3145E-02	0.0000E+00
Sr-91	3.2312E-01	9.9449E-04	1.1965E-01	1.5967E+13	7.3001E+01	1.0008E+00	4.3153E-01	0.0000E+00
Sr-92	2.7778E-01	6.1595E-04	1.0709E-01	1.4357E+13	6.6329E+01	9.0271E-01	3.9863E-01	0.0000E+00
Y-90	4.8936E-04	5.2620E-06	1.6528E-04	2.1148E+10	9.6042E-02	1.3411E-03	5.4426E-04	0.0000E+00
Y-91	3.6592E-03	2.4536E-04	1.3315E-03	1.7719E+11	8.0673E-01	1.1095E-02	4.7338E-03	0.0000E+00
Y-92	2.6298E-02	2.7076E-05	7.8163E-03	9.0500E+11	4.1170E+00	5.9660E-02	2.1261E-02	0.0000E+00
Y-93	4.1509E-03	1.2771E-05	1.5356E-03	2.0490E+11	9.3658E-01	1.2842E-02	5.5342E-03	0.0000E+00
Zr-95	5.0968E-03	1.6841E-04	1.8580E-03	2.4749E+11	1.1269E+00	1.5492E-02	6.6178E-03	0.0000E+00
Zr-97	4.9002E-03	3.2643E-05	1.8020E-03	2.4028E+11	1.0966E+00	1.5052E-02	6.4634E-03	0.0000E+00
Nb-95	5.1340E-03	4.3808E-05	1.8714E-03	2.4927E+11	1.1350E+00	1.5604E-02	6.6651E-03	0.0000E+00
Mo-99	7.2350E-02	4.0249E-04	2.6432E-02	3.5217E+12	1.6044E+01	2.2049E-01	9.4308E-02	0.0000E+00
Tc-99m	6.4683E-02	8.4378E-06	2.3584E-02	3.1326E+12	1.4305E+01	1.9666E-01	8.4011E-02	0.0000E+00
Ru-103	6.1539E-02	7.7839E-04	2.2435E-02	2.9884E+12	1.3607E+01	1.8707E-01	7.9913E-02	0.0000E+00
Ru-105	3.5433E-02	4.3248E-05	1.3362E-02	1.7867E+12	8.2080E+00	1.1215E-01	4.8886E-02	0.0000E+00
Ru-106	2.4923E-02	1.6364E-02	9.0850E-03	1.2101E+12	5.5099E+00	7.5751E-02	3.2356E-02	0.0000E+00
Rh-105	3.9671E-02	5.4245E-05	1.4465E-02	1.9260E+12	8.7739E+00	1.2062E-01	5.1529E-02	0.0000E+00
Sb-127	8.5684E-02	7.5339E-04	3.1283E-02	4.1677E+12	1.8984E+01	2.6093E-01	1.1156E-01	0.0000E+00
Sb-129	2.0768E-01	4.1366E-04	7.8391E-02	1.0484E+13	4.8172E+01	6.5811E-01	2.8702E-01	0.0000E+00
Te-127	8.6902E-02	3.8371E-05	3.1706E-02	4.2164E+12	1.9236E+01	2.6442E-01	1.1300E-01	0.0000E+00
Te-127m	1.1633E-02	3.4395E-04	4.2404E-03	5.6482E+11	2.5717E+00	3.5357E-02	1.5102E-02	0.0000E+00
Te-129	2.2520E-01	3.3660E-05	8.3847E-02	1.1056E+13	5.1252E+01	7.0201E-01	3.0355E-01	0.0000E+00
Te-129m	3.7261E-02	1.2311E-03	1.3581E-02	1.8090E+12	8.2366E+00	1.1324E-01	4.8367E-02	0.0000E+00
Te-131m	1.1010E-01	1.1099E-03	4.0332E-02	5.3754E+12	2.4507E+01	3.3662E-01	1.4422E-01	0.0000E+00
Te-132	1.0904E+00	1.4339E-02	3.9822E-01	5.3055E+13	2.4169E+02	3.3216E+00	1.4204E+00	0.0000E+00
I-131	7.2745E+00	4.2960E-01	3.4415E+00	4.5845E+14	1.6013E+03	4.9234E+01	4.5060E+01	6.8948E+02
I-132	9.0766E+00	2.6150E-02	4.4285E+00	5.9352E+14	2.0970E+03	6.3915E+01	5.9447E+01	8.9527E+02
I-133	1.4173E+01	1.5728E-01	6.7707E+00	9.0260E+14	3.1604E+03	9.6989E+01	8.9224E+01	1.3606E+03
I-134	5.8045E+00	2.0678E-02	3.6401E+00	4.9452E+14	1.8426E+03	5.3894E+01	5.6340E+01	7.9092E+02
I-135	1.2094E+01	4.6981E-02	5.9150E+00	7.8994E+14	2.7821E+03	8.4999E+01	7.9158E+01	1.1974E+03
Xe-133	3.5093E+01	8.5489E-04	1.3740E+01	1.8301E+15	8.6012E+03	5.7611E+03	2.6914E+03	2.9008E+03
Xe-135	1.3418E+01	2.4770E-03	5.2186E+00	6.9389E+14	3.2315E+03	2.1871E+03	1.0170E+03	3.0828E+01
Cs-134	1.0520E+00	9.2749E-02	5.2248E-01	6.9594E+13	3.5270E+02	4.4505E+00	2.4976E+00	0.0000E+00
Cs-136	3.3568E-01	5.3171E-03	1.6685E-01	2.2225E+13	1.1265E+02	1.4213E+00	7.9795E-01	0.0000E+00
Cs-137	6.3121E-01	3.8109E-02	3.1350E-01	4.1758E+13	2.1162E+02	2.6704E+00	1.4986E+00	0.0000E+00
Ba-139	2.9205E-01	8.7469E-05	1.1912E-01	1.6068E+13	7.5302E+01	1.0146E+00	4.6274E-01	0.0000E+00
Ba-140	5.3818E-01	2.8345E-03	1.9627E-01	2.6145E+13	1.1906E+02	1.6367E+00	6.9929E-01	0.0000E+00
La-140	9.3233E-03	7.0295E-05	3.0624E-03	3.8558E+11	1.7494E+00	2.4583E-02	9.7661E-03	0.0000E+00
La-141	4.0639E-03	3.5206E-06	1.5394E-03	2.0595E+11	9.4721E-01	1.2932E-02	5.6519E-03	0.0000E+00
La-142	2.7467E-03	7.4123E-06	1.1066E-03	1.4907E+11	6.9644E-01	9.4041E-03	4.2593E-03	0.0000E+00
Ce-141	1.2803E-02	1.5831E-04	4.6671E-03	6.2166E+11	2.8306E+00	3.8915E-02	1.6623E-02	0.0000E+00
Ce-143	1.1458E-02	5.5808E-05	4.1955E-03	5.5914E+11	2.5489E+00	3.5014E-02	1.4997E-02	0.0000E+00
Ce-144	1.0485E-02	5.3890E-03	3.8219E-03	5.0907E+11	2.3179E+00	3.1867E-02	1.3612E-02	0.0000E+00
Pr-143	4.6131E-03	5.1393E-05	1.6810E-03	2.2386E+11	1.0193E+00	1.4015E-02	5.9850E-03	0.0000E+00
Nd-147	5.1395E-03	4.8872E-05	1.8745E-03	2.4969E+11	1.1371E+00	1.5631E-02	6.6789E-03	0.0000E+00
Np-239	1.6524E-01	5.9010E-04	6.0389E-02	8.0463E+12	3.6662E+01	5.0379E-01	2.1553E-01	0.0000E+00
Pu-238	3.6673E-05	1.4537E-02	1.3368E-05	1.7806E+09	8.1072E-03	1.1146E-04	4.7609E-05	0.0000E+00
Pu-239	3.6966E-06	1.5669E-03	1.3474E-06	1.7947E+08	8.1717E-04	1.1235E-05	4.7987E-06	0.0000E+00
Pu-240	5.0711E-06	2.1495E-03	1.8485E-06	2.4622E+08	1.1211E-03	1.5413E-05	6.5833E-06	0.0000E+00
Pu-241	1.5299E-03	1.0432E-02	5.5767E-04	7.4282E+10	3.3822E-01	4.6499E-03	1.9861E-03	0.0000E+00
Am-241	7.8753E-07	4.8086E-04	2.8705E-07	3.8234E+07	1.7408E-04	2.3934E-06	1.0223E-06	0.0000E+00
Cm-242	1.9821E-04	4.7105E-03	7.2254E-05	9.6243E+09	4.3821E-02	6.0246E-04	2.5734E-04	0.0000E+00
Cm-244	1.2721E-05	4.3369E-03	4.6368E-06	6.1763E+08	2.8122E-03	3.8662E-05	1.6514E-05	0.0000E+00
Total	1.2028E+02	1.0000E+00	0.0000E+00	0.0000E+00	2.9617E+04	1.1403E+04	5.5586E+03	4.9677E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 1.7734E-06
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 2.2063E-06
 Total I (Ci) 4.8423E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	1.3000	Atmosphere	Sump
Noble gases (atoms)	5.2963E+18	0.0000E+00	
Elemental I (atoms)	1.1685E+17	0.0000E+00	
Organic I (atoms)	3.6140E+15	0.0000E+00	
Aerosol I (atoms)	2.2628E+17	0.0000E+00	
All Aerosols (kg)	8.5054E-06	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 1.3000



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	9.8441E-04	4.9221E-05	0.00000	0.00000	0.00000	0.00000
Co-60	1.1787E-03	5.8935E-05	0.00002	0.00001	0.00000	0.00000
Kr-85	6.0335E+01	3.0114E+00	0.00000	0.00000	0.00000	0.00000
Kr-85m	9.6186E+02	4.7996E+01	0.00496	0.00237	0.00001	0.00007
Kr-87	1.2519E+03	6.2418E+01	0.03551	0.01806	0.00012	0.00052
Kr-88	2.3657E+03	1.1803E+02	0.16626	0.08066	0.00043	0.00246
Rb-86	9.0538E-02	4.1371E-03	0.00003	0.00002	0.00001	0.00000
Sr-89	1.2565E+00	6.2827E-02	0.00345	0.00147	0.00000	0.00011
Sr-90	1.4943E-01	7.4716E-03	0.01286	0.00549	0.00000	0.00040
Sr-91	1.4792E+00	7.3959E-02	0.00022	0.00009	0.00000	0.00001
Sr-92	1.3313E+00	6.6566E-02	0.00013	0.00006	0.00000	0.00000
Y-90	2.0393E-03	1.0197E-04	0.00000	0.00000	0.00000	0.00000
Y-91	1.6424E-02	8.2121E-04	0.00005	0.00002	0.00000	0.00000
Y-92	9.7005E-02	4.8502E-03	0.00001	0.00000	0.00000	0.00000
Y-93	1.8982E-02	9.4908E-04	0.00000	0.00000	0.00000	0.00000
Zr-95	2.2919E-02	1.1460E-03	0.00004	0.00002	0.00000	0.00000
Zr-97	2.2256E-02	1.1128E-03	0.00001	0.00000	0.00000	0.00000
Nb-95	2.3084E-02	1.1542E-03	0.00001	0.00000	0.00000	0.00000
Mo-99	3.2615E-01	1.6307E-02	0.00009	0.00004	0.00000	0.00000
Tc-99m	2.9093E-01	1.4546E-02	0.00000	0.00000	0.00000	0.00000
Ru-103	2.7675E-01	1.3838E-02	0.00017	0.00007	0.00000	0.00001
Ru-105	1.6560E-01	8.2800E-03	0.00001	0.00000	0.00000	0.00000
Ru-106	1.1206E-01	5.6032E-03	0.00355	0.00151	0.00000	0.00011
Rh-105	1.7844E-01	8.9220E-03	0.00001	0.00001	0.00000	0.00000
Sb-127	3.8597E-01	1.9299E-02	0.00016	0.00007	0.00000	0.00001
Sb-129	9.7168E-01	4.8584E-02	0.00009	0.00004	0.00000	0.00000
Te-127	3.9115E-01	1.9558E-02	0.00001	0.00000	0.00000	0.00000
Te-127m	5.2306E-02	2.6153E-03	0.00007	0.00003	0.00000	0.00000
Te-129	1.0373E+00	5.1863E-02	0.00001	0.00000	0.00000	0.00000
Te-129m	1.6753E-01	8.3763E-03	0.00027	0.00011	0.00000	0.00001
Te-131m	4.9785E-01	2.4893E-02	0.00024	0.00010	0.00000	0.00001
Te-132	4.9134E+00	2.4567E-01	0.00311	0.00133	0.00000	0.00010
I-131	1.0230E+02	4.9485E+00	0.15971	0.14618	0.01938	0.00345
I-132	1.3239E+02	6.3823E+00	0.00981	0.00912	0.00132	0.00020
I-133	2.0201E+02	9.7638E+00	0.05855	0.05386	0.00730	0.00126
I-134	1.2066E+02	5.6822E+00	0.00796	0.00832	0.00190	0.00017
I-135	1.7807E+02	8.5895E+00	0.01754	0.01634	0.00233	0.00038
Xe-133	8.6743E+03	4.3295E+02	0.00932	0.00435	0.00002	0.00014
Xe-135	3.3823E+03	1.6884E+02	0.02698	0.01254	0.00005	0.00045
Cs-134	8.7530E+00	4.0000E-01	0.02053	0.01152	0.00683	0.00109
Cs-136	2.7963E+00	1.2777E-01	0.00118	0.00066	0.00039	0.00006
Cs-137	5.2519E+00	2.4001E-01	0.00844	0.00473	0.00281	0.00045
Ba-139	1.4922E+00	7.4609E-02	0.00002	0.00001	0.00000	0.00000
Ba-140	2.4212E+00	1.2106E-01	0.00061	0.00026	0.00000	0.00002
La-140	3.7791E-02	1.8895E-03	0.00001	0.00001	0.00000	0.00000
La-141	1.9090E-02	9.5451E-04	0.00000	0.00000	0.00000	0.00000
La-142	1.3839E-02	6.9195E-04	0.00000	0.00000	0.00000	0.00000
Ce-141	5.7570E-02	2.8785E-03	0.00003	0.00001	0.00000	0.00000
Ce-143	5.1785E-02	2.5893E-03	0.00001	0.00001	0.00000	0.00000
Ce-144	4.7143E-02	2.3572E-03	0.00117	0.00050	0.00000	0.00004
Pr-143	2.0735E-02	1.0368E-03	0.00001	0.00000	0.00000	0.00000
Nd-147	2.3124E-02	1.1562E-03	0.00001	0.00000	0.00000	0.00000
Np-239	7.4519E-01	3.7259E-02	0.00013	0.00005	0.00000	0.00000
Pu-238	1.6489E-04	8.2446E-06	0.00315	0.00135	0.00000	0.00010
Pu-239	1.6620E-05	8.3102E-07	0.00034	0.00015	0.00000	0.00001
Pu-240	2.2801E-05	1.1401E-06	0.00047	0.00020	0.00000	0.00001
Pu-241	6.8790E-03	3.4395E-04	0.00226	0.00097	0.00000	0.00007
Am-241	3.5408E-06	1.7704E-07	0.00010	0.00004	0.00000	0.00000
Cm-242	8.9127E-04	4.4564E-05	0.00102	0.00044	0.00000	0.00003
Cm-244	5.7196E-05	2.8598E-06	0.00094	0.00040	0.00000	0.00003

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 1.3000		
Noble gases (atoms)	1.3077E+21	2.7942E+17
Elemental I (atoms)	2.8191E+18	6.0238E+14
Organic I (atoms)	3.2303E+17	6.9024E+13
Aerosol I (atoms)	1.7637E+18	3.7686E+14
All Aerosols (kg)	6.9285E-05	1.4804E-08



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 1.3000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	4.9483E+02	3.9503E-06	2.1033E+02	2.8016E+16	0.0000E+00
Co-60	5.9254E+02	9.1431E-05	2.5184E+02	3.3544E+16	0.0000E+00
Rb-86	2.6541E+04	1.8463E-04	1.6764E+04	2.2331E+18	0.0000E+00
Sr-89	6.3159E+05	1.8360E-02	2.6847E+05	3.5760E+19	0.0000E+00
Sr-90	7.5121E+04	6.8425E-02	3.1927E+04	4.2527E+18	0.0000E+00
Sr-91	7.3036E+05	1.1493E-03	3.1615E+05	4.2188E+19	0.0000E+00
Sr-92	6.2788E+05	7.1652E-04	2.8483E+05	3.8183E+19	0.0000E+00
Y-90	1.1182E+03	6.0245E-06	4.3265E+02	5.5340E+16	0.0000E+00
Y-91	8:2734E+03	2.8280E-04	3.5085E+03	4.6691E+17	0.0000E+00
Y-92	6.1327E+04	3.0646E-05	2.0227E+04	2.3318E+18	0.0000E+00
Y-93	9.3825E+03	1.4757E-05	4.0570E+03	5.4131E+17	0.0000E+00
Zr-95	1.1521E+04	1.9414E-04	4.8968E+03	6.5227E+17	0.0000E+00
Zr-97	1.1076E+04	3.7684E-05	4.7561E+03	6.3416E+17	0.0000E+00
Nb-95	1.1605E+04	5.0499E-05	4.9321E+03	6.5695E+17	0.0000E+00
Mo-99	1.6354E+05	4.6414E-04	6.9687E+04	9.2848E+18	0.0000E+00
Tc-99m	1.4621E+05	9.7269E-06	6.2158E+04	8.2562E+18	0.0000E+00
Ru-103	1.3910E+05	8.9730E-04	5.9130E+04	7.8762E+18	0.0000E+00
Ru-105	8.0090E+04	5.0130E-05	3.5410E+04	4.7351E+18	0.0000E+00
Ru-106	5.6336E+04	1.8864E-02	2.3943E+04	3.1893E+18	0.0000E+00
Rh-105	8.9670E+04	6.2534E-05	3.8125E+04	5.0761E+18	0.0000E+00
Sb-127	1.9368E+05	8.6869E-04	8.2469E+04	1.0987E+19	0.0000E+00
Sb-129	4.6943E+05	4.7956E-04	2.0778E+05	2.7787E+19	0.0000E+00
Te-127	1.9643E+05	4.4238E-05	8.3574E+04	1.1114E+19	0.0000E+00
Te-127m	2.6296E+04	3.9649E-04	1.1176E+04	1.4886E+18	0.0000E+00
Te-129	5.0904E+05	3.8932E-05	2.2172E+05	2.9236E+19	0.0000E+00
Te-129m	8.4222E+04	1.4192E-03	3.5793E+04	4.7675E+18	0.0000E+00
Te-131m	2.4886E+05	1.2804E-03	1.0638E+05	1.4178E+19	0.0000E+00
Te-132	2.4647E+06	1.6535E-02	1.0498E+06	1.3987E+20	0.0000E+00
I-131	1.2057E+07	3.9632E-01	7.2586E+06	9.6694E+20	6.8948E+02
I-132	1.4924E+07	2.4133E-02	9.3437E+06	1.2518E+21	8.9527E+02
I-133	2.3491E+07	1.4535E-01	1.4306E+07	1.9071E+21	1.3606E+03
I-134	9.6209E+06	2.0002E-02	8.0503E+06	1.0936E+21	7.9092E+02
I-135	2.0046E+07	4.3600E-02	1.2550E+07	1.6760E+21	1.1974E+03
Xe-133	7.6308E+04	9.0143E-07	3.3123E+04	3.9056E+18	2.9008E+00
Xe-135	7.9181E+05	7.2877E-05	3.5104E+05	4.1434E+19	3.0828E+01
Cs-134	2.5680E+06	1.2587E-01	1.6211E+06	2.1592E+20	0.0000E+00
Cs-136	8.1944E+05	7.2165E-03	5.1772E+05	6.8965E+19	0.0000E+00
Cs-137	1.5408E+06	5.1716E-02	9.7266E+05	1.2956E+20	0.0000E+00
Ba-139	6.6015E+05	1.0268E-04	3.1969E+05	4.3123E+19	0.0000E+00
Ba-140	1.2165E+06	3.2677E-03	5.1731E+05	6.8909E+19	0.0000E+00
La-140	2.1383E+04	8.0270E-05	7.9951E+03	1.0061E+18	0.0000E+00
La-141	9.1860E+03	4.0838E-06	4.0825E+03	5.4619E+17	0.0000E+00
La-142	6.2086E+03	8.6839E-06	2.9640E+03	3.9928E+17	0.0000E+00
Ce-141	2.8939E+04	1.8249E-04	1.2300E+04	1.6384E+18	0.0000E+00
Ce-143	2.5899E+04	6.4380E-05	1.1065E+04	1.4747E+18	0.0000E+00
Ce-144	2.3699E+04	6.2122E-03	1.0072E+04	1.3417E+18	0.0000E+00
Pr-143	1.0428E+04	5.9241E-05	4.4301E+03	5.8997E+17	0.0000E+00
Nd-147	1.1617E+04	5.6342E-05	4.9405E+03	6.5812E+17	0.0000E+00
Np-239	3.7349E+05	6.8052E-04	1.5922E+05	2.1215E+19	0.0000E+00
Pu-238	8.2894E+01	1.6757E-02	3.5230E+01	4.6927E+15	0.0000E+00
Pu-239	8.3557E+00	1.8062E-03	3.5511E+00	4.7300E+14	0.0000E+00
Pu-240	1.1463E+01	2.4778E-03	4.8716E+00	6.4890E+14	0.0000E+00
Pu-241	3.4582E+03	1.2025E-02	1.4697E+03	1.9577E+17	0.0000E+00
Am-241	1.7801E+00	5.5430E-04	7.5650E-01	1.0076E+14	0.0000E+00
Cm-242	4.4804E+02	5.4300E-03	1.9043E+02	2.5365E+16	0.0000E+00
Cm-244	2.8753E+01	4.9993E-03	1.2220E+01	1.6277E+15	0.0000E+00
Total	9.5402E+07	1.0000E+00	0.0000E+00	0.0000E+00	4.9674E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 6.0953E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 7.5818E-03
 Total I (Ci) 8.0139E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 1.3000	Atmosphere	Sump
Noble gases (atoms)	3.2290E+21	0.0000E+00
Elemental I (atoms)	5.5742E+23	0.0000E+00
Organic I (atoms)	1.7240E+22	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Aerosol I (atoms) 0.0000E+00 0.0000E+00
 All Aerosols (kg) 2.0573E+01 0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 1.3000

Nuclide	Filter	Decays	Transported	Activity Pathway 2	Activity Pathway 3	Activity Pathway 7	Activity Pathway 11
Co-58	7.3082E-09	2.27E+05	1.4916E-10	2.817E-14	1.251E-14	0.000E+00	7.457E-09
Co-60	8.7514E-09	2.72E+05	1.7860E-10	3.373E-14	1.498E-14	0.000E+00	8.930E-09
Kr-85	0.0000E+00	0.00E+00	3.9671E-04	1.656E-09	7.861E-10	1.843E-04	2.124E-04
Kr-85m	0.0000E+00	0.00E+00	6.7902E-03	2.642E-08	1.285E-08	3.411E-03	3.380E-03
Kr-87	0.0000E+00	0.00E+00	1.0791E-02	3.444E-08	1.782E-08	6.420E-03	4.371E-03
Kr-88	0.0000E+00	0.00E+00	1.7437E-02	6.501E-08	3.207E-08	9.136E-03	8.302E-03
Rb-86	2.9460E-05	4.84E+09	5.9798E-06	1.728E-12	9.448E-13	3.464E-05	8.059E-07
Sr-89	9.3281E-06	2.90E+08	1.9039E-07	3.596E-11	1.597E-11	0.000E+00	9.518E-06
Sr-90	1.1095E-06	3.45E+07	2.2643E-08	4.276E-12	1.899E-12	0.000E+00	1.132E-06
Sr-91	1.0787E-05	3.39E+08	2.2393E-07	4.174E-11	1.878E-11	0.000E+00	1.101E-05
Sr-92	9.2734E-06	3.01E+08	2.0106E-07	3.624E-11	1.686E-11	0.000E+00	9.474E-06
Y-90	1.8774E-08	5.25E+05	3.2681E-10	6.535E-14	2.695E-14	0.000E+00	1.910E-08
Y-91	1.2263E-07	3.80E+06	2.4921E-09	4.715E-13	2.090E-13	0.000E+00	1.251E-07
Y-92	1.2599E-06	3.10E+07	1.7604E-08	3.557E-12	1.314E-12	0.000E+00	1.278E-06
Y-93	1.3857E-07	4.36E+06	2.8738E-09	5.360E-13	2.410E-13	0.000E+00	1.414E-07
Zr-95	1.7015E-07	5.29E+06	3.4728E-09	6.558E-13	2.913E-13	0.000E+00	1.736E-07
Zr-97	1.6359E-07	5.12E+06	3.3707E-09	6.319E-13	2.827E-13	0.000E+00	1.670E-07
Nb-95	1.7139E-07	5.33E+06	3.4978E-09	6.606E-13	2.934E-13	0.000E+00	1.749E-07
Mo-99	2.4153E-06	7.52E+07	4.9413E-08	9.315E-12	4.145E-12	0.000E+00	2.465E-06
Tc-99m	2.1594E-06	6.69E+07	4.4082E-08	8.324E-12	3.697E-12	0.000E+00	2.203E-06
Ru-103	2.0544E-06	6.38E+07	4.1934E-08	7.919E-12	3.517E-12	0.000E+00	2.096E-06
Ru-105	1.1829E-06	3.78E+07	2.5044E-08	4.597E-12	2.100E-12	0.000E+00	1.208E-06
Ru-106	8.3203E-07	2.59E+07	1.6981E-08	3.207E-12	1.424E-12	0.000E+00	8.490E-07
Rh-105	1.3244E-06	4.11E+07	2.7038E-08	5.105E-12	2.268E-12	0.000E+00	1.351E-06
Sb-127	2.8605E-06	8.90E+07	5.8479E-08	1.103E-11	4.905E-12	0.000E+00	2.919E-06
Sb-129	6.9331E-06	2.21E+08	1.4694E-07	2.695E-11	1.232E-11	0.000E+00	7.080E-06
Te-127	2.9011E-06	9.01E+07	5.9266E-08	1.118E-11	4.971E-12	0.000E+00	2.960E-06
Te-127m	3.8837E-07	1.21E+07	7.9257E-09	1.497E-12	6.648E-13	0.000E+00	3.963E-07
Te-129	7.5182E-06	2.35E+08	1.5700E-07	2.913E-11	1.316E-11	0.000E+00	7.675E-06
Te-129m	1.2439E-06	3.86E+07	2.5384E-08	4.794E-12	2.129E-12	0.000E+00	1.269E-06
Te-131m	3.6755E-06	1.15E+08	7.5416E-08	1.418E-11	6.325E-12	0.000E+00	3.751E-06
Te-132	3.6402E-05	1.13E+09	7.4443E-07	1.404E-10	6.244E-11	0.000E+00	3.715E-05
I-131	1.1428E-02	1.88E+12	2.3833E-03	1.789E-09	1.585E-09	1.349E-02	3.322E-04
I-132	1.1339E-02	2.25E+12	3.4364E-03	3.982E-08	6.026E-08	1.920E-02	4.451E-03
I-133	2.2273E-02	3.72E+12	4.8258E-03	5.504E-09	7.854E-09	2.726E-02	5.868E-04
I-134	9.1219E-03	2.55E+12	5.2363E-03	1.302E-07	2.014E-07	2.834E-02	1.400E-02
I-135	1.9006E-02	3.33E+12	4.5145E-03	1.731E-08	2.700E-08	2.540E-02	1.920E-03
Xe-133	0.0000E+00	0.00E+00	5.6979E-02	2.366E-07	1.124E-07	2.649E-02	3.049E-02
Xe-135	0.0000E+00	0.00E+00	2.0827E-02	7.904E-08	3.736E-08	9.403E-03	1.142E-02
Cs-134	2.8505E-03	4.68E+11	5.7746E-04	1.808E-10	1.028E-10	3.345E-03	8.273E-05
Cs-136	9.0959E-04	1.50E+11	1.8478E-04	5.229E-11	2.842E-11	1.070E-03	2.431E-05
Cs-137	1.7104E-03	2.81E+11	3.4648E-04	1.087E-10	6.191E-11	2.007E-03	4.971E-05
Ba-139	9.7499E-06	3.31E+08	2.2448E-07	3.868E-11	1.883E-11	0.000E+00	9.974E-06
Ba-140	1.7967E-05	5.59E+08	3.6686E-07	6.926E-11	3.077E-11	0.000E+00	1.833E-05
La-140	3.7387E-07	1.01E+07	6.1839E-09	1.254E-12	5.047E-13	0.000E+00	3.801E-07
La-141	1.3567E-07	4.35E+06	2.8862E-09	5.279E-13	2.420E-13	0.000E+00	1.386E-07
La-142	9.1696E-08	3.08E+06	2.0838E-09	3.626E-13	1.748E-13	0.000E+00	9.378E-08
Ce-141	4.2736E-07	1.33E+07	8.7229E-09	1.647E-12	7.317E-13	0.000E+00	4.361E-07
Ce-143	3.8252E-07	1.19E+07	7.8448E-09	1.476E-12	6.580E-13	0.000E+00	3.904E-07
Ce-144	3.5002E-07	1.09E+07	7.1434E-09	1.349E-12	5.992E-13	0.000E+00	3.572E-07
Pr-143	1.5410E-07	4.79E+06	3.1427E-09	5.937E-13	2.636E-13	0.000E+00	1.572E-07
Nd-147	1.7157E-07	5.33E+06	3.5037E-09	6.614E-13	2.939E-13	0.000E+00	1.751E-07
Np-239	5.5162E-06	1.72E+08	1.1290E-07	2.128E-11	9.469E-12	0.000E+00	5.629E-06
Pu-238	1.2243E-09	3.80E+04	2.4985E-11	4.719E-15	2.096E-15	0.000E+00	1.249E-09
Pu-239	1.2341E-10	3.83E+03	2.5184E-12	4.757E-16	2.112E-16	0.000E+00	1.259E-10
Pu-240	1.6929E-10	5.26E+03	3.4550E-12	6.525E-16	2.898E-16	0.000E+00	1.727E-10
Pu-241	5.1074E-08	1.59E+06	1.0423E-09	1.969E-13	8.743E-14	0.000E+00	5.212E-08
Am-241	2.6292E-11	8.17E+02	5.3652E-13	1.013E-16	4.500E-17	0.000E+00	2.683E-11
Cm-242	6.6172E-09	2.06E+05	1.3505E-10	2.551E-14	1.133E-14	0.000E+00	6.752E-09
Cm-244	4.2466E-10	1.32E+04	8.6666E-12	1.637E-15	7.269E-16	0.000E+00	4.333E-10

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 1.3000	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	7.4152E+15



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Elemental I (atoms) 2.0154E+13 6.0867E+12
Organic I (atoms) 1.0796E+12 2.4465E+11
Aerosol I (atoms) 4.2602E+14 7.8900E+13
All Aerosols (kg) 1.7662E-08 3.2726E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) = 1.8000 Whole Body Thyroid TEDE
Delta dose (rem) 2.1246E-01 5.7909E+00 4.4613E-01
Accumulated dose (rem) 2.3689E-01 6.6604E+00 5.0388E-01

Low Population Zone Doses:

Time (h) = 1.8000 Whole Body Thyroid TEDE
Delta dose (rem) 2.4788E-01 6.7560E+00 5.2048E-01
Accumulated dose (rem) 3.0894E-01 8.9299E+00 6.6487E-01

Control Room Doses:

Time (h) = 1.8000 Whole Body Thyroid TEDE Skin
Delta dose (rem) 2.8788E-03 1.3712E+00 5.9410E-02 1.1210E-01
Accumulated dose (rem) 3.6795E-03 4.2240E+00 1.8075E-01 1.3942E-01

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 1.8000

Table with 10 columns: Nuclide, Compartment, Dose Fract, Exposure (Ci-hr), Decays (Bq-s), Compartment Dep Surfaces, Pathway 1 Outflow, Pathway 7 Outflow, Pathway 8 Outflow, Pathway 9 Outflow. Lists various isotopes like Co-58, Kr-85, Sr-90, etc.



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Xe-135	4.2422E+07	3.4199E-03	3.0591E+07	4.0718E+21	0.0000E+00	7.8161E+03	4.1642E+00	1.7929E+04	1.7929E+04
Cs-134	2.9057E+06	1.1161E-01	2.6693E+06	3.5556E+20	7.5122E+05	6.8636E+02	1.4816E+00	1.5769E+03	1.5769E+03
Cs-136	9.2621E+05	6.3947E-03	8.5192E+05	1.1348E+20	2.3946E+05	2.1907E+02	4.7405E-01	5.0332E+02	5.0332E+02
Cs-137	1.7435E+06	4.5859E-02	1.6017E+06	2.1334E+20	4.5076E+05	4.1183E+02	8.8893E-01	9.4619E+02	9.4619E+02
Ba-139	7.0757E+05	1.0869E-04	6.2843E+05	8.4769E+19	1.2598E+05	1.6371E+02	0.0000E+00	3.7532E+02	3.7532E+02
Ba-140	1.6747E+06	4.0315E-03	1.1852E+06	1.5788E+20	2.9818E+05	3.0252E+02	0.0000E+00	6.9356E+02	6.9356E+02
La-140	3.5419E+04	1.1428E-04	2.1138E+04	2.6808E+18	7.5890E+03	5.2258E+00	0.0000E+00	1.1980E+01	1.1980E+01
La-141	1.1592E+04	4.7684E-06	8.8519E+03	1.1843E+18	2.0639E+03	2.2758E+00	0.0000E+00	5.2174E+00	5.2174E+00
La-142	6.8343E+03	9.3362E-06	5.9176E+03	7.9715E+17	1.2168E+03	1.5383E+00	0.0000E+00	3.5266E+00	3.5266E+00
Ce-141	3.9878E+04	2.2529E-04	2.8198E+04	3.7560E+18	7.0994E+03	7.1971E+00	0.0000E+00	1.6500E+01	1.6500E+01
Ce-143	3.5323E+04	7.8952E-05	2.5200E+04	3.3584E+18	6.2892E+03	6.4373E+00	0.0000E+00	1.4758E+01	1.4758E+01
Ce-144	3.2662E+04	7.6697E-03	2.3093E+04	3.0760E+18	5.8154E+03	5.8940E+00	0.0000E+00	1.3513E+01	1.3513E+01
Pr-143	1.4381E+04	7.3175E-05	1.0162E+04	1.3533E+18	2.5627E+03	2.5933E+00	0.0000E+00	5.9453E+00	5.9453E+00
Nd-147	1.5990E+04	6.9504E-05	1.1318E+04	1.5076E+18	2.8470E+03	2.8890E+00	0.0000E+00	6.6232E+00	6.6232E+00
Np-239	5.1162E+05	8.3690E-04	3.6363E+05	4.8450E+19	9.1093E+04	9.2855E+01	0.0000E+00	2.1288E+02	2.1288E+02
Pu-238	1.1425E+02	2.0690E-02	8.0775E+01	1.0759E+16	2.0342E+01	2.0616E-02	0.0000E+00	4.7264E-02	4.7264E-02
Pu-239	1.1517E+01	2.2301E-03	8.1422E+00	1.0845E+15	2.0506E+00	2.0781E-03	0.0000E+00	4.7642E-03	4.7642E-03
Pu-240	1.5798E+01	3.0593E-03	1.1170E+01	1.4878E+15	2.8129E+00	2.8508E-03	0.0000E+00	6.5356E-03	6.5356E-03
Pu-241	4.7662E+03	1.4847E-02	3.3698E+03	4.4885E+17	8.4862E+02	8.6006E-01	0.0000E+00	1.9718E+00	1.9718E+00
Am-241	2.4537E+00	6.8443E-04	1.7346E+00	2.3105E+14	4.3690E-01	4.4272E-04	0.0000E+00	1.0150E-03	1.0150E-03
Cm-242	6.1745E+02	6.7038E-03	4.3658E+02	5.8153E+16	1.0994E+02	1.1143E-01	0.0000E+00	2.5546E-01	2.5546E-01
Cm-244	3.9629E+01	6.1725E-03	2.8018E+01	3.7320E+15	7.0560E+00	7.1511E-03	0.0000E+00	1.6394E-02	1.6394E-02
Total	3.0748E+08	1.0000E+00	0.0000E+00	0.0000E+00	2.3659E+07	6.4238E+04	7.7975E+01	1.4745E+05	1.4745E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 5.2148E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 6.4454E-03
 Total I (Ci) 8.8711E+07

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 1.8000	Atmosphere	Sump
Noble gases (atoms)	1.6793E+25	0.0000E+00
Elemental I (atoms)	4.0178E+22	0.0000E+00
Organic I (atoms)	1.2426E+21	0.0000E+00
Aerosol I (atoms)	6.3254E+23	0.0000E+00
All Aerosols (kg)	2.3630E+01	0.0000E+00

Time (h) = 1.8000	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
Aerosol I (atoms)	1.5653E+23	0.0000E+00
All Aerosols (kg)	6.0126E+00	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 1.8000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	3.3742E-04	4.0642E-06	2.2236E-04	2.9619E+10	1.2306E-01	1.9151E-03	5.2546E-04	0.0000E+00
Co-60	4.0413E-04	9.4079E-05	2.6628E-04	3.5469E+10	1.4737E-01	2.2933E-03	6.2920E-04	0.0000E+00
Kr-85	3.8372E-01	5.1760E-07	2.5621E-01	3.4127E+13	1.4391E+02	1.1041E+02	3.2303E+01	0.0000E+00
Kr-85m	5.4040E+00	4.8888E-04	3.8498E+00	5.1478E+14	2.1936E+03	1.6698E+03	5.0482E+02	0.0000E+00
Kr-87	5.1093E+00	3.0331E-03	4.3365E+00	5.8555E+14	2.5672E+03	1.9114E+03	6.3139E+02	0.0000E+00
Kr-88	1.2364E+01	1.5853E-02	9.1549E+00	1.2269E+15	5.2609E+03	3.9857E+03	1.2287E+03	0.0000E+00
Rb-86	1.4854E-02	1.2808E-04	1.1950E-02	1.5918E+12	7.0949E+00	1.0375E-01	3.6977E-02	0.0000E+00
Sr-89	4.3064E-01	1.8888E-02	2.8381E-01	3.7804E+13	1.5708E+02	2.4443E+00	6.7070E-01	0.0000E+00
Sr-90	5.1236E-02	7.0408E-02	3.3759E-02	4.4967E+12	1.8683E+01	2.9074E-01	7.9769E-02	0.0000E+00
Sr-91	4.8029E-01	1.1521E-03	3.2566E-01	4.3458E+13	1.8129E+02	2.8132E+00	7.8138E-01	0.0000E+00
Sr-92	3.7683E-01	6.7345E-04	2.7509E-01	3.6878E+13	1.5544E+02	2.3942E+00	6.8652E-01	0.0000E+00
Y-90	8.7827E-04	6.9750E-06	5.1473E-04	6.6145E+10	2.7454E-01	4.3307E-03	1.1213E-03	0.0000E+00
Y-91	5.6624E-03	2.9178E-04	3.7199E-03	4.9505E+11	2.0568E+00	3.2019E-02	8.7727E-03	0.0000E+00
Y-92	5.3624E-02	4.1762E-05	2.8324E-02	3.4285E+12	1.4310E+01	2.3055E-01	5.4249E-02	0.0000E+00
Y-93	6.1833E-03	1.4815E-05	4.1855E-03	5.5846E+11	2.3291E+00	3.6149E-02	1.0033E-02	0.0000E+00
Zr-95	7.8557E-03	1.9973E-04	5.1770E-03	6.8958E+11	2.8652E+00	4.4587E-02	1.2234E-02	0.0000E+00
Zr-97	7.4010E-03	3.8208E-05	4.9554E-03	6.6074E+11	2.7515E+00	4.2750E-02	1.1810E-02	0.0000E+00
Nb-95	7.9149E-03	5.1962E-05	5.2151E-03	6.9464E+11	2.8862E+00	4.4914E-02	1.2323E-02	0.0000E+00
Mo-99	1.1095E-01	4.7579E-04	7.3408E-02	9.7805E+12	4.0660E+01	6.3249E-01	1.7384E-01	0.0000E+00
Tc-99m	9.9632E-02	1.0003E-05	6.5690E-02	8.7255E+12	3.6359E+01	5.6578E-01	1.5526E-01	0.0000E+00
Ru-103	9.4837E-02	9.2305E-04	6.2506E-02	8.3259E+12	3.4594E+01	5.3834E-01	1.4772E-01	0.0000E+00
Ru-105	5.0523E-02	4.8790E-05	3.5415E-02	4.7357E+12	1.9848E+01	3.0697E-01	8.6492E-02	0.0000E+00
Ru-106	3.8421E-02	1.9410E-02	2.5316E-02	3.3722E+12	1.4011E+01	2.1803E-01	5.9821E-02	0.0000E+00
Rh-105	6.1075E-02	6.4298E-05	4.0283E-02	5.3636E+12	2.2297E+01	3.4696E-01	9.5220E-02	0.0000E+00



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Sb-127	1.3160E-01	8.9145E-04	8.6965E-02	1.1586E+13	4.8157E+01	7.4921E-01	2.0581E-01	0.0000E+00
Sb-129	2.9549E-01	4.6603E-04	2.0749E-01	2.7749E+13	1.1632E+02	1.7988E+00	5.0721E-01	0.0000E+00
Te-127	1.3368E-01	4.5449E-05	8.8231E-02	1.1733E+13	4.8846E+01	7.6001E-01	2.0867E-01	0.0000E+00
Te-127m	1.7935E-02	4.0799E-04	1.1817E-02	1.5740E+12	6.5398E+00	1.0177E-01	2.7922E-02	0.0000E+00
Te-129	3.2929E-01	3.8636E-05	2.2611E-01	2.9825E+13	1.2615E+02	1.9557E+00	5.4555E-01	0.0000E+00
Te-129m	5.7447E-02	1.4604E-03	3.7849E-02	5.0414E+12	2.0946E+01	3.2597E-01	8.9430E-02	0.0000E+00
Te-131m	1.6778E-01	1.3066E-03	1.1155E-01	1.4868E+13	6.1851E+01	9.6166E-01	2.6487E-01	0.0000E+00
Te-132	1.6736E+00	1.6960E-02	1.1065E+00	1.4742E+14	6.1282E+02	9.5334E+00	2.6195E+00	0.0000E+00
I-131	1.0280E+01	4.2045E-01	7.9133E+00	1.0541E+15	3.2211E+03	1.1639E+02	6.7141E+01	1.4207E+03
I-132	1.2232E+01	2.4775E-02	9.8569E+00	1.3206E+15	4.0923E+03	1.4616E+02	8.6490E+01	1.7813E+03
I-133	1.9731E+01	1.5234E-01	1.5408E+01	2.0541E+15	6.2937E+03	2.2688E+02	1.3194E+02	2.7752E+03
I-134	5.5334E+00	1.5718E-02	6.5006E+00	8.8317E+14	2.9205E+03	9.8547E+01	7.1020E+01	1.2769E+03
I-135	1.6245E+01	4.4407E-02	1.3135E+01	1.7542E+15	5.4108E+03	1.9397E+02	1.1499E+02	2.3840E+03
Xe-133	5.5027E+01	9.7381E-04	3.6770E+01	4.8979E+15	2.0649E+04	1.5847E+04	4.6384E+03	8.2888E+00
Xe-135	2.1265E+01	2.8448E-03	1.4081E+01	1.8735E+15	7.8161E+03	6.0686E+03	1.7663E+03	8.5738E+01
Cs-134	1.4383E+00	8.7365E-02	1.1562E+00	1.5401E+14	6.8636E+02	1.0038E+01	3.5761E+00	0.0000E+00
Cs-136	4.5848E-01	5.0047E-03	3.6895E-01	4.9147E+13	2.1907E+02	3.2032E+00	1.1419E+00	0.0000E+00
Cs-137	8.6306E-01	3.5897E-02	6.9378E-01	9.2411E+13	4.1183E+02	6.0228E+00	2.1457E+00	0.0000E+00
Ba-139	3.5015E-01	8.8691E-05	2.8377E-01	3.8277E+13	1.6371E+02	2.4943E+00	7.4837E-01	0.0000E+00
Ba-140	8.2875E-01	3.3596E-03	5.4654E-01	7.2804E+13	3.0252E+02	4.7075E+00	1.2920E+00	0.0000E+00
La-140	1.7541E-02	9.6932E-05	9.9213E-03	1.2594E+12	5.2258E+00	8.2820E-02	2.1008E-02	0.0000E+00
La-141	5.7363E-03	3.9464E-06	4.0540E-03	5.4239E+11	2.2758E+00	3.5169E-02	9.9442E-03	0.0000E+00
La-142	3.3820E-03	7.6368E-06	2.6786E-03	3.6083E+11	1.5383E+00	2.3494E-02	6.9791E-03	0.0000E+00
Ce-141	1.9734E-02	1.8775E-04	1.3004E-02	1.7322E+12	7.1971E+00	1.1200E-01	3.0730E-02	0.0000E+00
Ce-143	1.7480E-02	6.5746E-05	1.1612E-02	1.5476E+12	6.4373E+00	1.0010E-01	2.7559E-02	0.0000E+00
Ce-144	1.6163E-02	6.3919E-03	1.0650E-02	1.4186E+12	5.8940E+00	9.1722E-02	2.5166E-02	0.0000E+00
Pr-143	7.1168E-03	6.0988E-05	4.6866E-03	6.2413E+11	2.5933E+00	4.0359E-02	1.1070E-02	0.0000E+00
Nd-147	7.9128E-03	5.7919E-05	5.2191E-03	6.9523E+11	2.8890E+00	4.4953E-02	1.2339E-02	0.0000E+00
Np-239	2.5318E-01	6.9715E-04	1.6762E-01	2.2334E+13	9.2855E+01	1.4443E+00	3.9708E-01	0.0000E+00
Pu-238	5.6537E-05	1.7243E-02	3.7252E-05	4.9619E+09	2.0616E-02	3.2083E-04	8.8022E-05	0.0000E+00
Pu-239	5.6993E-06	1.8586E-03	3.7550E-06	5.0017E+08	2.0781E-03	3.2339E-05	8.8725E-06	0.0000E+00
Pu-240	7.8179E-06	2.5496E-03	5.1512E-06	6.8614E+08	2.8508E-03	4.4364E-05	1.2172E-05	0.0000E+00
Pu-241	2.3586E-03	1.2374E-02	1.5541E-03	2.0700E+11	8.6006E-01	1.3384E-02	3.6721E-03	0.0000E+00
Am-241	1.2142E-06	5.7041E-04	7.9998E-07	1.0656E+08	4.4272E-04	6.8896E-06	1.8902E-06	0.0000E+00
Cm-242	3.0555E-04	5.5869E-03	2.0134E-04	2.6819E+10	1.1143E-01	1.7340E-03	4.7576E-04	0.0000E+00
Cm-244	1.9611E-05	5.1441E-03	1.2921E-05	1.7211E+09	7.1511E-03	1.1128E-04	3.0532E-05	0.0000E+00
Total	1.7257E+02	1.0000E+00	0.0000E+00	0.0000E+00	6.4238E+04	3.0431E+04	9.2904E+03	9.7322E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 2.4920E-06
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 3.0796E-06
 Total I (Ci) 6.4021E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	1.8000	Atmosphere	Sump
Noble gases (atoms)	8.3102E+18	0.0000E+00	
Elemental I (atoms)	1.6872E+17	0.0000E+00	
Organic I (atoms)	5.2183E+15	0.0000E+00	
Aerosol I (atoms)	3.1309E+17	0.0000E+00	
All Aerosols (kg)	1.1697E-05	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 1.8000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	2.5410E-03	1.2705E-04	0.00000	0.00000	0.00000	0.00000
Co-60	3.0428E-03	1.5214E-04	0.00003	0.00001	0.00000	0.00000
Kr-85	1.4573E+02	7.2814E+00	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.2039E+03	1.1010E+02	0.00736	0.00158	0.00000	0.00016
Kr-87	2.5283E+03	1.2624E+02	0.04327	0.00962	0.00001	0.00091
Kr-88	5.2614E+03	2.6281E+02	0.23594	0.05105	0.00005	0.00499
Rb-86	1.6358E-01	7.7893E-03	0.00004	0.00001	0.00000	0.00000
Sr-89	3.2432E+00	1.6216E-01	0.00591	0.00123	0.00000	0.00030
Sr-90	3.8576E-01	1.9288E-02	0.02202	0.00459	0.00000	0.00113
Sr-91	3.7283E+00	1.8642E-01	0.00036	0.00007	0.00000	0.00002
Sr-92	3.1651E+00	1.5825E-01	0.00020	0.00004	0.00000	0.00001
Y-90	5.9112E-03	2.9556E-04	0.00000	0.00000	0.00000	0.00000
Y-91	4.2513E-02	2.1257E-03	0.00009	0.00002	0.00000	0.00000
Y-92	3.2904E-01	1.6452E-02	0.00001	0.00000	0.00000	0.00000
Y-93	4.7912E-02	2.3956E-03	0.00000	0.00000	0.00000	0.00000
Zr-95	5.9158E-02	2.9579E-03	0.00006	0.00001	0.00000	0.00000
Zr-97	5.6685E-02	2.8343E-03	0.00001	0.00000	0.00000	0.00000
Nb-95	5.9593E-02	2.9796E-03	0.00002	0.00000	0.00000	0.00000



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Mo-99	8.3906E-01	4.1953E-02	0.00015	0.00003	0.00000	0.00001
Tc-99m	7.5067E-01	3.7533E-02	0.00000	0.00000	0.00000	0.00000
Ru-103	7.1427E-01	3.5713E-02	0.00029	0.00006	0.00000	0.00001
Ru-105	4.0635E-01	2.0317E-02	0.00002	0.00000	0.00000	0.00000
Ru-106	2.8929E-01	1.4465E-02	0.00607	0.00127	0.00000	0.00031
Rh-105	4.6033E-01	2.3017E-02	0.00002	0.00000	0.00000	0.00000
Sb-127	9.9394E-01	4.9697E-02	0.00028	0.00006	0.00000	0.00001
Sb-129	2.3810E+00	1.1905E-01	0.00014	0.00003	0.00000	0.00001
Te-127	1.0083E+00	5.0416E-02	0.00001	0.00000	0.00000	0.00000
Te-127m	1.3503E-01	6.7517E-03	0.00013	0.00003	0.00000	0.00001
Te-129	2.5904E+00	1.2952E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	4.3250E-01	2.1625E-02	0.00046	0.00010	0.00000	0.00002
Te-131m	1.2755E+00	6.3774E-02	0.00041	0.00009	0.00000	0.00002
Te-132	1.2647E+01	6.3236E-01	0.00530	0.00111	0.00000	0.00027
I-131	1.9340E+02	9.5033E+00	0.20347	0.07753	0.00220	0.00573
I-132	2.4183E+02	1.1854E+01	0.01185	0.00457	0.00015	0.00031
I-133	3.7796E+02	1.8561E+01	0.07336	0.02805	0.00083	0.00206
I-134	1.7888E+02	8.5934E+00	0.00651	0.00279	0.00022	0.00018
I-135	3.2514E+02	1.5943E+01	0.02113	0.00815	0.00026	0.00059
Xe-133	2.0942E+04	1.0463E+03	0.01493	0.00317	0.00000	0.00032
Xe-135	8.2629E+03	4.1287E+02	0.04380	0.00929	0.00001	0.00105
Cs-134	1.5824E+01	7.5354E-01	0.02426	0.00554	0.00078	0.00171
Cs-136	5.0512E+00	2.4051E-01	0.00139	0.00032	0.00004	0.00010
Cs-137	9.4946E+00	4.5214E-01	0.00997	0.00228	0.00032	0.00070
Ba-139	3.2888E+00	1.6444E-01	0.00003	0.00001	0.00000	0.00000
Ba-140	6.2457E+00	3.1229E-01	0.00105	0.00022	0.00000	0.00005
La-140	1.1413E-01	5.7063E-03	0.00003	0.00001	0.00000	0.00000
La-141	4.6541E-02	2.3270E-03	0.00000	0.00000	0.00000	0.00000
La-142	3.0993E-02	1.5497E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	1.4860E-01	7.4300E-03	0.00006	0.00001	0.00000	0.00000
Ce-143	1.3276E-01	6.6382E-03	0.00002	0.00000	0.00000	0.00000
Ce-144	1.2170E-01	6.0849E-03	0.00200	0.00042	0.00000	0.00010
Pr-143	5.3556E-02	2.6778E-03	0.00002	0.00000	0.00000	0.00000
Nd-147	5.9642E-02	2.9821E-03	0.00002	0.00000	0.00000	0.00000
Np-239	1.9160E+00	9.5799E-02	0.00022	0.00005	0.00000	0.00001
Pu-238	4.2568E-04	2.1284E-05	0.00539	0.00112	0.00000	0.00028
Pu-239	4.2909E-05	2.1454E-06	0.00058	0.00012	0.00000	0.00003
Pu-240	5.8862E-05	2.9431E-06	0.00080	0.00017	0.00000	0.00004
Pu-241	1.7758E-02	8.8792E-04	0.00387	0.00081	0.00000	0.00020
Am-241	9.1413E-06	4.5707E-07	0.00018	0.00004	0.00000	0.00001
Cm-242	2.3007E-03	1.1504E-04	0.00175	0.00036	0.00000	0.00009
Cm-244	1.4765E-04	7.3827E-06	0.00161	0.00034	0.00000	0.00008

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 1.8000		
Noble gases (atoms)	3.1581E+21	4.8736E+17
Elemental I (atoms)	5.4200E+18	8.3643E+14
Organic I (atoms)	5.2082E+17	8.0373E+13
Aerosol I (atoms)	3.2912E+18	5.0791E+14
All Aerosols (kg)	1.2660E-04	1.9538E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 1.8000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	8.0391E+02	4.8309E-06	5.4274E+02	7.2294E+16	0.0000E+00
Co-60	9.6285E+02	1.1183E-04	6.4994E+02	8.6572E+16	0.0000E+00
Rb-86	3.7804E+04	1.7293E-04	3.3133E+04	4.4134E+18	0.0000E+00
Sr-89	1.0260E+06	2.2452E-02	6.9274E+05	9.2274E+19	0.0000E+00
Sr-90	1.2207E+05	8.3690E-02	8.2398E+04	1.0975E+19	0.0000E+00
Sr-91	1.1443E+06	1.3722E-03	7.9646E+05	1.0628E+20	0.0000E+00
Sr-92	8.9780E+05	8.0635E-04	6.7636E+05	9.0670E+19	0.0000E+00
Y-90	2.1415E+03	8.3339E-06	1.2629E+03	1.6232E+17	0.0000E+00
Y-91	1.3500E+04	3.4688E-04	9.0809E+03	1.2085E+18	0.0000E+00
Y-92	1.3463E+05	5.0454E-05	7.0266E+04	8.5133E+18	0.0000E+00
Y-93	1.4732E+04	1.7643E-05	1.0235E+04	1.3656E+18	0.0000E+00
Zr-95	1.8716E+04	2.3741E-04	1.2636E+04	1.6831E+18	0.0000E+00
Zr-97	1.7633E+04	4.5467E-05	1.2109E+04	1.6145E+18	0.0000E+00
Nb-95	1.8857E+04	6.1764E-05	1.2729E+04	1.6955E+18	0.0000E+00
Mo-99	2.6435E+05	5.6571E-04	1.7922E+05	2.3879E+19	0.0000E+00
Tc-99m	2.3737E+05	1.1891E-05	1.6034E+05	2.1298E+19	0.0000E+00



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Ru-103	2.2595E+05	1.0972E-03	1.5257E+05	2.0322E+19	0.0000E+00
Ru-105	1.2037E+05	5.8247E-05	8.6817E+04	1.1609E+19	0.0000E+00
Ru-106	9.1539E+04	2.3071E-02	6.1792E+04	8.2308E+18	0.0000E+00
Rh-105	1.4551E+05	7.6431E-05	9.8326E+04	1.3092E+19	0.0000E+00
Sb-127	3.1354E+05	1.0598E-03	2.1231E+05	2.8285E+19	0.0000E+00
Sb-129	7.0400E+05	5.5643E-04	5.0871E+05	6.8032E+19	0.0000E+00
Te-127	3.1849E+05	5.4029E-05	2.1538E+05	2.8642E+19	0.0000E+00
Te-127m	4.2731E+04	4.8495E-04	2.8843E+04	3.8419E+18	0.0000E+00
Te-129	7.8453E+05	4.6050E-05	5.5339E+05	7.2992E+19	0.0000E+00
Te-129m	1.3687E+05	1.7359E-03	9.2382E+04	1.2305E+19	0.0000E+00
Te-131m	3.9975E+05	1.5541E-03	2.7245E+05	3.6311E+19	0.0000E+00
Te-132	3.9873E+06	2.0164E-02	2.7015E+06	3.5992E+20	0.0000E+00
I-131	1.7508E+07	3.8262E-01	1.4787E+07	1.9698E+21	1.4207E+03
I-132	2.0577E+07	2.2506E-02	1.8387E+07	2.4621E+21	1.7813E+03
I-133	3.3604E+07	1.3890E-01	2.8846E+07	3.8455E+21	2.7752E+03
I-134	9.4241E+06	1.5145E-02	1.2862E+07	1.7473E+21	1.2769E+03
I-135	2.7667E+07	4.0674E-02	2.4704E+07	3.2993E+21	2.3840E+03
Xe-133	1.5373E+05	1.1797E-06	9.1464E+04	1.1160E+19	8.2888E+00
Xe-135	1.5394E+06	9.2829E-05	9.4353E+05	1.1523E+20	8.5738E+01
Cs-134	3.6606E+06	1.1795E-01	3.2055E+06	4.2697E+20	0.0000E+00
Cs-136	1.1668E+06	6.7578E-03	1.0230E+06	1.3627E+20	0.0000E+00
Cs-137	2.1965E+06	4.8465E-02	1.9234E+06	2.5620E+20	0.0000E+00
Ba-139	8.3423E+05	1.0703E-04	7.0321E+05	9.4856E+19	0.0000E+00
Ba-140	1.9745E+06	3.9936E-03	1.3341E+06	1.7771E+20	0.0000E+00
La-140	4.3048E+04	1.1602E-04	2.4383E+04	3.0962E+18	0.0000E+00
La-141	1.3667E+04	4.7141E-06	9.9440E+03	1.3304E+18	0.0000E+00
La-142	8.0576E+03	9.2001E-06	6.6261E+03	8.9259E+17	0.0000E+00
Ce-141	4.7015E+04	2.2317E-04	3.1741E+04	4.2279E+18	0.0000E+00
Ce-143	4.1646E+04	7.8194E-05	2.8359E+04	3.7794E+18	0.0000E+00
Ce-144	3.8508E+04	7.5978E-03	2.5995E+04	3.4625E+18	0.0000E+00
Pr-143	1.6958E+04	7.2495E-05	1.1439E+04	1.5234E+18	0.0000E+00
Nd-147	1.8852E+04	6.8851E-05	1.2740E+04	1.6970E+18	0.0000E+00
Np-239	6.0320E+05	8.2895E-04	4.0926E+05	5.4530E+19	0.0000E+00
Pu-238	1.3470E+02	2.0496E-02	9.0924E+01	1.2111E+16	0.0000E+00
Pu-239	1.3579E+01	2.2092E-03	9.1652E+00	1.2208E+15	0.0000E+00
Pu-240	1.8626E+01	3.0306E-03	1.2573E+01	1.6747E+15	0.0000E+00
Pu-241	5.6194E+03	1.4708E-02	3.7932E+03	5.0525E+17	0.0000E+00
Am-241	2.8929E+00	6.7801E-04	1.9526E+00	2.6008E+14	0.0000E+00
Cm-242	7.2798E+02	6.6409E-03	4.9143E+02	6.5459E+16	0.0000E+00
Cm-244	4.6723E+01	6.1146E-03	3.1539E+01	4.2009E+15	0.0000E+00
Total	1.3237E+08	1.0000E+00	0.0000E+00	0.0000E+00	9.7322E+03

Dose Effective (Ci/cc) I-131 (Thyroid) 8.8006E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.0873E-02
 Total I (Ci) 1.0878E+08

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 1.8000	Atmosphere	Sump
Noble gases (atoms)	6.4078E+21	0.0000E+00
Elemental I (atoms)	8.0447E+23	0.0000E+00
Organic I (atoms)	2.4880E+22	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	2.9499E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 1.8000

Nuclide	Filter	Decays	Transported	Activity	Activity	Activity	Activity
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	2.0232E-07	7.36E+06	4.1294E-09	1.482E-07	2.861E-08	0.000E+00	2.965E-08
Co-60	2.4232E-07	8.81E+06	4.9453E-09	1.775E-07	3.426E-08	0.000E+00	3.551E-08
Kr-85	0.0000E+00	0.00E+00	1.0854E-02	8.331E-03	1.608E-03	1.843E-04	7.299E-04
Kr-85m	0.0000E+00	0.00E+00	1.6005E-01	1.221E-01	2.357E-02	3.411E-03	1.095E-02
Kr-87	0.0000E+00	0.00E+00	1.7139E-01	1.280E-01	2.471E-02	6.420E-03	1.225E-02
Kr-88	0.0000E+00	0.00E+00	3.7636E-01	2.860E-01	5.521E-02	9.136E-03	2.600E-02
Rb-86	3.8771E-05	7.13E+09	6.1704E-06	6.788E-06	1.310E-06	3.464E-05	2.209E-06
Sr-89	2.5822E-04	9.39E+09	5.2705E-06	1.891E-04	3.651E-05	0.000E+00	3.784E-05
Sr-90	3.0721E-05	1.12E+09	6.2696E-07	2.250E-05	4.344E-06	0.000E+00	4.501E-06
Sr-91	2.8798E-04	1.06E+10	5.9959E-06	2.108E-04	4.069E-05	0.000E+00	4.249E-05
Sr-92	2.2595E-04	8.63E+09	4.9494E-06	1.651E-04	3.186E-05	0.000E+00	3.396E-05
Y-90	5.7521E-07	1.91E+07	9.9168E-09	4.146E-07	8.003E-08	0.000E+00	9.047E-08
Y-91	3.4044E-06	1.23E+08	6.9149E-08	2.493E-06	4.811E-07	0.000E+00	4.998E-07
Y-92	3.8929E-05	1.20E+09	5.7174E-07	2.733E-05	5.276E-06	0.000E+00	6.890E-06



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Y-93	3.7076E-06	1.37E+08	7.7100E-08	2.714E-06	5.239E-07	0.000E+00	5.468E-07
Zr-95	4.7103E-06	1.71E+08	9.6140E-08	3.450E-06	6.660E-07	0.000E+00	6.902E-07
Zr-97	4.4377E-06	1.63E+08	9.1587E-08	3.249E-06	6.272E-07	0.000E+00	6.528E-07
Nb-95	4.7458E-06	1.73E+08	9.6853E-08	3.476E-06	6.710E-07	0.000E+00	6.954E-07
Mo-99	6.6529E-05	2.42E+09	1.3616E-06	4.873E-05	9.406E-06	0.000E+00	9.758E-06
Tc-99m	5.9740E-05	2.17E+09	1.2198E-06	4.376E-05	8.447E-06	0.000E+00	8.755E-06
Ru-103	5.6865E-05	2.07E+09	1.1607E-06	4.165E-05	8.040E-06	0.000E+00	8.333E-06
Ru-105	3.0294E-05	1.13E+09	6.4539E-07	2.216E-05	4.277E-06	0.000E+00	4.507E-06
Ru-106	2.3038E-05	8.38E+08	4.7017E-07	1.687E-05	3.257E-06	0.000E+00	3.376E-06
Rh-105	3.6621E-05	1.33E+09	7.4795E-07	2.682E-05	5.178E-06	0.000E+00	5.367E-06
Sb-127	7.8909E-05	2.87E+09	1.6137E-06	5.780E-05	1.116E-05	0.000E+00	1.157E-05
Sb-129	1.7718E-04	6.64E+09	3.7791E-06	1.296E-04	2.501E-05	0.000E+00	2.637E-05
Te-127	8.0155E-05	2.91E+09	1.6378E-06	5.871E-05	1.133E-05	0.000E+00	1.175E-05
Te-127m	1.0754E-05	3.91E+08	2.1947E-07	7.877E-06	1.521E-06	0.000E+00	1.576E-06
Te-129	1.9744E-04	7.24E+09	4.1493E-06	1.445E-04	2.789E-05	0.000E+00	2.923E-05
Te-129m	3.4446E-05	1.25E+09	7.0295E-07	2.523E-05	4.870E-06	0.000E+00	5.047E-06
Te-131m	1.0060E-04	3.67E+09	2.0661E-06	7.368E-05	1.422E-05	0.000E+00	1.477E-05
Te-132	1.0035E-03	3.66E+10	2.0529E-05	7.350E-04	1.419E-04	0.000E+00	1.472E-04
I-131	2.1719E-02	2.99E+12	3.2360E-03	7.898E-03	2.597E-03	1.349E-02	9.804E-04
I-132	2.1512E-02	3.37E+12	4.4831E-03	7.989E-03	2.627E-03	1.920E-02	5.056E-03
I-133	4.1697E-02	5.88E+12	6.4752E-03	1.494E-02	4.911E-03	2.726E-02	1.812E-03
I-134	1.1694E-02	3.28E+12	5.8031E-03	2.228E-03	7.324E-04	2.834E-02	1.418E-02
I-135	3.4330E-02	5.13E+12	5.8982E-03	1.184E-02	3.894E-03	2.540E-02	2.890E-03
Xe-133	0.0000E+00	0.00E+00	1.5573E+00	1.195E+00	2.307E-01	2.649E-02	1.051E-01
Xe-135	0.0000E+00	0.00E+00	5.9805E-01	4.570E-01	8.822E-02	9.403E-03	4.342E-02
Cs-134	3.7541E-03	6.89E+11	5.9590E-04	6.588E-04	1.272E-04	3.345E-03	2.189E-04
Cs-136	1.1966E-03	2.20E+11	1.9066E-04	2.093E-04	4.040E-05	1.070E-03	6.757E-05
Cs-137	2.2526E-03	4.14E+11	3.5754E-04	3.953E-04	7.631E-05	2.007E-03	1.314E-04
Ba-139	2.0995E-04	8.42E+09	4.9333E-06	1.529E-04	2.952E-05	0.000E+00	3.245E-05
Ba-140	4.9692E-04	1.81E+10	1.0148E-05	3.640E-04	7.026E-05	0.000E+00	7.283E-05
La-140	1.1764E-05	3.80E+08	1.9341E-07	8.437E-06	1.629E-06	0.000E+00	1.892E-06
La-141	3.4395E-06	1.29E+08	7.3690E-08	2.515E-06	4.855E-07	0.000E+00	5.128E-07
La-142	2.0279E-06	8.05E+07	4.6927E-08	1.478E-06	2.853E-07	0.000E+00	3.114E-07
Ce-141	1.1832E-05	4.30E+08	2.4150E-07	8.667E-06	1.673E-06	0.000E+00	1.734E-06
Ce-143	1.0481E-05	3.83E+08	2.1513E-07	7.676E-06	1.482E-06	0.000E+00	1.539E-06
Ce-144	9.6913E-06	3.52E+08	1.9779E-07	7.099E-06	1.370E-06	0.000E+00	1.420E-06
Pr-143	4.2693E-06	1.55E+08	8.7054E-08	3.127E-06	6.036E-07	0.000E+00	6.258E-07
Nd-147	4.7446E-06	1.73E+08	9.6898E-08	3.475E-06	6.708E-07	0.000E+00	6.954E-07
Np-239	1.5181E-04	5.53E+09	3.1085E-06	1.112E-04	2.146E-05	0.000E+00	2.227E-05
Pu-238	3.3900E-08	1.23E+06	6.9183E-10	2.483E-08	4.793E-09	0.000E+00	4.967E-09
Pu-239	3.4173E-09	1.24E+05	6.9739E-11	2.503E-09	4.832E-10	0.000E+00	5.007E-10
Pu-240	4.6876E-09	1.70E+05	9.5666E-11	3.434E-09	6.628E-10	0.000E+00	6.869E-10
Pu-241	1.4142E-06	5.14E+07	2.8862E-08	1.036E-06	2.000E-07	0.000E+00	2.072E-07
Am-241	7.2808E-10	2.65E+04	1.4857E-11	5.333E-10	1.029E-10	0.000E+00	1.067E-10
Cm-242	1.8321E-07	6.66E+06	3.7392E-09	1.342E-07	2.590E-08	0.000E+00	2.685E-08
Cm-244	1.1759E-08	4.28E+05	2.3997E-10	8.613E-09	1.663E-09	0.000E+00	1.723E-09

Filtered Environment to Control Room Transport Group Inventory:

	Pathway	
	Filtered	Transported
Time (h) =	1.8000	
Noble gases (atoms)	0.0000E+00	2.2881E+17
Elemental I (atoms)	2.8947E+14	3.9373E+13
Organic I (atoms)	2.2068E+13	2.8387E+12
Aerosol I (atoms)	6.1716E+14	8.2801E+13
All Aerosols (kg)	2.4850E-08	3.4193E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:05

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Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.3754E-02	3.8534E-01	2.9370E-02
Accumulated dose (rem)	2.5065E-01	7.0458E+00	5.3325E-01

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
Delta dose (rem)	3.4386E-02	9.6335E-01	7.3424E-02



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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Accumulated dose (rem) 3.4333E-01 9.8932E+00 7.3830E-01

Control Room Doses:

Time (h) =	2.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)		2.0793E-03	7.5038E-01	3.2754E-02	8.1148E-02
Accumulated dose (rem)		5.7588E-03	4.9744E+00	2.1350E-01	2.2057E-01

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 2.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	7.7078E+02	5.0865E-06	6.2971E+02	8.3878E+16	1.5588E+02	1.6151E-01	0.0000E+00	3.7028E-01	3.7028E-01
Co-60	9.2324E+02	1.1775E-04	7.5412E+02	1.0045E+17	1.8672E+02	1.9342E-01	0.0000E+00	4.4343E-01	4.4343E-01
Kr-85	8.8785E+05	6.5407E-07	7.3257E+05	9.7579E+19	0.0000E+00	1.8792E+02	8.1591E-02	4.3100E+02	4.3100E+02
Kr-85m	1.2123E+07	6.0999E-04	1.0869E+07	1.4534E+21	0.0000E+00	2.8061E+03	1.5084E+00	6.4366E+03	6.4366E+03
Kr-87	1.0601E+07	3.6887E-03	1.1933E+07	1.6113E+21	0.0000E+00	3.1293E+03	2.8333E+00	7.1807E+03	7.1807E+03
Kr-88	2.7246E+07	1.9649E-02	2.5675E+07	3.4408E+21	0.0000E+00	6.6527E+03	4.0384E+00	1.5261E+04	1.5261E+04
Rb-86	3.3007E+04	1.6090E-04	3.3970E+04	4.5249E+18	9.2517E+03	8.7627E+00	1.5341E-02	2.0124E+01	2.0124E+01
Sr-89	9.8362E+05	2.3639E-02	8.0372E+05	1.0706E+20	1.9894E+05	2.0615E+02	0.0000E+00	4.7261E+02	4.7261E+02
Sr-90	1.1705E+05	8.8123E-02	9.5606E+04	1.2735E+19	2.3672E+04	2.4522E+01	0.0000E+00	5.6218E+01	5.6218E+01
Sr-91	1.0813E+06	1.4325E-03	9.1624E+05	1.2227E+20	2.1869E+05	2.3571E+02	0.0000E+00	5.4039E+02	5.4039E+02
Sr-92	8.1794E+05	8.2462E-04	7.6218E+05	1.0217E+20	1.6542E+05	1.9755E+02	0.0000E+00	4.5290E+02	4.5290E+02
Y-90	2.1149E+03	8.9752E-06	1.4987E+03	1.9278E+17	5.0263E+02	3.7579E-01	0.0000E+00	8.6153E-01	8.6153E-01
Y-91	1.2953E+04	3.6543E-04	1.0542E+04	1.4029E+18	2.6339E+03	2.7022E+00	0.0000E+00	6.1951E+00	6.1951E+00
Y-92	1.3161E+05	5.4774E-05	8.4058E+04	1.0246E+19	3.6662E+04	2.0476E+01	0.0000E+00	4.6943E+01	4.6943E+01
Y-93	1.3933E+04	1.8428E-05	1.1780E+04	1.5718E+18	2.8179E+03	3.0300E+00	0.0000E+00	6.9466E+00	6.9466E+00
Zr-95	1.7945E+04	2.4997E-04	1.4661E+04	1.9528E+18	3.6292E+03	3.7603E+00	0.0000E+00	8.6208E+00	8.6208E+00
Zr-97	1.6769E+04	4.7644E-05	1.3982E+04	1.8643E+18	3.3915E+03	3.5922E+00	0.0000E+00	8.2354E+00	8.2354E+00
Nb-95	1.8081E+04	6.5035E-05	1.4769E+04	1.9672E+18	3.6568E+03	3.7881E+00	0.0000E+00	8.6845E+00	8.6845E+00
Mo-99	2.5294E+05	5.9492E-04	2.0769E+05	2.7672E+19	5.1156E+04	5.3293E+01	0.0000E+00	1.2218E+02	1.2218E+02
Tc-99m	2.2751E+05	1.2518E-05	1.8600E+05	2.4706E+19	4.6013E+04	4.7710E+01	0.0000E+00	1.0938E+02	1.0938E+02
Ru-103	2.1662E+05	1.1552E-03	1.7701E+05	2.3578E+19	4.3810E+04	4.5401E+01	0.0000E+00	1.0408E+02	1.0408E+02
Ru-105	1.1187E+05	6.0231E-05	9.8925E+04	1.3228E+19	2.2625E+04	2.5537E+01	0.0000E+00	5.8545E+01	5.8545E+01
Ru-106	8.7772E+04	2.4293E-02	7.1696E+04	9.5500E+18	1.7751E+04	1.8389E+01	0.0000E+00	4.2159E+01	4.2159E+01
Rh-105	1.3942E+05	8.0452E-05	1.1405E+05	1.5186E+19	2.8197E+04	2.9255E+01	0.0000E+00	6.7069E+01	6.7069E+01
Sb-127	3.0019E+05	1.1150E-03	2.4612E+05	3.2789E+19	6.0711E+04	6.3145E+01	0.0000E+00	1.4477E+02	1.4477E+02
Sb-129	6.5372E+05	5.7510E-04	5.7937E+05	7.7483E+19	1.3221E+05	1.4959E+02	0.0000E+00	3.4294E+02	3.4294E+02
Te-127	3.0512E+05	5.6861E-05	2.4977E+05	3.3215E+19	6.1708E+04	6.4074E+01	0.0000E+00	1.4690E+02	1.4690E+02
Te-127m	4.0974E+04	5.1064E-04	3.3467E+04	4.4577E+18	8.2867E+03	8.5837E+00	0.0000E+00	1.9679E+01	1.9679E+01
Te-129	7.3574E+05	4.7890E-05	6.3417E+05	8.3655E+19	1.4880E+05	1.6336E+02	0.0000E+00	3.7452E+02	3.7452E+02
Te-129m	1.3124E+05	1.8278E-03	1.0719E+05	1.4277E+19	2.6542E+04	2.7493E+01	0.0000E+00	6.3029E+01	6.3029E+01
Te-131m	3.8153E+05	1.6319E-03	3.1526E+05	4.2017E+19	7.7162E+04	8.0937E+01	0.0000E+00	1.8555E+02	1.8555E+02
Te-132	3.8165E+06	2.1209E-02	3.1312E+06	4.1717E+20	7.7186E+05	8.0340E+02	0.0000E+00	1.8419E+03	1.8419E+03
I-131	1.5731E+07	3.6569E-01	1.5573E+07	2.0746E+21	3.9306E+06	4.0140E+03	5.9740E+00	9.2161E+03	9.2161E+03
I-132	1.8530E+07	2.1554E-02	1.9404E+07	2.5978E+21	4.1122E+06	5.0399E+03	8.5765E+00	1.1574E+04	1.1574E+04
I-133	3.0012E+07	1.3228E-01	3.0272E+07	4.0356E+21	7.5000E+06	7.8120E+03	1.2087E+01	1.7937E+04	1.7937E+04
I-134	7.2338E+06	1.3371E-02	1.2512E+07	1.6998E+21	1.8077E+06	3.3227E+03	1.2841E+01	7.6471E+03	7.6471E+03
I-135	2.4359E+07	3.8415E-02	2.5711E+07	3.4336E+21	6.0873E+06	6.6540E+03	1.1285E+01	1.5281E+04	1.5281E+04
Xe-133	1.2720E+08	1.2298E-03	1.0507E+08	1.3996E+22	0.0000E+00	2.6956E+04	1.1726E+01	6.1827E+04	6.1827E+04
Xe-135	4.8674E+07	3.5586E-03	3.9856E+07	5.3058E+21	0.0000E+00	1.0228E+04	4.1642E+00	2.3459E+04	2.3459E+04
Cs-134	3.1970E+06	1.0977E-01	3.2871E+06	4.3784E+20	8.9611E+05	8.4787E+02	1.4816E+00	1.9472E+03	1.9472E+03
Cs-136	1.0186E+06	6.2872E-03	1.0488E+06	1.3970E+20	2.8552E+05	2.7055E+02	4.7405E+01	6.2133E+02	6.2133E+02
Cs-137	1.9183E+06	4.5101E-02	1.9723E+06	2.6272E+20	5.3770E+05	5.0875E+02	8.8893E-01	1.1684E+03	1.1684E+03
Ba-139	7.2337E+05	1.0665E-04	7.7214E+05	1.0415E+20	1.4630E+05	2.0211E+02	0.0000E+00	4.6336E+02	4.6336E+02
Ba-140	1.8924E+06	4.2040E-03	1.5475E+06	2.0614E+20	3.8273E+05	3.9695E+02	0.0000E+00	9.1004E+02	9.1004E+02
La-140	4.2842E+04	1.2584E-04	2.9143E+04	3.7061E+18	1.0583E+04	7.2544E+00	0.0000E+00	1.6631E+01	1.6631E+01
La-141	1.2650E+04	4.8636E-06	1.1305E+04	1.5125E+18	2.5585E+03	2.9207E+00	0.0000E+00	6.6959E+00	6.6959E+00
La-142	7.0617E+03	9.2170E-06	7.3149E+03	9.8538E+17	1.4282E+03	1.9107E+00	0.0000E+00	4.3804E+00	4.3804E+00
Ce-141	4.5078E+04	2.3498E-04	3.6827E+04	4.9054E+18	9.1155E+03	9.4458E+00	0.0000E+00	2.1655E+01	2.1655E+01
Ce-143	3.9765E+04	8.2130E-05	3.2823E+04	4.3743E+18	8.0422E+03	8.4260E+00	0.0000E+00	1.9317E+01	1.9317E+01
Ce-144	3.6923E+04	8.0001E-03	3.0161E+04	4.0174E+18	7.4674E+03	7.7358E+00	0.0000E+00	1.7735E+01	1.7735E+01
Pr-143	1.6263E+04	7.6342E-05	1.3274E+04	1.7678E+18	3.2921E+03	3.4043E+00	0.0000E+00	7.8047E+00	7.8047E+00
Nd-147	1.8067E+04	7.2474E-05	1.4777E+04	1.9684E+18	3.6540E+03	3.7905E+00	0.0000E+00	8.6900E+00	8.6900E+00
Np-239	5.7697E+05	8.7158E-04	4.7417E+05	6.3178E+19	1.1669E+05	1.2168E+02	0.0000E+00	2.7896E+02	2.7896E+02
Pu-238	1.2916E+02	2.1581E-02	1.0550E+02	1.4052E+16	2.6121E+01	2.7059E-02	0.0000E+00	6.2034E-02	6.2034E-02
Pu-239	1.3020E+01	3.5262E-03	1.0634E+01	1.4165E+15	2.6333E+00	2.7276E-03	0.0000E+00	6.2532E-03	6.2532E-03
Pu-240	1.7860E+01	3.1911E-03	1.4588E+01	1.9431E+15	3.6120E+00	3.7417E-03	0.0000E+00	8.5781E-03	8.5781E-03
Pu-241	5.3882E+03	1.5487E-02	4.4012E+03	5.8623E+17	1.0897E+03	1.1288E+00	0.0000E+00	2.5879E+00	2.5879E+00
Am-241	2.7740E+00	7.1394E-04	2.2656E+00	3.0177E+14	5.6106E-01	5.8109E-04	0.0000E+00	1.3322E-03	1.3322E-03
Cm-242	6.9800E+02	6.9925E-03	5.7019E+02	7.5950E+16	1.4117E+02	1.4625E-01	0.0000E+00	3.3528E-01	3.3528E-01



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Cm-244	4.4801E+01	6.4384E-03	3.6594E+01	4.8743E+15	9.0606E+00	9.3858E-03	0.0000E+00	2.1518E-02	2.1518E-02
Total	3.4280E+08	1.0000E+00	0.0000E+00	0.0000E+00	2.8017E+07	8.1489E+04	7.7975E+01	1.8700E+05	1.8700E+05

Dose Effective (Ci/cc) I-131 (Thyroid)	5.7544E-03
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	7.0952E-03
Total I (Ci)	9.5866E+07

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) =	2.0000	Atmosphere	Sump
Noble gases (atoms)		1.9223E+25	0.0000E+00
Elemental I (atoms)		4.5058E+22	0.0000E+00
Organic I (atoms)		1.3936E+21	0.0000E+00
Aerosol I (atoms)		6.9718E+23	0.0000E+00
All Aerosols (kg)		2.6035E+01	0.0000E+00

Time (h) =	2.0000	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
Aerosol I (atoms)		1.8811E+23	0.0000E+00
All Aerosols (kg)		7.1918E+00	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 2.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Inflow	Pathway 2 Outflow	Pathway 3 Outflow	Pathway 12 Inflow
Co-58	3.8150E-04	4.2100E-06	2.9538E-04	3.9345E+10	1.6151E-01	2.5589E-03	6.4974E-04	0.0000E+00
Co-60	4.5696E-04	9.7461E-05	3.5375E-04	4.7119E+10	1.9342E-01	3.0645E-03	7.7806E-04	0.0000E+00
Kr-85	4.3939E-01	5.3550E-07	3.3991E-01	4.5276E+13	1.8792E+02	1.4725E+02	3.9415E+01	0.0000E+00
Kr-85m	5.9994E+00	4.9569E-04	5.0057E+00	6.6935E+14	2.8061E+03	2.1826E+03	6.0379E+02	0.0000E+00
Kr-87	5.2463E+00	2.9327E-03	5.3769E+00	7.2604E+14	3.1293E+03	2.3820E+03	7.2223E+02	0.0000E+00
Kr-88	1.3484E+01	1.5893E-02	1.1770E+01	1.5774E+15	6.6527E+03	5.1508E+03	1.4536E+03	0.0000E+00
Rb-86	1.6341E-02	1.2627E-04	1.5108E-02	2.0124E+12	8.7627E+00	1.3168E-01	4.2369E-02	0.0000E+00
Sr-89	4.8688E-01	1.9565E-02	3.7701E-01	5.0218E+13	2.0615E+02	3.2661E+00	8.2931E-01	0.0000E+00
Sr-90	5.7932E-02	7.2939E-02	4.4847E-02	5.9737E+12	2.4522E+01	3.8851E-01	9.8641E-02	0.0000E+00
Sr-91	5.3520E-01	1.1825E-03	4.2865E-01	5.7201E+13	2.3571E+02	3.7245E+00	9.5729E-01	0.0000E+00
Sr-92	4.0484E-01	6.7590E-04	3.5405E-01	4.7463E+13	1.9755E+02	3.0993E+00	8.2263E-01	0.0000E+00
Y-90	1.0474E-03	7.5176E-06	7.1142E-04	9.1552E+10	3.7579E-01	6.0272E-03	1.4488E-03	0.0000E+00
Y-91	6.4114E-03	3.0256E-04	4.9464E-03	6.5828E+11	2.7022E+00	4.2826E-02	1.0859E-02	0.0000E+00
Y-92	6.5223E-02	4.6563E-05	4.0497E-02	4.9538E+12	2.0476E+01	3.3395E-01	7.4207E-02	0.0000E+00
Y-93	6.8962E-03	1.5215E-05	5.5121E-03	7.3547E+11	3.0300E+00	4.7886E-02	1.2299E-02	0.0000E+00
Zr-95	8.8817E-03	2.0689E-04	6.8770E-03	9.1603E+11	3.7603E+00	5.9576E-02	1.5127E-02	0.0000E+00
Zr-97	8.3000E-03	3.9376E-05	6.5489E-03	8.7320E+11	3.5922E+00	5.6828E-02	1.4528E-02	0.0000E+00
Nb-95	8.9494E-03	5.3829E-05	6.9280E-03	9.2280E+11	3.7881E+00	6.0017E-02	1.5238E-02	0.0000E+00
Mo-99	1.2519E-01	4.9223E-04	9.7389E-02	1.2976E+13	5.3293E+01	8.4404E-01	2.1467E-01	0.0000E+00
Tc-99m	1.1261E-01	1.0361E-05	8.7247E-02	1.1589E+13	4.7710E+01	7.5587E-01	1.9196E-01	0.0000E+00
Ru-103	1.0722E-01	9.5614E-04	8.3029E-02	1.1060E+13	4.5401E+01	7.1929E-01	1.8265E-01	0.0000E+00
Ru-105	5.5371E-02	4.9564E-05	4.6135E-02	6.1693E+12	2.5537E+01	4.0223E-01	1.0488E-01	0.0000E+00
Ru-106	4.3443E-02	2.0107E-02	3.3632E-02	4.4797E+12	1.8389E+01	2.9135E-01	7.3973E-02	0.0000E+00
Rh-105	6.9008E-02	6.6585E-05	5.3495E-02	7.1229E+12	2.9255E+01	4.6347E-01	1.1771E-01	0.0000E+00
Sb-127	1.4858E-01	9.2261E-04	1.1542E-01	1.5377E+13	6.3145E+01	1.0002E+00	2.5426E-01	0.0000E+00
Sb-129	3.2356E-01	4.7317E-04	2.7015E-01	3.6129E+13	1.4959E+02	2.3557E+00	6.1472E-01	0.0000E+00
Te-127	1.5102E-01	4.7056E-05	1.1715E-01	1.5578E+13	6.4074E+01	1.0150E+00	2.5789E-01	0.0000E+00
Te-127m	2.0280E-02	4.2266E-04	1.5699E-02	2.0911E+12	8.5837E+00	1.3600E-01	3.4528E-02	0.0000E+00
Te-129	3.6415E-01	3.9493E-05	2.9639E-01	3.9099E+13	1.6336E+02	2.5787E+00	6.6581E-01	0.0000E+00
Te-129m	6.4957E-02	1.5129E-03	5.0282E-02	6.6974E+12	2.7493E+01	4.3559E-01	1.1059E-01	0.0000E+00
Te-131m	1.8884E-01	1.3496E-03	1.4776E-01	1.9693E+13	8.0937E+01	1.2813E+00	3.2656E-01	0.0000E+00
Te-132	1.8890E+00	1.7549E-02	1.4683E+00	1.9563E+14	8.0340E+02	1.2725E+01	3.2355E+00	0.0000E+00
I-131	1.1430E+01	4.1903E-01	1.0113E+01	1.3472E+15	4.0140E+03	1.4981E+02	7.8183E+01	1.7887E+03
I-132	1.3351E+01	2.4391E-02	1.2444E+01	1.6672E+15	5.0399E+03	1.8581E+02	9.9589E+01	2.2118E+03
I-133	2.1806E+01	1.5123E-01	1.9615E+01	2.6149E+15	7.8120E+03	2.9089E+02	1.5308E+02	3.4797E+03
I-134	5.2559E+00	1.4280E-02	7.5736E+00	1.0289E+15	3.3227E+03	1.1550E+02	7.6620E+01	1.4635E+03
I-135	1.7698E+01	4.3678E-02	1.6568E+01	2.2126E+15	6.6540E+03	2.4638E+02	1.3230E+02	2.9609E+03
Xe-133	6.2985E+01	1.0072E-03	4.8770E+01	6.4964E+15	2.6956E+04	2.1130E+04	5.6581E+03	1.1608E+01
Xe-135	2.4428E+01	2.9507E-03	1.8730E+01	2.4924E+15	1.0228E+04	8.1153E+03	2.1613E+03	1.1879E+02
Cs-134	1.5827E+00	8.6146E-02	1.4620E+00	1.9475E+14	8.4787E+02	1.2743E+01	4.0982E+00	0.0000E+00
Cs-136	5.0428E-01	4.9335E-03	4.6640E-01	6.2128E+13	2.7055E+02	4.0654E+00	1.3083E+00	0.0000E+00
Cs-137	9.4970E-01	3.5396E-02	8.7727E-01	1.1685E+14	5.0875E+02	7.6461E+00	2.4590E+00	0.0000E+00
Ba-139	3.5803E-01	8.6496E-05	3.5489E-01	4.7871E+13	2.0211E+02	3.1373E+00	8.7249E-01	0.0000E+00
Ba-140	9.3665E-01	3.4794E-03	7.2585E-01	9.6689E+13	3.9695E+02	6.2886E+00	1.5972E+00	0.0000E+00
La-140	2.1221E-02	1.0580E-04	1.3886E-02	1.7672E+12	7.2544E+00	1.1682E-01	2.7570E-02	0.0000E+00



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La-141	6.2613E-03	3.9990E-06	5.2681E-03	7.0481E+11	2.9207E+00	4.5968E-02	1.2029E-02	0.0000E+00
La-142	3.4952E-03	7.4929E-06	3.3701E-03	4.5399E+11	1.9107E+00	2.9730E-02	8.1828E-03	0.0000E+00
Ce-141	2.2311E-02	1.9449E-04	1.7275E-02	2.3010E+12	9.4458E+00	1.4965E-01	3.7999E-02	0.0000E+00
Ce-143	1.9682E-02	6.7928E-05	1.5385E-02	2.0504E+12	8.4260E+00	1.3340E-01	3.3987E-02	0.0000E+00
Ce-144	1.8275E-02	6.6216E-03	1.4148E-02	1.8845E+12	7.7358E+00	1.2256E-01	3.1119E-02	0.0000E+00
Pr-143	8.0492E-03	6.3191E-05	6.2271E-03	8.2928E+11	3.4043E+00	5.3940E-02	1.3692E-02	0.0000E+00
Nd-147	8.9424E-03	5.9981E-05	6.9310E-03	9.2327E+11	3.7905E+00	6.0049E-02	1.5253E-02	0.0000E+00
Np-239	2.8557E-01	7.2108E-04	2.2233E-01	2.9623E+13	1.2168E+02	1.9270E+00	4.9025E-01	0.0000E+00
Pu-238	6.3927E-05	1.7863E-02	4.9488E-05	6.5918E+09	2.7059E-02	4.2871E-04	1.0885E-04	0.0000E+00
Pu-239	6.4444E-06	1.9254E-03	4.9885E-06	6.6446E+08	2.7276E-03	4.3215E-05	1.0972E-05	0.0000E+00
Pu-240	8.8397E-06	2.6413E-03	6.8431E-06	9.1150E+08	3.7417E-03	5.9281E-05	1.5051E-05	0.0000E+00
Pu-241	2.6669E-03	1.2819E-02	2.0645E-03	2.7499E+11	1.1288E+00	1.7885E-02	4.5409E-03	0.0000E+00
Am-241	1.3730E-06	5.9093E-04	1.0628E-06	1.4156E+08	5.8109E-04	9.2066E-06	2.3374E-06	0.0000E+00
Cm-242	3.4548E-04	5.7876E-03	2.6747E-04	3.5627E+10	1.4625E-01	2.3171E-03	5.8831E-04	0.0000E+00
Cm-244	2.2174E-05	5.3290E-03	1.7166E-05	2.2865E+09	9.3858E-03	1.4870E-04	3.7756E-05	0.0000E+00
Total	1.9212E+02	1.0000E+00	0.0000E+00	0.0000E+00	8.1489E+04	4.0169E+04	1.1199E+04	1.2035E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 2.7645E-06
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 3.4081E-06
 Total I (Ci) 6.9541E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	2.0000	Atmosphere	Sump
Noble gases (atoms)	9.5146E+18	0.0000E+00	
Elemental I (atoms)	1.8927E+17	0.0000E+00	
Organic I (atoms)	5.8536E+15	0.0000E+00	
Aerosol I (atoms)	3.4513E+17	0.0000E+00	
All Aerosols (kg)	1.2889E-05	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 2.0000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	3.3539E-03	1.6770E-04	0.00000	0.00000	0.00000	0.00000
Co-60	4.0166E-03	2.0083E-04	0.00003	0.00001	0.00000	0.00000
Kr-85	1.9071E+02	9.5304E+00	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.8250E+03	1.4115E+02	0.00738	0.00158	0.00000	0.00016
Kr-87	3.0874E+03	1.5419E+02	0.04303	0.00951	0.00001	0.00092
Kr-88	6.6666E+03	3.3307E+02	0.23613	0.05079	0.00005	0.00508
Rb-86	1.9941E-01	9.5808E-03	0.00004	0.00001	0.00000	0.00000
Sr-89	4.2807E+00	2.1404E-01	0.00594	0.00123	0.00000	0.00031
Sr-90	5.0922E-01	2.5461E-02	0.02214	0.00460	0.00000	0.00116
Sr-91	4.8749E+00	2.4375E-01	0.00036	0.00007	0.00000	0.00002
Sr-92	4.0441E+00	2.0221E-01	0.00020	0.00004	0.00000	0.00001
Y-90	8.1382E-03	4.0691E-04	0.00000	0.00000	0.00000	0.00000
Y-91	5.6176E-02	2.8088E-03	0.00009	0.00002	0.00000	0.00000
Y-92	4.6958E-01	2.3479E-02	0.00001	0.00000	0.00000	0.00000
Y-93	6.2681E-02	3.1341E-03	0.00000	0.00000	0.00000	0.00000
Zr-95	7.8085E-02	3.9043E-03	0.00006	0.00001	0.00000	0.00000
Zr-97	7.4425E-02	3.7213E-03	0.00001	0.00000	0.00000	0.00000
Nb-95	7.8664E-02	3.9332E-03	0.00002	0.00000	0.00000	0.00000
Mo-99	1.1060E+00	5.5302E-02	0.00015	0.00003	0.00000	0.00001
Tc-99m	9.9067E-01	4.9533E-02	0.00000	0.00000	0.00000	0.00000
Ru-103	9.4276E-01	4.7138E-02	0.00029	0.00006	0.00000	0.00002
Ru-105	5.2569E-01	2.6285E-02	0.00002	0.00000	0.00000	0.00000
Ru-106	3.8187E-01	1.9093E-02	0.00610	0.00127	0.00000	0.00032
Rh-105	6.0742E-01	3.0371E-02	0.00002	0.00000	0.00000	0.00000
Sb-127	1.3107E+00	6.5537E-02	0.00028	0.00006	0.00000	0.00001
Sb-129	3.0786E+00	1.5393E-01	0.00014	0.00003	0.00000	0.00001
Te-127	1.3302E+00	6.6512E-02	0.00001	0.00000	0.00000	0.00000
Te-127m	1.7825E-01	8.9125E-03	0.00013	0.00003	0.00000	0.00001
Te-129	3.3728E+00	1.6864E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	5.7092E-01	2.8546E-02	0.00046	0.00010	0.00000	0.00002
Te-131m	1.6786E+00	8.3929E-02	0.00041	0.00009	0.00000	0.00002
Te-132	1.6675E+01	8.3376E-01	0.00533	0.00111	0.00000	0.00028
I-131	2.3901E+02	1.1784E+01	0.20387	0.07710	0.00208	0.00582
I-132	2.9482E+02	1.4503E+01	0.01185	0.00453	0.00014	0.00031
I-133	4.6518E+02	2.2922E+01	0.07346	0.02787	0.00078	0.00210
I-134	2.0112E+02	9.7054E+00	0.00642	0.00272	0.00020	0.00018
I-135	3.9630E+02	1.9501E+01	0.02112	0.00808	0.00025	0.00060
Xe-133	2.7401E+04	1.3693E+03	0.01503	0.00317	0.00000	0.00033
Xe-135	1.0860E+04	5.4272E+02	0.04409	0.00930	0.00001	0.00108



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Cs-134	1.9294E+01	9.2704E-01	0.02426	0.00549	0.00073	0.00174
Cs-136	6.1570E+00	2.9580E-01	0.00139	0.00031	0.00004	0.00010
Cs-137	1.1577E+01	5.5625E-01	0.00997	0.00226	0.00030	0.00071
Ba-139	4.0806E+00	2.0403E-01	0.00003	0.00001	0.00000	0.00000
Ba-140	8.2420E+00	4.1210E-01	0.00106	0.00022	0.00000	0.00006
La-140	1.5922E-01	7.9612E-03	0.00003	0.00001	0.00000	0.00000
La-141	6.0057E-02	3.0028E-03	0.00000	0.00000	0.00000	0.00000
La-142	3.8692E-02	1.9346E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	1.9615E-01	9.8073E-03	0.00006	0.00001	0.00000	0.00000
Ce-143	1.7477E-01	8.7385E-03	0.00002	0.00000	0.00000	0.00000
Ce-144	1.6064E-01	8.0321E-03	0.00201	0.00042	0.00000	0.00010
Pr-143	7.0708E-02	3.5354E-03	0.00002	0.00000	0.00000	0.00000
Nd-147	7.8702E-02	3.9351E-03	0.00002	0.00000	0.00000	0.00000
Np-239	2.5251E+00	1.2625E-01	0.00022	0.00005	0.00000	0.00001
Pu-238	5.6190E-04	2.8095E-05	0.00542	0.00113	0.00000	0.00028
Pu-239	5.6641E-05	2.8321E-06	0.00058	0.00012	0.00000	0.00003
Pu-240	7.7700E-05	3.8850E-06	0.00080	0.00017	0.00000	0.00004
Pu-241	2.3441E-02	1.1721E-03	0.00389	0.00081	0.00000	0.00020
Am-241	1.2067E-05	6.0336E-07	0.00018	0.00004	0.00000	0.00001
Cm-242	3.0369E-03	1.5185E-04	0.00176	0.00036	0.00000	0.00009
Cm-244	1.9491E-04	9.7453E-06	0.00162	0.00034	0.00000	0.00008

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 2.0000		
Noble gases (atoms)	4.1326E+21	5.7397E+17
Elemental I (atoms)	6.7243E+18	9.3393E+14
Organic I (atoms)	6.2031E+17	8.6155E+13
Aerosol I (atoms)	4.0449E+18	5.6179E+14
All Aerosols (kg)	1.5482E-04	2.1503E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 2.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.2751E+02	5.0561E-06	7.1898E+02	9.5769E+16	0.0000E+00
Co-60	1.1110E+03	1.1705E-04	8.6103E+02	1.1469E+17	0.0000E+00
Rb-86	4.2305E+04	1.7013E-04	4.1256E+04	5.4955E+18	0.0000E+00
Sr-89	1.1837E+06	2.3498E-02	9.1765E+05	1.2223E+20	0.0000E+00
Sr-90	1.4085E+05	8.7597E-02	1.0916E+05	1.4540E+19	0.0000E+00
Sr-91	1.3012E+06	1.4224E-03	1.0450E+06	1.3945E+20	0.0000E+00
Sr-92	9.8426E+05	8.1656E-04	8.6691E+05	1.1621E+20	0.0000E+00
Y-90	2.6203E+03	9.1263E-06	1.7504E+03	2.2534E+17	0.0000E+00
Y-91	1.5602E+04	3.6347E-04	1.2043E+04	1.6028E+18	0.0000E+00
Y-92	1.6847E+05	5.7519E-05	1.0139E+05	1.2428E+19	0.0000E+00
Y-93	1.6766E+04	1.8300E-05	1.3437E+04	1.7928E+18	0.0000E+00
Zr-95	2.1593E+04	2.4848E-04	1.6739E+04	2.2297E+18	0.0000E+00
Zr-97	2.0179E+04	4.7331E-05	1.5954E+04	2.1273E+18	0.0000E+00
Nb-95	2.1758E+04	6.4647E-05	1.6863E+04	2.2461E+18	0.0000E+00
Mo-99	3.0438E+05	5.9128E-04	2.3710E+05	3.1590E+19	0.0000E+00
Tc-99m	2.7378E+05	1.2443E-05	2.1237E+05	2.8208E+19	0.0000E+00
Ru-103	2.6067E+05	1.1483E-03	2.0210E+05	2.6920E+19	0.0000E+00
Ru-105	1.3462E+05	5.9733E-05	1.1269E+05	1.5069E+19	0.0000E+00
Ru-106	1.0562E+05	2.4148E-02	8.1860E+04	1.0904E+19	0.0000E+00
Rh-105	1.6777E+05	7.9969E-05	1.3021E+05	1.7338E+19	0.0000E+00
Sb-127	3.6123E+05	1.1082E-03	2.8098E+05	3.7433E+19	0.0000E+00
Sb-129	7.8665E+05	5.7031E-04	6.5993E+05	8.8257E+19	0.0000E+00
Te-127	3.6716E+05	5.6518E-05	2.8516E+05	3.7922E+19	0.0000E+00
Te-127m	4.9306E+04	5.0759E-04	3.8211E+04	5.0897E+18	0.0000E+00
Te-129	8.8534E+05	4.7532E-05	7.2298E+05	9.5371E+19	0.0000E+00
Te-129m	1.5793E+05	1.8169E-03	1.2239E+05	1.6302E+19	0.0000E+00
Te-131m	4.5911E+05	1.6216E-03	3.5983E+05	4.7957E+19	0.0000E+00
Te-132	4.5926E+06	2.1080E-02	3.5746E+06	4.7625E+20	0.0000E+00
I-131	1.9683E+07	3.7944E-01	1.8561E+07	2.4725E+21	1.7887E+03
I-132	2.2665E+07	2.2015E-02	2.2765E+07	3.0479E+21	2.2118E+03
I-133	3.7553E+07	1.3719E-01	3.6062E+07	4.8074E+21	3.4797E+03
I-134	9.0514E+06	1.3678E-02	1.4702E+07	1.9973E+21	1.4635E+03
I-135	3.0479E+07	3.9793E-02	3.0591E+07	4.0855E+21	2.9609E+03
Xe-133	1.9212E+05	1.2936E-06	1.2694E+05	1.5630E+19	1.1608E+01
Xe-135	1.8965E+06	1.0071E-04	1.2956E+06	1.5966E+20	1.1879E+02
Cs-134	4.0976E+06	1.1606E-01	3.9922E+06	5.3177E+20	0.0000E+00
Cs-136	1.3056E+06	6.6476E-03	1.2737E+06	1.6967E+20	0.0000E+00



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Cs-137	2.4587E+06	4.7689E-02	2.3955E+06	3.1908E+20	0.0000E+00
Ba-139	8.7046E+05	1.0520E-04	8.7484E+05	1.1801E+20	0.0000E+00
Ba-140	2.2772E+06	4.1788E-03	1.7668E+06	2.3535E+20	0.0000E+00
La-140	5.3482E+04	1.2887E-04	3.4281E+04	4.3656E+18	0.0000E+00
La-141	1.5223E+04	4.8219E-06	1.2874E+04	1.7224E+18	0.0000E+00
La-142	8.4976E+03	9.0994E-06	8.2949E+03	1.1174E+18	0.0000E+00
Ce-141	5.4243E+04	2.3358E-04	4.2047E+04	5.6007E+18	0.0000E+00
Ce-143	4.7851E+04	8.1615E-05	3.7465E+04	4.9929E+18	0.0000E+00
Ce-144	4.4431E+04	7.9523E-03	3.4437E+04	4.5870E+18	0.0000E+00
Pr-143	1.9572E+04	7.5894E-05	1.5158E+04	2.0186E+18	0.0000E+00
Nd-147	2.1741E+04	7.2039E-05	1.6871E+04	2.2474E+18	0.0000E+00
Np-239	6.9429E+05	8.6622E-04	5.4129E+05	7.2122E+19	0.0000E+00
Pu-238	1.5542E+02	2.1452E-02	1.2045E+02	1.6044E+16	0.0000E+00
Pu-239	1.5668E+01	2.3124E-03	1.2142E+01	1.6173E+15	0.0000E+00
Pu-240	2.1492E+01	3.1721E-03	1.6656E+01	2.2186E+15	0.0000E+00
Pu-241	6.4838E+03	1.5395E-02	5.0251E+03	6.6934E+17	0.0000E+00
Am-241	3.3381E+00	7.0968E-04	2.5868E+00	3.4456E+14	0.0000E+00
Cm-242	8.3994E+02	6.9507E-03	6.5102E+02	8.6716E+16	0.0000E+00
Cm-244	5.3910E+01	6.4000E-03	4.1782E+01	5.5653E+15	0.0000E+00
Total	1.4632E+08	1.0000E+00	0.0000E+00	0.0000E+00	1.2035E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 9.8719E-03
 Dose Effective (Ci/cc) I-131' (ICRP2 Thyroid) 1.2167E-02
 Total I (Ci) 1.1943E+08

Suppression Pool Compartment Group Inventory Distribution:

Time (h) =	2.0000	Atmosphere	Sump
Noble gases (atoms)		7.9601E+21	0.0000E+00
Elemental I (atoms)		9.0231E+23	0.0000E+00
Organic I (atoms)		2.7907E+22	0.0000E+00
Aerosol I (atoms)		0.0000E+00	0.0000E+00
All Aerosols (kg)		3.3069E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 2.0000

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	2.1732E-07	1.30E+07	4.4358E-09	1.482E-07	2.861E-08	0.000E+00	4.495E-08
Co-60	2.6030E-07	1.56E+07	5.3123E-09	1.775E-07	3.426E-08	0.000E+00	5.385E-08
Kr-85	0.0000E+00	0.00E+00	1.1204E-02	8.331E-03	1.608E-03	1.843E-04	1.080E-03
Kr-85m	0.0000E+00	0.00E+00	1.6493E-01	1.221E-01	2.357E-02	3.411E-03	1.582E-02
Kr-87	0.0000E+00	0.00E+00	1.7586E-01	1.280E-01	2.471E-02	6.420E-03	1.672E-02
Kr-88	0.0000E+00	0.00E+00	3.8743E-01	2.860E-01	5.521E-02	9.136E-03	3.706E-02
Rb-86	3.9591E-05	8.17E+09	6.1873E-06	6.788E-06	1.310E-06	3.464E-05	3.046E-06
Sr-89	2.7735E-04	1.66E+10	5.6616E-06	1.891E-04	3.651E-05	0.000E+00	5.736E-05
Sr-90	3.3001E-05	1.97E+09	6.7349E-07	2.250E-05	4.344E-06	0.000E+00	6.828E-06
Sr-91	3.0487E-04	1.86E+10	6.4295E-06	2.108E-04	4.069E-05	0.000E+00	5.981E-05
Sr-92	2.3061E-04	1.48E+10	5.2847E-06	1.651E-04	3.186E-05	0.000E+00	3.896E-05
Y-90	6.8909E-07	3.58E+07	1.0850E-08	4.146E-07	8.003E-08	0.000E+00	2.053E-07
Y-91	3.6696E-06	2.18E+08	7.4316E-08	2.493E-06	4.811E-07	0.000E+00	7.702E-07
Y-92	4.9495E-05	2.36E+09	6.3820E-07	2.733E-05	5.276E-06	0.000E+00	1.752E-05
Y-93	3.9284E-06	2.39E+08	8.2685E-08	2.714E-06	5.239E-07	0.000E+00	7.732E-07
Zr-95	5.0594E-06	3.02E+08	1.0327E-07	3.450E-06	6.660E-07	0.000E+00	1.046E-06
Zr-97	4.7280E-06	2.86E+08	9.8286E-08	3.249E-06	6.272E-07	0.000E+00	9.498E-07
Nb-95	5.0979E-06	3.05E+08	1.0404E-07	3.476E-06	6.710E-07	0.000E+00	1.055E-06
Mo-99	7.1316E-05	4.27E+09	1.4623E-06	4.873E-05	9.406E-06	0.000E+00	1.465E-05
Tc-99m	6.4147E-05	3.82E+09	1.3102E-06	4.376E-05	8.447E-06	0.000E+00	1.325E-05
Ru-103	6.1076E-05	3.65E+09	1.2469E-06	4.165E-05	8.040E-06	0.000E+00	1.263E-05
Ru-105	3.1542E-05	1.96E+09	6.9070E-07	2.216E-05	4.277E-06	0.000E+00	5.800E-06
Ru-106	2.4747E-05	1.48E+09	5.0506E-07	1.687E-05	3.257E-06	0.000E+00	5.120E-06
Rh-105	3.9310E-05	2.35E+09	8.0340E-07	2.682E-05	5.178E-06	0.000E+00	8.112E-06
Sb-127	8.4637E-05	5.07E+09	1.7331E-06	5.780E-05	1.116E-05	0.000E+00	1.742E-05
Sb-129	1.8431E-04	1.15E+10	4.0441E-06	1.296E-04	2.501E-05	0.000E+00	3.377E-05
Te-127	8.6027E-05	5.14E+09	1.7591E-06	5.871E-05	1.133E-05	0.000E+00	1.774E-05
Te-127m	1.1552E-05	6.90E+08	2.3575E-07	7.877E-06	1.521E-06	0.000E+00	2.390E-06
Te-129	2.0744E-04	1.26E+10	4.4457E-06	1.445E-04	2.789E-05	0.000E+00	3.952E-05
Te-129m	3.7003E-05	2.21E+09	7.5511E-07	2.523E-05	4.870E-06	0.000E+00	7.656E-06
Te-131m	1.0757E-04	6.47E+09	2.2182E-06	7.368E-05	1.422E-05	0.000E+00	2.189E-05
Te-132	1.0760E-03	6.45E+10	2.2048E-05	7.350E-04	1.419E-04	0.000E+00	2.212E-04
I-131	2.2093E-02	3.58E+12	3.2472E-03	7.898E-03	2.597E-03	1.349E-02	1.365E-03
I-132	2.0723E-02	3.93E+12	4.4953E-03	7.989E-03	2.627E-03	1.920E-02	5.857E-03
I-133	4.2161E-02	7.00E+12	6.4967E-03	1.494E-02	4.911E-03	2.726E-02	2.298E-03



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

I-134	1.0162E-02	3.57E+12	5.8088E-03	2.228E-03	7.324E-04	2.834E-02	1.572E-02
I-135	3.4220E-02	6.05E+12	5.9158E-03	1.184E-02	3.894E-03	2.540E-02	3.018E-03
Xe-133	0.0000E+00	0.00E+00	1.6075E+00	1.195E+00	2.307E-01	2.649E-02	1.552E-01
Xe-135	0.0000E+00	0.00E+00	6.1686E-01	4.570E-01	8.822E-02	9.403E-03	6.223E-02
Cs-134	3.8347E-03	7.91E+11	5.9755E-04	6.588E-04	1.272E-04	3.345E-03	3.011E-04
Cs-136	1.2218E-03	2.52E+11	1.9119E-04	2.093E-04	4.040E-05	1.070E-03	9.324E-05
Cs-137	2.3010E-03	4.74E+11	3.5853E-04	3.953E-04	7.631E-05	2.007E-03	1.808E-04
Ba-139	2.0395E-04	1.40E+10	5.2390E-06	1.529E-04	2.952E-05	0.000E+00	3.875E-05
Ba-140	5.3356E-04	3.19E+10	1.0900E-05	3.640E-04	7.026E-05	0.000E+00	1.102E-04
La-140	1.4457E-05	7.26E+08	2.1281E-07	8.437E-06	1.629E-06	0.000E+00	4.604E-06
La-141	3.5667E-06	2.23E+08	7.8827E-08	2.515E-06	4.855E-07	0.000E+00	6.451E-07
La-142	1.9910E-06	1.34E+08	4.9892E-08	1.478E-06	2.853E-07	0.000E+00	3.512E-07
Ce-141	1.2708E-05	7.60E+08	2.5942E-07	8.667E-06	1.673E-06	0.000E+00	2.628E-06
Ce-143	1.1212E-05	6.74E+08	2.3098E-07	7.676E-06	1.482E-06	0.000E+00	2.285E-06
Ce-144	1.0410E-05	6.22E+08	2.1246E-07	7.099E-06	1.370E-06	0.000E+00	2.154E-06
Pr-143	4.5890E-06	2.74E+08	9.3522E-08	3.127E-06	6.036E-07	0.000E+00	9.519E-07
Nd-147	5.0940E-06	3.05E+08	1.0408E-07	3.475E-06	6.708E-07	0.000E+00	1.052E-06
Np-239	1.6267E-04	9.75E+09	3.3382E-06	1.112E-04	2.146E-05	0.000E+00	3.336E-05
Pu-238	3.6415E-08	2.18E+06	7.4317E-10	2.483E-08	4.793E-09	0.000E+00	7.534E-09
Pu-239	3.6710E-09	2.19E+05	7.4914E-11	2.503E-09	4.832E-10	0.000E+00	7.596E-10
Pu-240	5.0355E-09	3.01E+05	1.0277E-10	3.434E-09	6.628E-10	0.000E+00	1.042E-09
Pu-241	1.5192E-06	9.08E+07	3.1004E-08	1.036E-06	2.000E-07	0.000E+00	3.143E-07
Am-241	7.8217E-10	4.67E+04	1.5960E-11	5.333E-10	1.029E-10	0.000E+00	1.619E-10
Cm-242	1.9680E-07	1.18E+07	4.0166E-09	1.342E-07	2.590E-08	0.000E+00	4.071E-08
Cm-244	1.2631E-08	7.55E+05	2.5778E-10	8.613E-09	1.663E-09	0.000E+00	2.613E-09

Filtered Environment to Control Room Transport Group Inventory:

	Pathway	
	Filtered	Transported
Time (h) =	2.0000	
Noble gases (atoms)	0.0000E+00	2.3616E+17
Elemental I (atoms)	2.9038E+14	3.9486E+13
Organic I (atoms)	2.2620E+13	2.9069E+12
Aerosol I (atoms)	6.3360E+14	8.3137E+13
All Aerosols (kg)	2.5482E-08	3.4322E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:06

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Exclusion Area Boundary Doses:

Time (h) =	Whole Body	Thyroid	TEDE
5.0000			
Delta dose (rem)	1.6282E-01	4.8596E+00	3.4079E-01
Accumulated dose (rem)	4.1346E-01	1.1905E+01	8.7404E-01

Low Population Zone Doses:

Time (h) =	Whole Body	Thyroid	TEDE
5.0000			
Delta dose (rem)	4.0705E-01	1.2149E+01	8.5197E-01
Accumulated dose (rem)	7.5037E-01	2.2042E+01	1.5903E+00

Control Room Doses:

Time (h) =	Whole Body	Thyroid	TEDE	Skin
5.0000				
Delta dose (rem)	1.6975E-02	6.8473E+00	3.1505E-01	6.6771E-01
Accumulated dose (rem)	2.2734E-02	1.1822E+01	5.2855E-01	8.8828E-01

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 5.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	6.2802E+01	5.3457E-06	1.4592E+03	1.9437E+17	8.6158E+02	3.8567E-01	0.0000E+00	8.8417E-01	8.8417E-01
Co-60	7.5313E+01	1.2379E-04	1.7480E+03	2.3284E+17	1.0332E+03	4.6201E-01	0.0000E+00	1.0592E+00	1.0592E+00
Kr-85	8.8395E+05	1.3728E-06	3.3902E+06	4.5157E+20	0.0000E+00	8.9110E+02	8.1591E-02	2.0431E+03	2.0431E+03
Kr-85m	7.5874E+06	1.0128E-03	3.9792E+07	5.3208E+21	0.0000E+00	1.0518E+04	1.5084E+00	2.4117E+04	2.4117E+04
Kr-87	2.0571E+06	3.8347E-03	2.7353E+07	3.6934E+21	0.0000E+00	7.3220E+03	2.8333E+00	1.6793E+04	1.6793E+04
Kr-88	1.3043E+07	2.8864E-02	8.3162E+07	1.1145E+22	0.0000E+00	2.2050E+04	4.0384E+00	5.0561E+04	5.0561E+04
Rb-86	2.6802E+03	1.4920E-04	6.9452E+04	9.2514E+18	3.9334E+04	1.8352E+01	1.5341E-02	4.2108E+01	4.2108E+01



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Sr-89	8.0111E+04	2.4840E-02	1.8622E+06	2.4804E+20	1.0990E+06	4.9218E+02	0.0000E+00	1.1284E+03	1.1284E+03
Sr-90	9.5485E+03	9.2643E-02	2.2162E+05	2.9519E+19	1.3099E+05	5.8573E+01	0.0000E+00	1.3428E+02	1.3428E+02
Sr-91	7.0871E+04	1.4207E-03	2.0036E+06	2.6736E+20	9.7227E+05	5.3061E+02	0.0000E+00	1.2165E+03	1.2165E+03
Sr-92	3.0978E+04	7.1831E-04	1.4639E+06	1.9624E+20	4.2498E+05	3.8961E+02	0.0000E+00	8.9321E+02	8.9321E+02
Y-90	4.7236E+02	1.3706E-05	5.0461E+03	6.5633E+17	6.5528E+03	1.3165E+00	0.0000E+00	3.0181E+00	3.0181E+00
Y-91	1.1044E+03	3.8831E-04	2.4699E+04	3.2871E+18	1.5165E+04	6.5249E+00	0.0000E+00	1.4959E+01	1.4959E+01
Y-92	2.6002E+04	9.4995E-05	3.2144E+05	4.1095E+19	3.6229E+05	8.3367E+01	0.0000E+00	1.9112E+02	1.9112E+02
Y-93	9.2515E+02	1.8338E-05	2.5846E+04	3.4487E+18	1.2692E+04	6.8442E+00	0.0000E+00	1.5691E+01	1.5691E+01
Zr-95	1.4619E+03	2.6269E-04	3.3971E+04	4.5250E+18	2.0056E+04	8.9787E+00	0.0000E+00	2.0584E+01	2.0584E+01
Zr-97	1.2096E+03	4.8449E-05	3.1349E+04	4.1800E+18	1.6595E+04	8.2951E+00	0.0000E+00	1.9017E+01	1.9017E+01
Nb-95	1.4750E+03	6.8371E-05	3.4235E+04	4.5600E+18	2.0235E+04	9.0483E+00	0.0000E+00	2.0744E+01	2.0744E+01
Mo-99	1.9995E+04	6.2006E-04	4.7730E+05	6.3593E+19	2.7431E+05	1.2619E+02	0.0000E+00	2.8929E+02	2.8929E+02
Tc-99m	1.8371E+04	1.3133E-05	4.3028E+05	5.7155E+19	2.5203E+05	1.1373E+02	0.0000E+00	2.6073E+02	2.6073E+02
Ru-103	1.7633E+04	1.2137E-03	4.1006E+05	5.4620E+19	2.4190E+05	1.0838E+02	0.0000E+00	2.4847E+02	2.4847E+02
Ru-105	5.7135E+03	5.6155E-05	2.0336E+05	2.7194E+19	7.8382E+04	5.3979E+01	0.0000E+00	1.2375E+02	1.2375E+02
Ru-106	7.1587E+03	2.5538E-02	1.6618E+05	2.2136E+19	9.8209E+04	4.3922E+01	0.0000E+00	1.0069E+02	1.0069E+02
Rh-105	1.1140E+04	8.4257E-05	2.6336E+05	3.5070E+19	1.5283E+05	6.9614E+01	0.0000E+00	1.5960E+02	1.5960E+02
Sb-127	2.3944E+04	1.1649E-03	5.6699E+05	7.5538E+19	3.2849E+05	1.4989E+02	0.0000E+00	3.4363E+02	3.4363E+02
Sb-129	3.2955E+04	5.3453E-04	1.1873E+06	1.5879E+20	4.5210E+05	3.1520E+02	0.0000E+00	7.2261E+02	7.2261E+02
Te-127	2.4548E+04	5.9557E-05	5.7684E+05	7.6710E+19	3.3677E+05	1.5248E+02	0.0000E+00	3.4956E+02	3.4956E+02
Te-127m	3.3434E+03	5.3687E-04	7.7582E+04	1.0334E+19	4.5868E+04	2.0505E+01	0.0000E+00	4.7009E+01	4.7009E+01
Te-129	4.1604E+04	4.6039E-05	1.3442E+06	1.7739E+20	5.7077E+05	3.5638E+02	0.0000E+00	8.1703E+02	8.1703E+02
Te-129m	1.0703E+04	1.9217E-03	2.4848E+05	3.3097E+19	1.4683E+05	6.5673E+01	0.0000E+00	1.5056E+02	1.5056E+02
Te-131m	2.9041E+04	1.6835E-03	7.1710E+05	9.5573E+19	3.9841E+05	1.8965E+02	0.0000E+00	4.3479E+02	4.3479E+02
Te-132	3.0318E+05	2.2135E-02	7.2054E+06	9.5998E+20	4.1593E+06	1.9049E+03	0.0000E+00	4.3670E+03	4.3670E+03
I-131	2.1585E+06	3.6553E-01	3.4323E+07	4.5723E+21	1.7230E+07	9.0652E+03	5.9740E+00	2.0796E+04	2.0796E+04
I-132	1.2925E+06	1.8682E-02	3.7083E+07	4.9622E+21	1.0547E+07	9.8587E+03	8.5765E+00	2.2622E+04	2.2622E+04
I-133	3.7659E+06	1.2874E-01	6.4960E+07	8.6598E+21	3.0061E+07	1.7171E+04	1.2087E+01	3.9394E+04	3.9394E+04
I-134	9.3587E+04	8.2354E-03	1.6993E+07	2.3086E+21	7.4705E+05	4.5793E+03	1.2841E+01	1.0528E+04	1.0528E+04
I-135	2.4662E+06	3.5181E-02	5.1917E+07	6.9335E+21	1.9686E+07	1.3751E+04	1.1285E+01	3.1551E+04	3.1551E+04
Xe-133	1.2513E+08	2.5667E-03	4.8352E+08	6.4409E+22	0.0000E+00	1.2711E+05	1.1726E+01	2.9144E+05	2.9144E+05
Xe-135	4.3053E+07	7.1827E-03	1.7738E+08	2.3625E+22	0.0000E+00	4.6688E+04	4.1642E+00	1.0705E+05	1.0705E+05
Cs-134	2.6078E+05	1.0191E-01	6.7288E+06	8.9628E+20	3.8271E+06	1.7779E+03	1.4816E+00	4.0794E+03	4.0794E+03
Cs-136	8.2551E+04	5.8267E-03	2.1431E+06	2.8548E+20	1.2115E+06	5.6629E+02	4.7405E-01	1.2994E+03	1.2994E+03
Cs-137	1.5650E+05	4.1873E-02	4.0376E+06	5.3781E+20	2.2967E+06	1.0668E+03	8.8893E-01	2.4478E+03	2.4478E+03
Ba-139	1.3054E+04	8.0521E-05	1.2853E+06	1.7338E+20	1.7908E+05	3.4432E+02	0.0000E+00	7.8939E+02	7.8939E+02
Ba-140	1.5334E+05	4.4114E-03	3.5804E+06	4.7694E+20	2.1036E+06	9.4637E+02	0.0000E+00	2.1696E+03	2.1696E+03
La-140	1.1065E+04	2.1061E-04	1.0755E+05	1.3921E+19	1.5362E+05	2.7986E+01	0.0000E+00	6.4161E+01	6.4161E+01
La-141	6.0798E+02	4.4699E-06	2.2909E+04	3.0649E+18	8.3408E+03	6.0841E+00	0.0000E+00	1.3948E+01	1.3948E+01
La-142	1.4952E+02	7.1565E-06	1.2523E+04	1.6870E+18	2.0512E+03	3.3501E+00	0.0000E+00	7.6803E+00	7.6803E+00
Ce-141	3.6697E+03	2.4692E-04	8.5326E+04	1.1366E+19	5.0343E+04	2.2552E+01	0.0000E+00	5.1702E+01	5.1702E+01
Ce-143	3.0459E+03	8.4872E-05	7.4788E+04	9.9670E+18	4.1786E+04	1.9778E+01	0.0000E+00	4.5343E+01	4.5343E+01
Ce-144	3.0112E+03	8.4098E-03	6.9908E+04	9.3118E+18	4.1311E+04	1.8477E+01	0.0000E+00	4.2359E+01	4.2359E+01
Pr-143	1.3383E+03	8.0420E-05	3.0832E+04	4.1060E+18	1.8362E+04	8.1482E+00	0.0000E+00	1.8681E+01	1.8681E+01
Nd-147	1.4623E+03	7.6027E-05	3.4179E+04	4.5530E+18	2.0061E+04	9.0342E+00	0.0000E+00	2.0712E+01	2.0712E+01
Np-239	4.5368E+04	9.0710E-04	1.0881E+06	1.4498E+20	6.2240E+05	2.8768E+02	0.0000E+00	6.5954E+02	6.5954E+02
Pu-238	1.0537E+01	2.2688E-02	2.4455E+02	3.2574E+16	1.4455E+02	6.4634E-02	0.0000E+00	1.4818E-01	1.4818E-01
Pu-239	1.0626E+00	2.4459E-03	2.4654E+01	3.2839E+15	1.4578E+01	6.5160E-03	0.0000E+00	1.4938E-02	1.4938E-02
Pu-240	1.4570E+00	3.3548E-03	3.3816E+01	4.5043E+15	1.9988E+01	8.9375E-03	0.0000E+00	2.0490E-02	2.0490E-02
Pu-241	4.3956E+02	1.6281E-02	1.0202E+04	1.3589E+18	6.0302E+03	2.6964E+00	0.0000E+00	6.1816E+00	6.1816E+00
Am-241	2.2654E-01	7.5076E-04	5.2531E+00	6.9970E+14	3.1080E+00	1.3884E-03	0.0000E+00	3.1830E-03	3.1830E-03
Cm-242	5.6912E+01	7.3501E-03	1.3215E+03	1.7603E+17	7.8077E+02	3.4928E-01	0.0000E+00	8.0075E-01	8.0075E-01
Cm-244	3.6547E+00	6.7687E-03	8.4825E+01	1.1299E+16	5.0139E+01	2.2419E-02	0.0000E+00	5.1398E-02	5.1398E-02
Total	2.0304E+08	1.0000E+00	0.0000E+00	0.0000E+00	9.9513E+07	2.7940E+05	7.7975E+01	6.4072E+05	6.4072E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 7.6490E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 9.1282E-04
 Total I (Ci) 9.7766E+04

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 5.0000	Atmosphere	Sump
Noble gases (atoms)	1.9079E+25	0.0000E+00
Elemental I (atoms)	4.2983E+22	0.0000E+00
Organic I (atoms)	1.3294E+21	0.0000E+00
Aerosol I (atoms)	5.4497E+22	0.0000E+00
All Aerosols (kg)	2.1233E+00	0.0000E+00

Time (h) = 5.0000	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



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Aerosol I (atoms) 8.1860E+23 0.0000E+00
 All Aerosols (kg) 3.1059E+01 0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 5.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1 Inflow	Pathway 2 Outflow	Pathway 3 Outflow	Pathway 12 Inflow
Co-58	3.1166E-05	3.7069E-06	7.0702E-04	9.4175E+10	3.8567E-01	6.3223E-03	1.3762E-03	0.0000E+00
Co-60	3.7374E-05	8.5842E-05	8.4699E-04	1.1282E+11	4.6201E-01	7.5738E-03	1.6485E-03	0.0000E+00
Kr-85	4.3797E-01	9.6010E-07	1.6567E+00	2.2067E+14	8.9110E+02	7.3666E+02	1.5319E+02	0.0000E+00
Kr-85m	3.7594E+00	7.0437E-04	1.9336E+01	2.5856E+15	1.0518E+04	8.6469E+03	1.8516E+03	0.0000E+00
Kr-87	1.0192E+00	2.6118E-03	1.3017E+01	1.7577E+15	7.3220E+03	5.8963E+03	1.4006E+03	0.0000E+00
Kr-88	6.4626E+00	1.9996E-02	4.0253E+01	5.3946E+15	2.2050E+04	1.8057E+04	3.9449E+03	0.0000E+00
Rb-86	1.3301E-03	1.0058E-04	3.2716E-02	4.3579E+12	1.8352E+01	2.9268E-01	7.3446E-02	0.0000E+00
Sr-89	3.9755E-02	1.7225E-02	9.0226E-01	1.2018E+14	4.9218E+02	8.0683E+00	1.7563E+00	0.0000E+00
Sr-90	4.7385E-03	6.4244E-02	1.0738E-01	1.4303E+13	5.8573E+01	9.6021E-01	2.0900E-01	0.0000E+00
Sr-91	3.5170E-02	9.8260E-04	9.6823E-01	1.2920E+14	5.3061E+02	8.6756E+00	1.9130E+00	0.0000E+00
Sr-92	1.5373E-02	4.9318E-04	7.0228E-01	9.4144E+13	3.8961E+02	6.3238E+00	1.4451E+00	0.0000E+00
Y-90	2.3441E-04	9.6085E-06	2.4718E-03	3.2159E+11	1.3165E+00	2.1821E-02	4.4975E-03	0.0000E+00
Y-91	5.4806E-04	2.6938E-04	1.1972E-02	1.5933E+12	6.5249E+00	1.0701E-01	2.3248E-02	0.0000E+00
Y-92	1.2903E-02	6.6954E-05	1.5830E-01	2.0262E+13	8.3367E+01	1.3899E+00	2.7803E-01	0.0000E+00
Y-93	4.5911E-04	1.2685E-05	1.2493E-02	1.6669E+12	6.8442E+00	1.1192E-01	2.4660E-02	0.0000E+00
Zr-95	7.2548E-04	1.8216E-04	1.6460E-02	2.1925E+12	8.9787E+00	1.4719E-01	3.2039E-02	0.0000E+00
Zr-97	6.0029E-04	3.3548E-05	1.5168E-02	2.0224E+12	8.2951E+00	1.3579E-01	2.9769E-02	0.0000E+00
Nb-95	7.3197E-04	4.7412E-05	1.6588E-02	2.2095E+12	9.0483E+00	1.4833E-01	3.2285E-02	0.0000E+00
Mo-99	9.9225E-03	4.2983E-04	2.3118E-01	3.0801E+13	1.2619E+02	2.0678E+00	4.5090E-01	0.0000E+00
Tc-99m	9.1165E-03	9.1068E-06	2.0847E-01	2.7692E+13	1.1373E+02	1.8643E+00	4.0591E-01	0.0000E+00
Ru-103	8.7504E-03	8.4166E-04	1.9868E-01	2.6465E+13	1.0838E+02	1.7767E+00	3.8675E-01	0.0000E+00
Ru-105	2.8353E-03	3.8715E-05	9.7961E-02	1.3099E+13	5.3979E+01	8.7975E-01	1.9706E-01	0.0000E+00
Ru-106	3.5525E-03	1.7709E-02	8.0521E-02	1.0725E+13	4.3922E+01	7.2003E-01	1.5672E-01	0.0000E+00
Rh-105	5.5282E-03	5.8421E-05	1.2759E-01	1.6991E+13	6.9614E+01	1.1411E+00	2.4851E-01	0.0000E+00
Sb-127	1.1882E-02	8.0763E-04	2.7465E-01	3.6591E+13	1.4989E+02	2.4565E+00	5.3537E-01	0.0000E+00
Sb-129	1.6354E-02	3.6845E-04	5.7186E-01	7.6478E+13	3.1520E+02	5.1362E+00	1.1514E+00	0.0000E+00
Te-127	1.2182E-02	4.1294E-05	2.7945E-01	3.7163E+13	1.5248E+02	2.4992E+00	5.4439E-01	0.0000E+00
Te-127m	1.6592E-03	3.7230E-04	3.7591E-02	5.0071E+12	2.0505E+01	3.3614E-01	7.3163E-02	0.0000E+00
Te-129	2.0646E-02	3.1800E-05	6.4875E-01	8.5615E+13	3.5638E+02	5.8194E+00	1.2914E+00	0.0000E+00
Te-129m	5.3113E-03	1.3326E-03	1.2040E-01	1.6036E+13	6.5673E+01	1.0766E+00	2.3432E-01	0.0000E+00
Te-131m	1.4411E-02	1.1665E-03	3.4717E-01	4.6270E+13	1.8965E+02	3.1065E+00	6.7888E-01	0.0000E+00
Zr-132	1.5045E-01	1.5345E-02	3.4902E+00	4.6499E+14	1.9049E+03	3.1217E+01	6.8051E+00	0.0000E+00
I-131	4.6770E+00	4.6173E-01	3.0294E+01	4.0355E+15	9.0652E+03	5.5437E+02	2.2925E+02	7.5985E+03
I-132	2.8301E+00	2.1838E-02	3.0288E+01	4.0578E+15	9.8587E+03	5.3862E+02	2.2992E+02	7.1299E+03
I-133	8.1601E+00	1.6072E-01	5.6664E+01	7.5540E+15	1.7171E+04	1.0321E+03	4.2946E+02	1.4092E+04
I-134	2.0279E-01	8.1023E-03	1.1681E+01	1.5871E+15	4.5793E+03	1.9431E+02	1.0501E+02	2.5106E+03
I-135	5.3437E+00	4.2732E-02	4.4062E+01	5.8844E+15	1.3751E+04	7.9377E+02	3.3570E+02	1.0740E+04
Xe-133	6.2135E+01	1.7971E-03	2.3654E+02	3.1510E+16	1.2711E+05	1.0520E+05	2.1885E+04	1.5264E+02
Xe-135	2.2418E+01	5.1652E-03	8.9127E+01	1.1875E+16	4.6688E+04	3.9688E+04	8.2557E+03	1.3481E+03
Cs-134	1.2941E-01	6.8710E-02	3.1700E+00	4.2225E+14	1.7779E+03	2.8358E+01	7.1124E+00	0.0000E+00
Cs-136	4.0966E-02	3.9280E-03	1.0095E+00	1.3447E+14	5.6629E+02	9.0309E+00	2.2668E+00	0.0000E+00
Cs-137	7.7661E-02	2.8233E-02	1.9022E+00	2.5337E+14	1.0668E+03	1.7016E+01	4.2677E+00	0.0000E+00
Ba-139	6.4779E-03	5.4653E-05	6.0957E-01	8.2224E+13	3.4432E+02	5.5249E+00	1.3334E+00	0.0000E+00
Ba-140	7.6093E-02	3.0589E-03	1.7347E+00	2.3108E+14	9.4637E+02	1.5513E+01	3.3778E+00	0.0000E+00
La-140	5.4911E-03	1.4797E-04	5.2795E-02	6.8363E+12	2.7986E+01	4.6490E-01	9.4761E-02	0.0000E+00
La-141	3.0171E-04	3.0791E-06	1.1027E-02	1.4752E+12	6.0841E+00	9.9079E-02	2.2281E-02	0.0000E+00
La-142	7.4199E-05	4.8702E-06	5.9547E-03	8.0215E+11	3.3501E+00	5.3896E-02	1.2847E-02	0.0000E+00
Ce-141	1.8211E-03	1.7123E-04	4.1343E-02	5.5069E+12	2.2552E+01	3.6970E-01	8.0474E-02	0.0000E+00
Ce-143	1.5115E-03	5.8811E-05	3.6210E-02	4.8258E+12	1.9778E+01	3.2399E-01	7.0777E-02	0.0000E+00
Ce-144	1.4943E-03	5.8318E-03	3.3872E-02	4.5118E+12	1.8477E+01	3.0289E-01	6.5928E-02	0.0000E+00
Pr-143	6.6411E-04	5.5772E-05	1.4940E-02	1.9896E+12	8.1482E+00	1.3359E-01	2.9066E-02	0.0000E+00
Nd-147	7.2568E-04	5.2717E-05	1.6559E-02	2.2059E+12	9.0342E+00	1.4809E-01	3.2247E-02	0.0000E+00
Np-239	2.2514E-02	6.2876E-04	5.2700E-01	7.0217E+13	2.8768E+02	4.7141E+00	1.0282E+00	0.0000E+00
Pu-238	5.2289E-06	1.5733E-02	1.1849E-04	1.5783E+10	6.4634E-02	1.0596E-03	2.3062E-04	0.0000E+00
Pu-239	5.2734E-07	1.6961E-03	1.1946E-05	1.5912E+09	6.5160E-03	1.0682E-04	2.3249E-05	0.0000E+00
Pu-240	7.2303E-07	2.3264E-03	1.6385E-05	2.1825E+09	8.9375E-03	1.4652E-04	3.1890E-05	0.0000E+00
Pu-241	2.1813E-04	1.1290E-02	4.9432E-03	6.5843E+11	2.6964E+00	4.4202E-02	9.6210E-03	0.0000E+00
Am-241	1.1242E-07	5.2062E-04	2.5453E-06	3.3903E+08	1.3884E-03	2.2760E-05	4.9537E-06	0.0000E+00
Cm-242	2.8243E-05	5.0970E-03	6.4032E-04	8.5290E+10	3.4928E-01	5.7258E-03	1.2463E-03	0.0000E+00
Cm-244	1.8137E-06	4.6938E-03	4.1101E-05	5.4746E+09	2.2419E-02	3.6753E-04	7.9995E-05	0.0000E+00
Total	1.1820E+02	1.0000E+00	0.0000E+00	0.0000E+00	2.7940E+05	1.8150E+05	3.8859E+04	4.3572E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 1.0960E-06
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.3081E-06
 Total I (Ci) 2.1214E+01



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	5.0000	Atmosphere	Sump
Noble gases (atoms)	9.4582E+18	0.0000E+00	
Elemental I (atoms)	1.8146E+17	0.0000E+00	
Organic I (atoms)	5.6121E+15	0.0000E+00	
Aerosol I (atoms)	2.7044E+16	0.0000E+00	
All Aerosols (kg)	1.0537E-06	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 5.0000

Nuclide	Compartment Atmosphere	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	9.3356E-03	4.6678E-04	0.00000	0.00000	0.00000	0.00000
Co-60	1.1185E-02	5.5923E-04	0.00002	0.00000	0.00000	0.00000
Kr-85	9.4398E+02	4.7193E+01	0.00001	0.00000	0.00000	0.00000
Kr-85m	1.0995E+04	5.4966E+02	0.00777	0.00159	0.00000	0.00036
Kr-87	7.4084E+03	3.7024E+02	0.03601	0.00768	0.00001	0.00125
Kr-88	2.2875E+04	1.1435E+03	0.23293	0.04813	0.00003	0.01007
Rb-86	4.6392E-01	2.2806E-02	0.00003	0.00001	0.00000	0.00000
Sr-89	1.1913E+01	5.9567E-01	0.00489	0.00100	0.00000	0.00069
Sr-90	1.4180E+00	7.0900E-02	0.01824	0.00372	0.00000	0.00259
Sr-91	1.2616E+01	6.3080E-01	0.00029	0.00006	0.00000	0.00004
Sr-92	8.8959E+00	4.4479E-01	0.00016	0.00003	0.00000	0.00002
Y-90	3.5790E-02	1.7895E-03	0.00000	0.00000	0.00000	0.00000
Y-91	1.5862E-01	7.9308E-03	0.00008	0.00002	0.00000	0.00001
Y-92	2.3066E+00	1.1533E-01	0.00001	0.00000	0.00000	0.00000
Y-93	1.6290E-01	8.1450E-03	0.00000	0.00000	0.00000	0.00000
Zr-95	2.1734E-01	1.0867E-02	0.00005	0.00001	0.00000	0.00001
Zr-97	1.9876E-01	9.9382E-03	0.00001	0.00000	0.00000	0.00000
Nb-95	2.1905E-01	1.0952E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	3.0467E+00	1.5234E-01	0.00012	0.00003	0.00000	0.00002
Tc-99m	2.7513E+00	1.3756E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	2.6233E+00	1.3116E-01	0.00024	0.00005	0.00000	0.00003
Ru-105	1.2590E+00	6.2949E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	1.0633E+00	5.3164E-02	0.00503	0.00102	0.00000	0.00071
Rh-105	1.6829E+00	8.4146E-02	0.00002	0.00000	0.00000	0.00000
Sb-127	3.6217E+00	1.8109E-01	0.00023	0.00005	0.00000	0.00003
Sb-129	7.3445E+00	3.6722E-01	0.00011	0.00002	0.00000	0.00001
Te-127	3.6870E+00	1.8435E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	4.9641E-01	2.4820E-02	0.00011	0.00002	0.00000	0.00002
Te-129	8.3862E+00	4.1931E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	1.5899E+00	7.9493E-02	0.00038	0.00008	0.00000	0.00005
Te-131m	4.5646E+00	2.2823E-01	0.00033	0.00007	0.00000	0.00005
Te-132	4.6011E+01	2.3006E+00	0.00437	0.00089	0.00000	0.00061
I-131	8.2824E+02	4.1245E+01	0.20988	0.07896	0.00127	0.01121
I-132	7.9572E+02	3.9549E+01	0.01075	0.00407	0.00009	0.00047
I-133	1.5422E+03	7.6773E+01	0.07396	0.02787	0.00048	0.00387
I-134	3.0909E+02	1.5104E+01	0.00467	0.00193	0.00012	0.00016
I-135	1.1871E+03	5.9043E+01	0.02024	0.00766	0.00015	0.00101
Xe-133	1.3514E+05	6.7564E+03	0.01803	0.00365	0.00000	0.00096
Xe-135	5.4062E+04	2.7028E+03	0.05228	0.01057	0.00000	0.00322
Cs-134	4.4957E+01	2.2102E+00	0.01948	0.00425	0.00045	0.00318
Cs-136	1.4314E+01	7.0363E-01	0.00111	0.00024	0.00003	0.00018
Cs-137	2.6977E+01	1.3262E+00	0.00800	0.00175	0.00018	0.00131
Ba-139	7.5143E+00	3.7571E-01	0.00002	0.00000	0.00000	0.00000
Ba-140	2.2897E+01	1.1449E+00	0.00087	0.00018	0.00000	0.00012
La-140	7.7696E-01	3.8848E-02	0.00003	0.00001	0.00000	0.00001
La-141	1.4127E-01	7.0635E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.3764E-02	3.6882E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	5.4586E-01	2.7293E-02	0.00005	0.00001	0.00000	0.00001
Ce-143	4.7627E-01	2.3814E-02	0.00002	0.00000	0.00000	0.00000
Ce-144	4.4729E-01	2.2364E-02	0.00166	0.00034	0.00000	0.00024
Pr-143	1.9742E-01	9.8708E-03	0.00002	0.00000	0.00000	0.00000
Nd-147	2.1856E-01	1.0928E-02	0.00001	0.00000	0.00000	0.00000
Np-239	6.9429E+00	3.4715E-01	0.00018	0.00004	0.00000	0.00003
Pu-238	1.5647E-03	7.8236E-05	0.00447	0.00091	0.00000	0.00063
Pu-239	1.5775E-04	7.8875E-06	0.00048	0.00010	0.00000	0.00007
Pu-240	2.1637E-04	1.0818E-05	0.00066	0.00013	0.00000	0.00009
Pu-241	6.5276E-02	3.2638E-03	0.00321	0.00065	0.00000	0.00046
Am-241	-3.3614E-05	1.6807E-06	0.00015	0.00003	0.00000	0.00002
Cm-242	8.4553E-03	4.2276E-04	0.00145	0.00029	0.00000	0.00021
Cm-244	5.4275E-04	2.7137E-05	0.00133	0.00027	0.00000	0.00019



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) =	5.0000	
Noble gases (atoms)	2.0434E+22	1.1352E+18
Elemental I (atoms)	2.7057E+19	1.5032E+15
Organic I (atoms)	2.2161E+18	1.2312E+14
Aerosol I (atoms)	9.5139E+18	5.2855E+14
All Aerosols (kg)	3.6344E-04	2.0191E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 5.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.2610E+02	5.8496E-06	3.4993E+03	4.6612E+17	0.0000E+00
Co-60	1.1106E+03	1.3550E-04	4.1934E+03	5.5856E+17	0.0000E+00
Rb-86	4.2096E+04	1.6453E-04	1.6785E+05	2.2359E+19	0.0000E+00
Sr-89	1.1813E+06	2.7178E-02	4.4652E+06	5.9477E+20	0.0000E+00
Sr-90	1.4080E+05	1.0141E-01	5.3164E+05	7.0814E+19	0.0000E+00
Sr-91	1.0451E+06	1.4703E-03	4.5440E+06	6.0636E+20	0.0000E+00
Sr-92	4.5681E+05	6.5269E-04	2.9151E+06	3.9079E+20	0.0000E+00
Y-90	7.0384E+03	2.0307E-05	1.6385E+04	2.1448E+18	0.0000E+00
Y-91	1.6300E+04	4.3010E-04	5.9953E+04	7.9796E+18	0.0000E+00
Y-92	3.8903E+05	1.4179E-04	1.0514E+06	1.3689E+20	0.0000E+00
Y-93	1.3643E+04	1.9039E-05	5.8811E+04	7.8471E+18	0.0000E+00
Zr-95	2.1558E+04	2.8745E-04	8.1465E+04	1.0851E+19	0.0000E+00
Zr-97	1.7838E+04	5.1372E-05	7.2849E+04	9.7134E+18	0.0000E+00
Nb-95	2.1751E+04	7.4840E-05	8.2126E+04	1.0939E+19	0.0000E+00
Mo-99	2.9485E+05	6.7319E-04	1.1356E+06	1.5130E+20	0.0000E+00
Tc-99m	2.7090E+05	1.4343E-05	1.0298E+06	1.3679E+20	0.0000E+00
Ru-103	2.6002E+05	1.3278E-03	9.8312E+05	1.3095E+20	0.0000E+00
Ru-105	8.4252E+04	5.4667E-05	4.3386E+05	5.8016E+19	0.0000E+00
Ru-106	1.0556E+05	2.7952E-02	3.9863E+05	5.3098E+19	0.0000E+00
Rh-105	1.6427E+05	9.1807E-05	6.2888E+05	8.3751E+19	0.0000E+00
Sb-127	3.5309E+05	1.2677E-03	1.3522E+06	1.8015E+20	0.0000E+00
Sb-129	4.8596E+05	5.1875E-04	2.5253E+06	3.3772E+20	0.0000E+00
Te-127	3.6199E+05	6.4960E-05	1.3788E+06	1.8336E+20	0.0000E+00
Te-127m	4.9303E+04	5.8771E-04	1.8612E+05	2.4791E+19	0.0000E+00
Te-129	6.1351E+05	4.6056E-05	2.9470E+06	3.8901E+20	0.0000E+00
Te-129m	1.5783E+05	2.1034E-03	5.9606E+05	7.9393E+19	0.0000E+00
Te-131m	4.2824E+05	1.8099E-03	1.6896E+06	2.2518E+20	0.0000E+00
Te-132	4.4707E+06	2.4063E-02	1.7166E+07	2.2870E+21	0.0000E+00
I-131	1.9470E+07	3.7556E-01	7.7284E+07	1.0295E+22	7.5985E+03
I-132	1.1886E+07	1.6538E-02	7.1945E+07	9.6208E+21	7.1299E+03
I-133	3.3970E+07	1.2947E-01	1.4317E+08	1.9086E+22	1.4092E+04
I-134	8.4420E+05	5.5014E-03	2.4877E+07	3.3798E+21	2.5106E+03
I-135	2.2246E+07	3.3650E-02	1.0883E+08	1.4534E+22	1.0740E+04
Xe-133	7.5668E+05	3.8294E-06	1.5810E+06	2.0552E+20	1.5264E+02
Xe-135	6.0336E+06	2.5739E-04	1.3930E+07	1.8119E+21	1.3481E+03
Cs-134	4.0959E+06	1.1252E-01	1.6282E+07	2.1688E+21	0.0000E+00
Cs-136	1.2966E+06	6.4222E-03	5.1766E+06	6.8957E+20	0.0000E+00
Cs-137	2.4580E+06	4.6236E-02	9.7705E+06	1.3014E+21	0.0000E+00
Ba-139	1.9249E+05	6.3054E-05	2.2058E+06	2.9754E+20	0.0000E+00
Ba-140	2.2611E+06	4.8203E-03	8.5739E+06	1.1421E+21	0.0000E+00
La-140	1.6500E+05	3.2745E-04	3.6645E+05	4.7848E+19	0.0000E+00
La-141	8.9654E+03	4.2892E-06	4.8176E+04	6.4454E+18	0.0000E+00
La-142	2.2049E+03	5.7709E-06	2.2131E+04	2.9812E+18	0.0000E+00
Ce-141	5.4114E+04	2.7014E-04	2.0458E+05	2.7251E+19	0.0000E+00
Ce-143	4.4915E+04	9.1394E-05	1.7649E+05	2.3521E+19	0.0000E+00
Ce-144	4.4404E+04	9.2048E-03	1.6769E+05	2.2336E+19	0.0000E+00
Pr-143	1.9737E+04	8.8230E-05	7.4131E+04	9.8723E+18	0.0000E+00
Nd-147	2.1564E+04	8.3050E-05	8.1824E+04	1.0900E+19	0.0000E+00
Np-239	6.6901E+05	9.8346E-04	2.5854E+06	3.4448E+20	0.0000E+00
Pu-238	1.5538E+02	2.4836E-02	5.8665E+02	7.8142E+16	0.0000E+00
Pu-239	1.5670E+01	2.6776E-03	5.9149E+01	7.8786E+15	0.0000E+00
Pu-240	2.1485E+01	3.6723E-03	8.1121E+01	1.0805E+16	0.0000E+00
Pu-241	6.4818E+03	1.7822E-02	2.4473E+04	3.2599E+18	0.0000E+00
Am-241	3.3407E+00	8.2203E-04	1.2605E+01	1.6790E+15	0.0000E+00
Cm-242	8.3924E+02	8.0445E-03	3.1698E+03	4.2221E+17	0.0000E+00
Cm-244	5.3894E+01	7.4092E-03	2.0349E+02	2.7105E+16	0.0000E+00
Total	1.1800E+08	1.0000E+00	0.0000E+00	0.0000E+00	4.3572E+04



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Dose Effective (Ci/cc) I-131 (Thyroid) 9.4617E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.1294E-02
 Total I (Ci) 8.8416E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) =	5.0000	Atmosphere	Sump
Noble gases (atoms)	2.8843E+22	0.0000E+00	
Elemental I (atoms)	8.6465E+23	0.0000E+00	
Organic I (atoms)	2.6742E+22	0.0000E+00	
Aerosol I (atoms)	0.0000E+00	0.0000E+00	
All Aerosols (kg)	3.3057E+01	0.0000E+00	

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 5.0000

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	4.7896E-07	1.48E+08	9.7838E-09	1.482E-07	2.861E-08	0.000E+00	3.119E-07
Co-60	5.7437E-07	1.77E+08	1.1722E-08	1.775E-07	3.426E-08	0.000E+00	3.743E-07
Kr-85	0.0000E+00	0.00E+00	2.0217E-02	8.332E-03	1.608E-03	1.843E-04	1.009E-02
Kr-85m	0.0000E+00	0.00E+00	2.5887E-01	1.221E-01	2.357E-02	3.411E-03	1.098E-01
Kr-87	0.0000E+00	0.00E+00	2.2057E-01	1.280E-01	2.471E-02	6.420E-03	6.143E-02
Kr-88	0.0000E+00	0.00E+00	5.6943E-01	2.860E-01	5.521E-02	9.136E-03	2.191E-01
Rb-86	5.2096E-05	2.63E+10	6.4469E-06	6.788E-06	1.310E-06	3.464E-05	1.581E-05
Sr-89	6.1096E-04	1.88E+11	1.2485E-05	1.891E-04	3.651E-05	0.000E+00	3.978E-04
Sr-90	7.2821E-05	2.24E+10	1.4861E-06	2.250E-05	4.344E-06	0.000E+00	4.746E-05
Sr-91	5.4049E-04	1.86E+11	1.3108E-05	2.108E-04	4.069E-05	0.000E+00	3.021E-04
Sr-92	2.3625E-04	1.10E+11	9.1146E-06	1.651E-04	3.186E-05	0.000E+00	5.819E-05
Y-90	3.7506E-06	8.14E+08	4.0671E-08	4.146E-07	8.004E-08	0.000E+00	3.297E-06
Y-91	8.4513E-06	2.55E+09	1.6677E-07	2.493E-06	4.811E-07	0.000E+00	5.644E-06
Y-92	2.0967E-04	5.35E+10	2.5964E-06	2.733E-05	5.276E-06	0.000E+00	1.797E-04
Y-93	7.0556E-06	2.41E+09	1.6933E-07	2.714E-06	5.239E-07	0.000E+00	3.987E-06
Zr-95	1.1149E-05	3.44E+09	2.2777E-07	3.450E-06	6.660E-07	0.000E+00	7.261E-06
Zr-97	9.2252E-06	3.02E+09	2.0725E-07	3.249E-06	6.272E-07	0.000E+00	5.556E-06
Nb-95	1.1249E-05	3.47E+09	2.2958E-07	3.476E-06	6.710E-07	0.000E+00	7.331E-06
Mo-99	1.5249E-04	4.77E+10	3.1888E-06	4.873E-05	9.406E-06	0.000E+00	9.754E-05
Tc-99m	1.4010E-04	4.33E+10	2.8821E-06	4.376E-05	8.447E-06	0.000E+00	9.078E-05
Ru-103	1.3448E-04	4.15E+10	2.7491E-06	4.165E-05	8.040E-06	0.000E+00	8.753E-05
Ru-105	4.3573E-05	1.71E+10	1.2981E-06	2.216E-05	4.277E-06	0.000E+00	1.844E-05
Ru-106	5.4595E-05	1.68E+10	1.1144E-06	1.688E-05	3.257E-06	0.000E+00	3.558E-05
Rh-105	8.4957E-05	2.65E+10	1.7620E-06	2.682E-05	5.178E-06	0.000E+00	5.472E-05
Sb-127	1.8261E-04	5.69E+10	3.7921E-06	5.780E-05	1.116E-05	0.000E+00	1.174E-04
Sb-129	2.5133E-04	9.93E+10	7.5703E-06	1.296E-04	2.501E-05	0.000E+00	1.043E-04
Te-127	1.8721E-04	5.80E+10	3.8619E-06	5.871E-05	1.133E-05	0.000E+00	1.210E-04
Te-127m	2.5498E-05	7.85E+09	5.2027E-07	7.877E-06	1.521E-06	0.000E+00	1.662E-05
Te-129	3.1729E-04	1.17E+11	8.6681E-06	1.445E-04	2.789E-05	0.000E+00	1.536E-04
Te-129m	8.1624E-05	2.51E+10	1.6662E-06	2.523E-05	4.870E-06	0.000E+00	5.319E-05
Te-131m	2.2148E-04	7.06E+10	4.7699E-06	7.368E-05	1.422E-05	0.000E+00	1.383E-04
Te-132	2.3122E-03	7.22E+11	4.8167E-05	7.350E-04	1.419E-04	0.000E+00	1.483E-03
I-131	2.8107E-02	1.35E+13	3.4514E-03	7.898E-03	2.597E-03	1.349E-02	7.583E-03
I-132	1.2668E-02	1.03E+13	4.6541E-03	7.989E-03	2.627E-03	1.920E-02	1.407E-02
I-133	4.9057E-02	2.51E+13	6.8673E-03	1.494E-02	4.912E-03	2.726E-02	9.564E-03
I-134	1.2191E-03	5.24E+12	5.8397E-03	2.228E-03	7.324E-04	2.834E-02	2.469E-02
I-135	3.2126E-02	1.92E+13	6.1833E-03	1.184E-02	3.894E-03	2.540E-02	5.380E-03
Xe-133	0.0000E+00	0.00E+00	2.8885E+00	1.195E+00	2.307E-01	2.649E-02	1.436E+00
Xe-135	0.0000E+00	0.00E+00	1.0693E+00	4.570E-01	8.822E-02	9.403E-03	5.146E-01
Cs-134	5.0688E-03	2.55E+12	6.2275E-04	6.588E-04	1.272E-04	3.345E-03	1.560E-03
Cs-136	1.6045E-03	8.12E+11	1.9919E-04	2.093E-04	4.040E-05	1.070E-03	4.840E-04
Cs-137	3.0418E-03	1.53E+12	3.7365E-04	3.953E-04	7.631E-05	2.007E-03	9.367E-04
Ba-139	9.9552E-05	7.30E+10	7.6561E-06	1.529E-04	2.952E-05	0.000E+00	1.456E-04
Ba-140	1.1694E-03	3.61E+11	2.3991E-05	3.640E-04	7.026E-05	0.000E+00	7.591E-04
La-140	8.8111E-05	1.86E+10	8.9407E-07	8.438E-06	1.629E-06	0.000E+00	7.894E-05
La-141	4.6367E-06	1.88E+09	1.4544E-07	2.515E-06	4.855E-07	0.000E+00	1.782E-06
La-142	1.1403E-06	7.54E+08	7.5178E-08	1.478E-06	2.853E-07	0.000E+00	1.227E-06
Ce-141	2.7984E-05	8.63E+09	5.7203E-07	8.667E-06	1.673E-06	0.000E+00	1.822E-05
Ce-143	2.3229E-05	7.38E+09	4.9782E-07	7.676E-06	1.482E-06	0.000E+00	1.457E-05
Ce-144	2.2965E-05	7.08E+09	4.6878E-07	7.099E-06	1.370E-06	0.000E+00	1.496E-05
Pr-143	1.0212E-05	3.13E+09	2.0703E-07	3.127E-06	6.036E-07	0.000E+00	6.689E-06
Nd-147	1.1152E-05	3.45E+09	2.2899E-07	3.475E-06	6.708E-07	0.000E+00	7.235E-06
Np-239	3.4600E-04	1.09E+11	7.2651E-06	1.112E-04	2.146E-05	0.000E+00	2.206E-04
Pu-238	8.0357E-08	2.48E+07	1.6399E-09	2.483E-08	4.793E-09	0.000E+00	5.237E-08
Pu-239	8.1041E-09	2.50E+06	1.6534E-10	2.503E-09	4.832E-10	0.000E+00	5.283E-09
Pu-240	1.1112E-08	3.42E+06	2.2677E-10	3.434E-09	6.628E-10	0.000E+00	7.242E-09



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Pu-241	3.3522E-06	1.03E+09	6.8414E-08	1.036E-06	2.000E-07	0.000E+00	2.185E-06
Am-241	1.7278E-09	5.32E+05	3.5232E-11	5.333E-10	1.029E-10	0.000E+00	1.127E-09
Cm-242	4.3403E-07	1.34E+08	8.8615E-09	1.342E-07	2.590E-08	0.000E+00	2.828E-07
Cm-244	2.7873E-08	8.59E+06	5.6883E-10	8.613E-09	1.663E-09	0.000E+00	1.817E-08

Filtered Environment to Control Room Transport Group Inventory:

	Pathway	
	Filtered	Transported
Time (h) = 5.0000		
Noble gases (atoms)	0.0000E+00	4.2933E+17
Elemental I (atoms)	3.1140E+14	4.2083E+13
Organic I (atoms)	3.5362E+13	4.4818E+12
Aerosol I (atoms)	8.8955E+14	8.8360E+13
All Aerosols (kg)	3.5421E-08	3.6350E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:06

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Exclusion Area Boundary Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.0096E-01	4.1382E+00	2.4022E-01
Accumulated dose (rem)	5.1442E-01	1.6044E+01	1.1143E+00

Low Population Zone Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	2.5239E-01	1.0346E+01	6.0056E-01
Accumulated dose (rem)	1.0028E+00	3.2388E+01	2.1908E+00

Control Room Doses:

Time (h) = 8.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.2970E-02	4.4108E+00	2.3091E-01	5.4921E-01
Accumulated dose (rem)	3.5704E-02	1.6232E+01	7.5946E-01	1.4375E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 8.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1	Pathway 7	Pathway 8	Pathway 9
						Outflow	Outflow	Outflow	Outflow
Co-58	1.2603E+01	5.1189E-06	1.5517E+03	2.0669E+17	9.1051E+02	4.1048E-01	0.0000E+00	9.4105E-01	9.4105E-01
Co-60	1.5131E+01	1.1855E-04	1.8590E+03	2.4763E+17	1.0932E+03	4.9177E-01	0.0000E+00	1.1274E+00	1.1274E+00
Kr-85	8.8005E+05	2.2010E-06	6.0361E+06	8.0400E+20	0.0000E+00	1.5912E+03	8.1591E-02	3.6481E+03	3.6481E+03
Kr-85m	4.7488E+06	1.3269E-03	5.7894E+07	7.7414E+21	0.0000E+00	1.5345E+04	1.5084E+00	3.5183E+04	3.5183E+04
Kr-87	3.9918E+05	3.8309E-03	3.0345E+07	4.0975E+21	0.0000E+00	8.1356E+03	2.8333E+00	1.8658E+04	1.8658E+04
Kr-88	6.2441E+06	3.4593E-02	1.1068E+08	1.4833E+22	0.0000E+00	2.9421E+04	4.0384E+00	6.7460E+04	6.7460E+04
Rb-86	5.3602E+02	1.4198E-04	7.3396E+04	9.7767E+18	4.1278E+04	1.9409E+01	1.5341E-02	4.4533E+01	4.4533E+01
Sr-89	1.6068E+04	2.3785E-02	1.9802E+06	2.6376E+20	1.1609E+06	5.2382E+02	0.0000E+00	1.2009E+03	1.2009E+03
Sr-90	1.9185E+03	8.8722E-02	2.3569E+05	3.1394E+19	1.3860E+05	6.2347E+01	0.0000E+00	1.4294E+02	1.4294E+02
Sr-91	1.1440E+04	1.3408E-03	2.0998E+06	2.8021E+20	8.2651E+05	5.5652E+02	0.0000E+00	1.2759E+03	1.2759E+03
Sr-92	2.8896E+03	6.6222E-04	1.4987E+06	2.0091E+20	2.0876E+05	3.9907E+02	0.0000E+00	9.1490E+02	9.1490E+02
Y-90	1.5322E+02	1.4445E-05	5.9060E+03	7.6989E+17	1.1140E+04	1.5451E+00	0.0000E+00	3.5424E+00	3.5424E+00
Y-91	2.2952E+02	3.7303E-04	2.6349E+04	3.5068E+18	1.6596E+04	6.9671E+00	0.0000E+00	1.5973E+01	1.5973E+01
Y-92	4.7723E+03	9.5678E-05	3.5953E+05	4.6147E+19	3.4788E+05	9.3588E+01	0.0000E+00	2.1456E+02	2.1456E+02
Y-93	1.5130E+02	1.7320E-05	2.7109E+04	3.6172E+18	1.0930E+04	7.1840E+00	0.0000E+00	1.6470E+01	1.6470E+01
Zr-95	2.9334E+02	2.5155E-04	3.6125E+04	4.8119E+18	2.1192E+04	9.5562E+00	0.0000E+00	2.1908E+01	2.1908E+01
Zr-97	2.1491E+02	4.5997E-05	3.3052E+04	4.4070E+18	1.5526E+04	8.7525E+00	0.0000E+00	2.0066E+01	2.0066E+01
Nb-95	2.9635E+02	6.5477E-05	3.6409E+04	4.8496E+18	2.1410E+04	9.6313E+00	0.0000E+00	2.2080E+01	2.2080E+01
Mo-99	3.8928E+03	5.9243E-04	5.0642E+05	6.7472E+19	2.8124E+05	1.3400E+02	0.0000E+00	3.0720E+02	3.0720E+02
Tc-99m	3.6315E+03	1.2566E-05	4.5720E+05	6.0732E+19	2.6236E+05	1.2095E+02	0.0000E+00	2.7729E+02	2.7729E+02
Ru-103	3.5351E+03	1.1622E-03	4.3602E+05	5.8079E+19	2.5539E+05	1.1534E+02	0.0000E+00	2.6443E+02	2.6443E+02
Ru-105	7.1867E+02	5.2334E-05	2.1046E+05	2.8143E+19	5.1921E+04	5.5899E+01	0.0000E+00	1.2815E+02	1.2815E+02
Ru-106	1.4380E+03	2.4456E-02	1.7673E+05	2.3541E+19	1.0389E+05	4.6751E+01	0.0000E+00	1.0718E+02	1.0718E+02
Rh-105	2.1627E+03	8.0545E-05	2.7958E+05	3.7231E+19	1.5624E+05	7.3967E+01	0.0000E+00	1.6957E+02	1.6957E+02
Sb-127	4.7039E+03	1.1138E-03	6.0199E+05	8.0200E+19	3.3984E+05	1.5927E+02	0.0000E+00	3.6515E+02	3.6515E+02
Sb-129	4.0917E+03	4.9787E-04	1.2281E+06	1.6424E+20	2.9561E+05	3.2622E+02	0.0000E+00	7.4789E+02	7.4789E+02
Te-127	4.8592E+03	5.6976E-05	6.1282E+05	8.1494E+19	3.5106E+05	1.6213E+02	0.0000E+00	3.7169E+02	3.7169E+02
Te-127m	6.7191E+02	5.1416E-04	8.2510E+04	1.0990E+19	4.8543E+04	2.1826E+01	0.0000E+00	5.0039E+01	5.0039E+01



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Te-129	5.7674E+03	4.3105E-05	1.3977E+06	1.8445E+20	4.1667E+05	3.7080E+02	0.0000E+00	8.5009E+02	8.5009E+02
Te-129m	2.1479E+03	1.8402E-03	2.6425E+05	3.5197E+19	1.5518E+05	6.9901E+01	0.0000E+00	1.6025E+02	1.6025E+02
Te-131m	5.4442E+03	1.6041E-03	7.5880E+05	1.0113E+20	3.9332E+05	2.0085E+02	0.0000E+00	4.6045E+02	4.6045E+02
Te-132	5.9317E+04	2.1156E-02	7.6478E+06	1.0189E+21	4.2854E+06	2.0235E+03	0.0000E+00	4.6391E+03	4.6391E+03
I-131	1.1901E+06	3.7355E-01	3.8953E+07	5.1890E+21	1.7979E+07	1.0297E+04	5.9740E+00	2.3619E+04	2.3619E+04
I-132	3.5207E+05	1.7756E-02	3.9140E+07	5.2374E+21	7.0730E+06	1.0412E+04	8.5765E+00	2.3891E+04	2.3891E+04
I-133	1.8991E+06	1.2977E-01	7.2715E+07	9.6937E+21	2.8687E+07	1.9237E+04	1.2087E+01	4.4130E+04	4.4130E+04
I-134	4.8659E+03	7.4526E-03	1.7077E+07	2.3200E+21	7.3504E+04	4.6026E+03	1.2841E+01	1.0581E+04	1.0581E+04
I-135	1.0034E+06	3.4498E-02	5.6536E+07	7.5503E+21	1.5158E+07	1.4986E+04	1.1285E+01	3.4382E+04	3.4382E+04
Xe-133	1.2305E+08	4.0905E-03	8.5574E+08	1.1399E+23	0.0000E+00	2.2562E+05	1.1726E+01	5.1727E+05	5.1727E+05
Xe-135	3.7379E+07	1.0861E-02	2.9785E+08	3.9677E+22	0.0000E+00	7.8635E+04	4.1642E+00	1.8029E+05	1.8029E+05
Cs-134	5.2391E+04	9.7007E-02	7.1132E+06	9.4747E+20	4.0345E+06	1.8810E+03	1.4816E+00	4.3157E+03	4.3157E+03
Cs-136	1.6477E+04	5.5440E-03	2.2645E+06	3.0164E+20	1.2688E+06	5.9884E+02	4.7405E-01	1.3740E+03	1.3740E+03
Cs-137	3.1443E+04	3.9861E-02	4.2683E+06	5.6853E+20	2.4214E+06	1.1287E+03	8.8893E-01	2.5896E+03	2.5896E+03
Ba-139	5.8017E+02	7.3169E-05	1.2971E+06	1.7496E+20	4.1915E+04	3.4755E+02	0.0000E+00	7.9677E+02	7.9677E+02
Ba-140	3.0600E+04	4.2225E-03	3.8059E+06	5.0697E+20	2.2107E+06	1.0068E+03	0.0000E+00	2.3082E+03	2.3082E+03
La-140	3.6571E+03	2.2555E-04	1.2790E+05	1.6608E+19	2.6594E+05	3.3398E+01	0.0000E+00	7.6567E+01	7.6567E+01
La-141	7.1965E+01	4.1551E-06	2.3649E+04	3.1640E+18	5.1992E+03	6.2844E+00	0.0000E+00	1.4407E+01	1.4407E+01
La-142	7.7972E+00	6.5166E-06	1.2664E+04	1.7059E+18	5.6331E+02	3.3886E+00	0.0000E+00	7.7686E+00	7.7686E+00
Ce-141	7.3562E+02	2.3643E-04	9.0730E+04	1.2085E+19	5.3144E+04	2.4001E+01	0.0000E+00	5.5025E+01	5.5025E+01
Ce-143	5.7462E+02	8.0906E-05	7.9172E+04	1.0551E+19	4.1513E+04	2.0955E+01	0.0000E+00	4.8040E+01	4.8040E+01
Ce-144	6.0484E+02	8.0536E-03	7.4346E+04	9.9028E+18	4.3697E+04	1.9667E+01	0.0000E+00	4.5087E+01	4.5087E+01
Pr-143	2.7095E+02	7.7064E-05	3.2811E+04	4.3695E+18	1.9578E+04	8.6787E+00	0.0000E+00	1.9897E+01	1.9897E+01
Nd-147	2.9151E+02	7.2766E-05	3.6328E+04	4.8392E+18	2.1060E+04	9.6105E+00	0.0000E+00	2.2033E+01	2.2033E+01
Np-239	8.7862E+03	8.6634E-04	1.1540E+06	1.5377E+20	6.3477E+05	3.0538E+02	0.0000E+00	7.0010E+02	7.0010E+02
Pu-238	2.1171E+00	2.1728E-02	2.6008E+02	3.4642E+16	1.5295E+02	6.8798E-02	0.0000E+00	1.5773E-01	1.5773E-01
Pu-239	2.1360E-01	2.3424E-03	2.6220E+01	3.4925E+15	1.5431E+01	6.9360E-03	0.0000E+00	1.5901E-02	1.5901E-02
Pu-240	2.9274E-01	3.2128E-03	3.5963E+01	4.7903E+15	2.1149E+01	9.5134E-03	0.0000E+00	2.1810E-02	2.1810E-02
Pu-241	8.8315E+01	1.5592E-02	1.0850E+04	1.4452E+18	6.3804E+03	2.8701E+00	0.0000E+00	6.5799E+00	6.5799E+00
Am-241	4.5566E-02	7.1904E-04	5.5871E+00	7.4419E+14	3.2920E+00	1.4779E-03	0.0000E+00	3.3883E-03	3.3883E-03
Cm-242	1.1429E+01	7.0387E-03	1.4054E+03	1.8720E+17	8.2568E+02	3.7177E-01	0.0000E+00	8.5231E-01	8.5231E-01
Cm-244	7.3431E-01	6.4822E-03	9.0212E+01	1.2016E+16	5.3051E+01	2.3864E-02	0.0000E+00	5.4710E-02	5.4710E-02
Total	1.7743E+08	1.0000E+00	0.0000E+00	0.0000E+00	9.0260E+07	4.2926E+05	7.7975E+01	9.8429E+05	9.8429E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 4.1052E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 4.7904E-04
 Total I (Ci) 4.4495E+06

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 8.0000	Atmosphere	Sump
Noble gases (atoms)	1.8941E+25	0.0000E+00
Elemental I (atoms)	4.1305E+22	0.0000E+00
Organic I (atoms)	1.2775E+21	0.0000E+00
Aerosol I (atoms)	1.0569E+22	0.0000E+00
All Aerosols (kg)	4.2652E-01	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
Aerosol I (atoms)	8.6146E+23	0.0000E+00
All Aerosols (kg)	3.2751E+01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 8.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	6.2507E-06	3.0189E-06	7.5290E-04	1.0029E+11	4.1048E-01	6.7387E-03	1.4566E-03	0.0000E+00
Co-60	7.5048E-06	6.9915E-05	9.0204E-04	1.2015E+11	4.9177E-01	8.0734E-03	1.7449E-03	0.0000E+00
Kr-85	4.3604E-01	1.3153E-06	2.9677E+00	3.9529E+14	1.5912E+03	1.3235E+03	2.6646E+02	0.0000E+00
Kr-85m	2.3529E+00	7.8853E-04	2.8305E+01	3.7849E+15	1.5345E+04	1.2693E+04	2.6326E+03	0.0000E+00
Kr-87	1.9778E-01	2.2249E-03	1.4500E+01	1.9579E+15	8.1356E+03	6.5782E+03	1.5322E+03	0.0000E+00
Kr-88	3.0938E+00	2.0472E-02	5.3889E+01	7.2220E+15	2.9421E+04	2.4235E+04	5.1375E+03	0.0000E+00
Rb-86	2.6585E-04	8.1521E-05	3.4672E-02	4.6184E+12	1.9409E+01	3.1042E-01	7.6872E-02	0.0000E+00
Sr-89	7.9695E-03	1.4027E-02	9.6079E-01	1.2798E+14	5.2382E+02	8.5993E+00	1.8588E+00	0.0000E+00
Sr-90	9.5152E-04	5.2324E-02	1.1436E-01	1.5233E+13	6.2347E+01	1.0235E+00	2.2122E-01	0.0000E+00
Sr-91	5.6740E-03	7.8851E-04	1.0160E+00	1.3558E+14	5.5652E+02	9.1105E+00	1.9969E+00	0.0000E+00
Sr-92	1.4332E-03	3.8644E-04	7.1955E-01	9.6460E+13	3.9907E+02	6.4826E+00	1.4757E+00	0.0000E+00
Y-90	7.5994E-05	8.6159E-06	2.8983E-03	3.7791E+11	1.5451E+00	2.5658E-02	5.2382E-03	0.0000E+00
Y-91	1.1383E-04	2.2009E-04	1.2790E-02	1.7023E+12	6.9671E+00	1.1443E-01	2.4680E-02	0.0000E+00
Y-92	2.3669E-03	5.7313E-05	1.7719E-01	2.2768E+13	9.3588E+01	1.5614E+00	3.1114E-01	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Y-93	7.5039E-05	1.0187E-05	1.3119E-02	1.7504E+12	7.1840E+00	1.1763E-01	2.5761E-02	0.0000E+00
Zr-95	1.4549E-04	1.4835E-04	1.7528E-02	2.3348E+12	9.5562E+00	1.5688E-01	3.3910E-02	0.0000E+00
Zr-97	1.0659E-04	2.7084E-05	1.6012E-02	2.1350E+12	8.7525E+00	1.4346E-01	3.1250E-02	0.0000E+00
Nb-95	1.4698E-04	3.8615E-05	1.7666E-02	2.3531E+12	9.6313E+00	1.5811E-01	3.4174E-02	0.0000E+00
Mo-99	1.9307E-03	3.4925E-04	2.4562E-01	3.2726E+13	1.3400E+02	2.1990E+00	4.7621E-01	0.0000E+00
Tc-99m	1.8011E-03	7.4105E-06	2.2182E-01	2.9465E+13	1.2095E+02	1.9855E+00	4.2930E-01	0.0000E+00
Ru-103	1.7533E-03	6.8538E-04	2.1156E-01	2.8180E+13	1.1534E+02	1.8935E+00	4.0931E-01	0.0000E+00
Ru-105	3.5644E-04	3.0672E-05	1.0148E-01	1.3571E+13	5.5899E+01	9.1197E-01	2.0327E-01	0.0000E+00
Ru-106	7.1321E-04	1.4423E-02	8.5753E-02	1.1422E+13	4.6751E+01	7.6751E-01	1.6589E-01	0.0000E+00
Rh-105	1.0726E-03	4.7495E-05	1.3564E-01	1.8062E+13	7.3967E+01	1.2141E+00	2.6261E-01	0.0000E+00
Sb-127	2.3330E-03	6.5666E-04	2.9201E-01	3.8903E+13	1.5927E+02	2.6140E+00	5.6578E-01	0.0000E+00
Sb-129	2.0294E-03	2.9174E-04	5.9209E-01	7.9183E+13	3.2622E+02	5.3212E+00	1.1871E+00	0.0000E+00
Te-127	2.4100E-03	3.3596E-05	2.9730E-01	3.9536E+13	1.6213E+02	2.6612E+00	5.7565E-01	0.0000E+00
Te-127m	3.3325E-04	3.0323E-04	4.0035E-02	5.3326E+12	2.1826E+01	3.5832E-01	7.7444E-02	0.0000E+00
Te-129	2.8605E-03	2.5312E-05	6.7525E-01	8.9115E+13	3.7080E+02	6.0613E+00	1.3381E+00	0.0000E+00
Te-129m	1.0653E-03	1.0853E-03	1.2822E-01	1.7078E+13	6.9901E+01	1.1476E+00	2.4802E-01	0.0000E+00
Te-131m	2.7002E-03	9.4522E-04	3.6785E-01	4.9027E+13	2.0085E+02	3.2943E+00	7.1514E-01	0.0000E+00
Te-132	2.9419E-02	1.2473E-02	3.7096E+00	4.9422E+14	2.0235E+03	3.3209E+01	7.1895E+00	0.0000E+00
I-131	4.1573E+00	5.0527E-01	4.3348E+01	5.7745E+15	1.0297E+04	8.8981E+02	3.6568E+02	1.3345E+04
I-132	1.5424E+00	2.0095E-02	3.6444E+01	4.8836E+15	1.0412E+04	6.9819E+02	2.9477E+02	9.9146E+03
I-133	6.6333E+00	1.7017E-01	7.8455E+01	1.0459E+16	1.9237E+04	1.5926E+03	6.5740E+02	2.3692E+04
I-134	1.6998E-02	6.3116E-03	1.1899E+01	1.6166E+15	4.6026E+03	2.0005E+02	1.0734E+02	2.6083E+03
I-135	3.5049E+00	4.2222E-02	5.6928E+01	7.6028E+15	1.4986E+04	1.1255E+03	4.7057E+02	1.6418E+04
Xe-133	6.1195E+01	2.4490E-03	4.2152E+02	5.6151E+16	2.2562E+05	1.8801E+05	3.7871E+04	4.5177E+02
Xe-135	1.9997E+01	6.7696E-03	1.5274E+02	2.0360E+16	7.8635E+04	6.8235E+04	1.3766E+04	3.4808E+03
Cs-134	2.5984E-02	5.5706E-02	3.3606E+00	4.4764E+14	1.8810E+03	3.0087E+01	7.4463E+00	0.0000E+00
Cs-136	8.1721E-03	3.1830E-03	1.0697E+00	1.4249E+14	5.9884E+02	9.5771E+00	2.3722E+00	0.0000E+00
Cs-137	1.5595E-02	2.2890E-02	2.0166E+00	2.6861E+14	1.1287E+03	1.8054E+01	4.4681E+00	0.0000E+00
Ba-139	2.8775E-04	4.2194E-05	6.1538E-01	8.3008E+13	3.4755E+02	5.5789E+00	1.3438E+00	0.0000E+00
Ba-140	1.5177E-02	2.4900E-03	1.8465E+00	2.4597E+14	1.0068E+03	1.6527E+01	3.5736E+00	0.0000E+00
La-140	1.8138E-03	1.3480E-04	6.2891E-02	8.1689E+12	3.3398E+01	5.5572E-01	1.1229E-01	0.0000E+00
La-141	3.5693E-05	2.4332E-06	1.1394E-02	1.5243E+12	6.2844E+00	1.0244E-01	2.2929E-02	0.0000E+00
La-142	3.8672E-06	3.7680E-06	6.0243E-03	8.1153E+11	3.3886E+00	5.4542E-02	1.2972E-02	0.0000E+00
Ce-141	3.6485E-04	1.3943E-04	4.4023E-02	5.8639E+12	2.4001E+01	3.9402E-01	8.5168E-02	0.0000E+00
Ce-143	2.8499E-04	4.7676E-05	3.8385E-02	5.1155E+12	2.0955E+01	3.4374E-01	7.4589E-02	0.0000E+00
Ce-144	2.9998E-04	4.7496E-03	3.6073E-02	4.8050E+12	1.9667E+01	3.2286E-01	6.9783E-02	0.0000E+00
Pr-143	1.3438E-04	4.5453E-05	1.5921E-02	2.1203E+12	8.6787E+00	1.4249E-01	3.0784E-02	0.0000E+00
Nd-147	1.4458E-04	4.2910E-05	1.7625E-02	2.3478E+12	9.6105E+00	1.5776E-01	3.4114E-02	0.0000E+00
Np-239	4.3577E-03	5.1069E-04	5.5970E-01	7.4575E+13	3.0538E+02	5.0110E+00	1.0856E+00	0.0000E+00
Pu-238	1.0500E-06	1.2814E-02	1.2619E-04	1.6809E+10	6.8798E-02	1.1295E-03	2.4411E-04	0.0000E+00
Pu-239	1.0594E-07	1.3815E-03	1.2723E-05	1.6946E+09	6.9360E-03	1.1387E-04	2.4610E-05	0.0000E+00
Pu-240	1.4519E-07	1.8948E-03	1.7450E-05	2.3243E+09	9.5134E-03	1.5618E-04	3.3755E-05	0.0000E+00
Pu-241	4.3802E-05	9.1956E-03	5.2645E-03	7.0123E+11	2.8701E+00	4.7118E-02	1.0184E-02	0.0000E+00
Am-241	2.2600E-08	4.2406E-04	2.7110E-06	3.6110E+08	1.4779E-03	2.4264E-05	5.2439E-06	0.0000E+00
Cm-242	5.6684E-06	4.1511E-03	6.8191E-04	9.0831E+10	3.7177E-01	6.1032E-03	1.3191E-03	0.0000E+00
Cm-244	3.6420E-07	3.8229E-03	4.3772E-05	5.8305E+09	2.3864E-02	3.9177E-04	8.4674E-05	0.0000E+00
Total	1.0327E+02	1.0000E+00	0.0000E+00	0.0000E+00	4.2926E+05	3.0576E+05	6.3143E+04	6.9911E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 9.4856E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.1085E-06
 Total I (Ci) 1.5855E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	8.0000	Atmosphere	Sump
Noble gases (atoms)	9.3931E+18	0.0000E+00	
Elemental I (atoms)	1.7515E+17	0.0000E+00	
Organic I (atoms)	5.4169E+15	0.0000E+00	
Aerosol I (atoms)	5.2417E+15	0.0000E+00	
All Aerosols (kg)	2.1154E-07	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 8.0000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	Atmosphere	1.1695E-02	0.00000	0.00000	0.00000	0.00000
Co-60	Atmosphere	1.4015E-02	0.00002	0.00000	0.00000	0.00001
Kr-85	Atmosphere	1.7582E+03	0.00001	0.00000	0.00000	0.00000
Kr-85m	Atmosphere	1.6549E+04	0.00769	0.00156	0.00000	0.00059
Kr-87	Atmosphere	8.3198E+03	0.02972	0.00631	0.00001	0.00125
Kr-88	Atmosphere	3.1304E+04	0.21601	0.04418	0.00002	0.01417
Rb-86	Atmosphere	5.7288E-01	0.00002	0.00000	0.00000	0.00001
Sr-89	Atmosphere	1.4922E+01	0.00394	0.00080	0.00000	0.00104



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Sr-90	1.7768E+00	8.8842E-02	0.01471	0.00299	0.00000	0.00388
Sr-91	1.5017E+01	7.5083E-01	0.00023	0.00005	0.00000	0.00005
Sr-92	9.7188E+00	4.8594E-01	0.00012	0.00003	0.00000	0.00002
Y-90	5.9174E-02	2.9587E-03	0.00000	0.00000	0.00000	0.00000
Y-91	2.0090E-01	1.0045E-02	0.00006	0.00001	0.00000	0.00002
Y-92	3.2878E+00	1.6439E-01	0.00001	0.00000	0.00000	0.00001
Y-93	1.9443E-01	9.7214E-03	0.00000	0.00000	0.00000	0.00000
Zr-95	2.7225E-01	1.3612E-02	0.00004	0.00001	0.00000	0.00001
Zr-97	2.4162E-01	1.2081E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	2.7448E-01	1.3724E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	3.7868E+00	1.8934E-01	0.00010	0.00002	0.00000	0.00003
Tc-99m	3.4366E+00	1.7183E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	3.2852E+00	1.6426E-01	0.00019	0.00004	0.00000	0.00005
Ru-105	1.4317E+00	7.1587E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	1.3323E+00	6.6615E-02	0.00405	0.00083	0.00000	0.00107
Rh-105	2.0951E+00	1.0475E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	4.5119E+00	2.2559E-01	0.00019	0.00004	0.00000	0.00005
Sb-129	8.3351E+00	4.1676E-01	0.00009	0.00002	0.00000	0.00002
Te-127	4.6030E+00	2.3015E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	6.2208E-01	3.1104E-02	0.00009	0.00002	0.00000	0.00002
Te-129	9.6980E+00	4.8490E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	1.9919E+00	9.9595E-02	0.00031	0.00006	0.00000	0.00008
Te-131m	5.6202E+00	2.8101E-01	0.00027	0.00005	0.00000	0.00007
Te-132	5.7260E+01	2.8630E+00	0.00352	0.00072	0.00000	0.00091
I-131	1.3480E+03	6.7235E+01	0.22020	0.08454	0.00099	0.01681
I-132	1.0399E+03	5.1760E+01	0.00968	0.00370	0.00007	0.00055
I-133	2.4093E+03	1.2013E+02	0.07529	0.02889	0.00037	0.00552
I-134	3.1761E+02	1.5530E+01	0.00370	0.00153	0.00010	0.00013
I-135	1.6983E+03	8.4602E+01	0.01937	0.00743	0.00012	0.00129
Xe-133	2.5050E+05	1.2524E+04	0.02098	0.00418	0.00000	0.00210
Xe-135	9.6960E+04	4.8477E+03	0.05900	0.01176	0.00000	0.00663
Cs-134	5.5583E+01	2.7415E+00	0.01568	0.00341	0.00035	0.00451
Cs-136	1.7667E+01	8.7128E-01	0.00090	0.00020	0.00002	0.00026
Cs-137	3.3354E+01	1.6451E+00	0.00644	0.00140	0.00014	0.00185
Ba-139	7.7735E+00	3.8868E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	2.8641E+01	1.4321E+00	0.00070	0.00014	0.00000	0.00018
La-140	1.3320E+00	6.6599E-02	0.00003	0.00001	0.00000	0.00002
La-141	1.5916E-01	7.9582E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.6915E-02	3.8457E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	6.8363E-01	3.4181E-02	0.00004	0.00001	0.00000	0.00001
Ce-143	5.8733E-01	2.9366E-02	0.00001	0.00000	0.00000	0.00000
Ce-144	5.6044E-01	2.8022E-02	0.00134	0.00027	0.00000	0.00035
Pr-143	2.4792E-01	1.2396E-02	0.00001	0.00000	0.00000	0.00000
Nd-147	2.7331E-01	1.3666E-02	0.00001	0.00000	0.00000	0.00000
Np-239	8.6180E+00	4.3090E-01	0.00014	0.00003	0.00000	0.00004
Pu-238	1.9607E-03	9.8036E-05	0.00360	0.00073	0.00000	0.00095
Pu-239	1.9770E-04	9.8848E-06	0.00039	0.00008	0.00000	0.00010
Pu-240	2.7113E-04	1.3556E-05	0.00053	0.00011	0.00000	0.00014
Pu-241	8.1796E-02	4.0898E-03	0.00258	0.00053	0.00000	0.00068
Am-241	4.2133E-05	2.1066E-06	0.00012	0.00002	0.00000	0.00003
Cm-242	1.0594E-02	5.2968E-04	0.00117	0.00024	0.00000	0.00031
Cm-244	6.8010E-04	3.4005E-05	0.00107	0.00022	0.00000	0.00028

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 8.0000		
Noble gases (atoms)	3.8013E+22	1.3199E+18
Elemental I (atoms)	4.6774E+19	1.6241E+15
Organic I (atoms)	3.8460E+18	1.3354E+14
Aerosol I (atoms)	1.1666E+19	4.0509E+14
All Aerosols (kg)	4.4960E-04	1.5611E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 8.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	Atmosphere	6.0447E-06	6.2755E+03	8.3590E+17	0.0000E+00
Co-60		1.4010E-04	7.5245E+03	1.0023E+18	0.0000E+00
Rb-86		1.6596E-04	2.9382E+05	3.9139E+19	0.0000E+00
Sr-89		2.8078E-02	8.0055E+06	1.0664E+21	0.0000E+00
Sr-90		1.0486E-01	9.5399E+05	1.2707E+20	0.0000E+00
Sr-91		1.3711E-03	7.3543E+06	9.8138E+20	0.0000E+00



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Sr-92	2.1201E+05	4.9874E-04	3.8657E+06	5.1822E+20	0.0000E+00
Y-90	1.1313E+04	3.1461E-05	4.4054E+04	5.8008E+18	0.0000E+00
Y-91	1.6854E+04	4.5360E-04	1.0973E+05	1.4606E+19	0.0000E+00
Y-92	3.5326E+05	1.7049E-04	2.1940E+06	2.8858E+20	0.0000E+00
Y-93	1.1101E+04	1.7858E-05	9.5731E+04	1.2773E+19	0.0000E+00
Zr-95	2.1522E+04	2.9702E-04	1.4608E+05	1.9459E+19	0.0000E+00
Zr-97	1.5768E+04	5.0038E-05	1.2314E+05	1.6419E+19	0.0000E+00
Nb-95	2.1743E+04	7.7382E-05	1.4737E+05	1.9629E+19	0.0000E+00
Mo-99	2.8562E+05	6.8521E-04	2.0060E+06	2.6727E+20	0.0000E+00
Tc-99m	2.6645E+05	1.4735E-05	1.8360E+06	2.4390E+20	0.0000E+00
Ru-103	2.5937E+05	1.3714E-03	1.7622E+06	2.3473E+20	0.0000E+00
Ru-105	5.2729E+04	4.6094E-05	6.3486E+05	8.4895E+19	0.0000E+00
Ru-106	1.0551E+05	2.8899E-02	7.1524E+05	9.5270E+19	0.0000E+00
Rh-105	1.5868E+05	9.3670E-05	1.1135E+06	1.4831E+20	0.0000E+00
Sb-127	3.4513E+05	1.2961E-03	2.3993E+06	3.1964E+20	0.0000E+00
Sb-129	3.0021E+05	4.3531E-04	3.6776E+06	4.9183E+20	0.0000E+00
Te-127	3.5652E+05	6.6687E-05	2.4565E+06	3.2668E+20	0.0000E+00
Te-127m	4.9299E+04	6.0776E-04	3.3403E+05	4.4492E+19	0.0000E+00
Te-129	4.2316E+05	4.0316E-05	4.4770E+06	5.9104E+20	0.0000E+00
Te-129m	1.5759E+05	2.1741E-03	1.0692E+06	1.4242E+20	0.0000E+00
Te-131m	3.9944E+05	1.8085E-03	2.9299E+06	3.9048E+20	0.0000E+00
Te-132	4.3521E+06	2.4552E-02	3.0396E+07	4.0497E+21	0.0000E+00
I-131	1.9259E+07	3.7906E-01	1.3537E+08	1.8033E+22	1.3345E+04
I-132	7.4504E+06	1.3229E-02	9.9875E+07	1.3343E+22	9.9146E+03
I-133	3.0729E+07	1.2509E-01	2.4005E+08	3.2002E+22	2.3692E+04
I-134	7.8736E+04	3.2909E-03	2.5826E+07	3.5087E+21	2.6083E+03
I-135	1.6237E+07	2.9563E-02	1.6593E+08	2.2160E+22	1.6418E+04
Xe-133	1.2577E+06	6.4623E-06	4.6301E+06	6.0826E+20	4.5177E+02
Xe-135	8.1013E+06	3.7897E-04	3.5594E+07	4.6782E+21	3.4808E+03
Cs-134	4.0942E+06	1.1376E-01	2.8567E+07	3.8052E+21	0.0000E+00
Cs-136	1.2876E+06	6.4714E-03	9.0527E+06	1.2059E+21	0.0000E+00
Cs-137	2.4572E+06	4.6746E-02	1.7143E+07	2.2835E+21	0.0000E+00
Ba-139	4.2568E+04	4.1181E-05	2.5002E+06	3.3724E+20	0.0000E+00
Ba-140	2.2451E+06	4.9671E-03	1.5333E+07	2.0425E+21	0.0000E+00
La-140	2.7006E+05	5.2686E-04	1.0232E+06	1.3460E+20	0.0000E+00
La-141	5.2802E+03	3.5381E-06	6.8966E+04	9.2269E+18	0.0000E+00
La-142	5.7209E+02	3.8647E-06	2.5721E+04	3.4649E+18	0.0000E+00
Ce-141	5.3972E+04	2.7902E-04	3.6671E+05	4.8846E+19	0.0000E+00
Ce-143	4.2160E+04	9.1602E-05	3.0700E+05	4.0913E+19	0.0000E+00
Ce-144	4.4378E+04	9.5163E-03	3.0086E+05	4.0075E+19	0.0000E+00
Pr-143	1.9883E+04	9.1603E-05	1.3357E+05	1.7788E+19	0.0000E+00
Nd-147	2.1388E+04	8.5533E-05	1.4625E+05	1.9481E+19	0.0000E+00
Np-239	6.4465E+05	9.9842E-04	4.5550E+06	6.0692E+20	0.0000E+00
Pu-238	1.5533E+02	2.5680E-02	1.0527E+03	1.4022E+17	0.0000E+00
Pu-239	1.5672E+01	2.7692E-03	1.0616E+02	1.4141E+16	0.0000E+00
Pu-240	2.1479E+01	3.7971E-03	1.4557E+02	1.9390E+16	0.0000E+00
Pu-241	6.4797E+03	1.8428E-02	4.3916E+04	5.8496E+18	0.0000E+00
Am-241	3.3433E+00	8.5042E-04	2.2631E+01	3.0144E+15	0.0000E+00
Cm-242	8.3854E+02	8.3157E-03	5.6864E+03	7.5743E+17	0.0000E+00
Cm-244	5.3877E+01	7.6609E-03	3.6514E+02	4.8637E+16	0.0000E+00
Total	1.0473E+08	1.0000E+00	0.0000E+00	0.0000E+00	6.9911E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 9.1133E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.0653E-02
 Total I (Ci) 7.3754E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) =	8.0000	Atmosphere	Sump
Noble gases (atoms)		4.4574E+22	0.0000E+00
Elemental I (atoms)		8.3507E+23	0.0000E+00
Organic I (atoms)		2.5827E+22	0.0000E+00
Aerosol I (atoms)		0.0000E+00	0.0000E+00
All Aerosols (kg)		3.3046E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 8.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 2	Activity Pathway 3	Activity Pathway 7	Activity Pathway 11
Co-58	8.0339E-07	4.05E+08	1.6421E-08	1.482E-07	2.861E-08	0.000E+00	6.430E-07
Co-60	9.6458E-07	4.85E+08	1.9686E-08	1.775E-07	3.426E-08	0.000E+00	7.725E-07
Kr-85	0.0000E+00	0.00E+00	4.0640E-02	8.332E-03	1.608E-03	1.843E-04	3.052E-02
Kr-85m	0.0000E+00	0.00E+00	3.9667E-01	1.221E-01	2.357E-02	3.411E-03	2.476E-01



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Kr-87	0.0000E+00	0.00E+00	2.4258E-01	1.280E-01	2.471E-02	6.420E-03	8.344E-02
Kr-88	0.0000E+00	0.00E+00	7.7724E-01	2.860E-01	5.521E-02	9.136E-03	4.269E-01
Rb-86	6.7152E-05	5.02E+10	6.7598E-06	6.788E-06	1.310E-06	3.464E-05	3.118E-05
Sr-89	1.0243E-03	5.16E+11	2.0949E-05	1.891E-04	3.651E-05	0.000E+00	8.196E-04
Sr-90	1.2230E-04	6.15E+10	2.4959E-06	2.250E-05	4.344E-06	0.000E+00	9.795E-05
Sr-91	7.2927E-04	4.44E+11	1.9846E-05	2.108E-04	4.069E-05	0.000E+00	4.976E-04
Sr-92	1.8420E-04	1.95E+11	1.1411E-05	1.651E-04	3.186E-05	0.000E+00	1.125E-04
Y-90	9.9662E-06	3.45E+09	1.0705E-07	4.146E-07	8.004E-08	0.000E+00	9.579E-06
Y-91	1.4671E-05	7.17E+09	2.8584E-07	2.493E-06	4.811E-07	0.000E+00	1.198E-05
Y-92	3.1298E-04	1.61E+11	5.3694E-06	2.733E-05	5.276E-06	0.000E+00	2.857E-04
Y-93	9.6446E-06	5.80E+09	2.5784E-07	2.714E-06	5.239E-07	0.000E+00	6.665E-06
Zr-95	1.8699E-05	9.42E+09	3.8226E-07	3.450E-06	6.660E-07	0.000E+00	1.497E-05
Zr-97	1.3699E-05	7.66E+09	3.2769E-07	3.249E-06	6.272E-07	0.000E+00	1.015E-05
Nb-95	1.8891E-05	9.50E+09	3.8555E-07	3.476E-06	6.710E-07	0.000E+00	1.513E-05
Mo-99	2.4815E-04	1.28E+11	5.2706E-06	4.873E-05	9.406E-06	0.000E+00	1.953E-04
Tc-99m	2.3149E-04	1.18E+11	4.8100E-06	4.376E-05	8.447E-06	0.000E+00	1.841E-04
Ru-103	2.2535E-04	1.14E+11	4.6117E-06	4.165E-05	8.040E-06	0.000E+00	1.803E-04
Ru-105	4.5812E-05	3.54E+10	1.7817E-06	2.216E-05	4.277E-06	0.000E+00	2.204E-05
Ru-106	9.1667E-05	4.61E+10	1.8713E-06	1.688E-05	3.257E-06	0.000E+00	7.341E-05
Rh-105	1.3786E-04	7.13E+10	2.9212E-06	2.682E-05	5.178E-06	0.000E+00	1.088E-04
Sb-127	2.9985E-04	1.54E+11	6.2961E-06	5.780E-05	1.116E-05	0.000E+00	2.372E-04
Sb-129	2.6083E-04	2.04E+11	1.0343E-05	1.296E-04	2.501E-05	0.000E+00	1.239E-04
Te-127	3.0976E-04	1.57E+11	6.4389E-06	5.871E-05	1.133E-05	0.000E+00	2.462E-04
Te-127m	4.2832E-05	2.15E+10	8.7387E-07	7.877E-06	1.521E-06	0.000E+00	3.431E-05
Te-129	3.6765E-04	2.55E+11	1.2344E-05	1.445E-04	2.789E-05	0.000E+00	2.076E-04
Te-129m	1.3692E-04	6.89E+10	2.7974E-06	2.523E-05	4.870E-06	0.000E+00	1.096E-04
Te-131m	3.4705E-04	1.85E+11	7.7379E-06	7.368E-05	1.422E-05	0.000E+00	2.669E-04
Te-132	3.7812E-03	1.94E+12	7.9809E-05	7.350E-04	1.419E-04	0.000E+00	2.984E-03
I-131	3.6046E-02	2.63E+13	3.7862E-03	7.898E-03	2.597E-03	1.349E-02	1.586E-02
I-132	9.4389E-03	1.47E+13	4.8062E-03	7.989E-03	2.627E-03	1.920E-02	1.745E-02
I-133	5.7536E-02	4.64E+13	7.4252E-03	1.494E-02	4.912E-03	2.726E-02	1.860E-02
I-134	1.4742E-04	5.45E+12	5.8451E-03	2.228E-03	7.325E-04	2.834E-02	2.577E-02
I-135	3.0401E-02	3.18E+13	6.5113E-03	1.184E-02	3.894E-03	2.540E-02	7.433E-03
Xe-133	0.0000E+00	0.00E+00	5.7547E+00	1.195E+00	2.307E-01	2.649E-02	4.302E+00
Xe-135	0.0000E+00	0.00E+00	1.9545E+00	4.570E-01	8.822E-02	9.403E-03	1.400E+00
Cs-134	6.5634E-03	4.88E+12	6.5326E-04	6.588E-04	1.272E-04	3.345E-03	3.086E-03
Cs-136	2.0642E-03	1.55E+12	2.0882E-04	2.093E-04	4.040E-05	1.070E-03	9.533E-04
Cs-137	3.9392E-03	2.93E+12	3.9196E-04	3.953E-04	7.631E-05	2.007E-03	1.852E-03
Ba-139	3.6984E-05	9.89E+10	8.3740E-06	1.529E-04	2.952E-05	0.000E+00	2.089E-04
Ba-140	1.9506E-03	9.87E+11	4.0151E-05	3.640E-04	7.026E-05	0.000E+00	1.557E-03
La-140	2.3803E-04	8.13E+10	2.4701E-06	8.438E-06	1.629E-06	0.000E+00	2.304E-04
La-141	4.5875E-06	3.77E+09	1.9550E-07	2.515E-06	4.855E-07	0.000E+00	2.126E-06
La-142	4.9704E-07	1.07E+09	8.3916E-08	1.478E-06	2.853E-07	0.000E+00	1.879E-06
Ce-141	4.6890E-05	2.36E+10	9.5964E-07	8.667E-06	1.673E-06	0.000E+00	3.751E-05
Ce-143	3.6630E-05	1.94E+10	8.1008E-07	7.676E-06	1.482E-06	0.000E+00	2.828E-05
Ce-144	3.8556E-05	1.94E+10	7.8717E-07	7.099E-06	1.370E-06	0.000E+00	3.087E-05
Pr-143	1.7281E-05	8.64E+09	3.4915E-07	3.127E-06	6.036E-07	0.000E+00	1.390E-05
Nd-147	1.8582E-05	9.41E+09	3.8302E-07	3.475E-06	6.708E-07	0.000E+00	1.482E-05
Np-239	5.6009E-04	2.91E+11	1.1976E-05	1.112E-04	2.146E-05	0.000E+00	4.394E-04
Pu-238	1.3496E-07	6.79E+07	2.7542E-09	2.483E-08	4.793E-09	0.000E+00	1.081E-07
Pu-239	1.3616E-08	6.85E+06	2.7773E-10	2.503E-09	4.832E-10	0.000E+00	1.091E-08
Pu-240	1.8661E-08	9.39E+06	3.8084E-10	3.434E-09	6.628E-10	0.000E+00	1.495E-08
Pu-241	5.6298E-06	2.83E+09	1.1490E-07	1.036E-06	2.000E-07	0.000E+00	4.509E-06
Am-241	2.9048E-09	1.46E+06	5.9202E-11	5.333E-10	1.029E-10	0.000E+00	2.328E-09
Cm-242	7.2855E-07	3.67E+08	1.4878E-08	1.342E-07	2.590E-08	0.000E+00	5.833E-07
Cm-244	4.6810E-08	2.35E+07	9.5531E-10	8.613E-09	1.663E-09	0.000E+00	3.749E-08

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 8.0000	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	8.6869E+17
Elemental I (atoms)	3.5639E+14	4.7643E+13
Organic I (atoms)	6.2640E+13	7.8532E+12
Aerosol I (atoms)	1.1913E+15	9.4518E+13
All Aerosols (kg)	4.7529E-08	3.8821E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:06

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Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Exclusion Area Boundary Doses:

Time (h) =	8.3333	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.0170E-03	2.3040E-01	1.6702E-02	
Accumulated dose (rem)	5.2344E-01	1.6274E+01	1.1310E+00	

Low Population Zone Doses:

Time (h) =	8.3333	Whole Body	Thyroid	TEDE
Delta dose (rem)	9.0170E-03	2.3040E-01	1.6702E-02	
Accumulated dose (rem)	1.0118E+00	3.2618E+01	2.2075E+00	

Control Room Doses:

Time (h) =	8:3333	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.4190E-03	4.5216E-01	2.4250E-02	6.3316E-02	
Accumulated dose (rem)	3.7123E-02	1.6685E+01	7.8371E-01	1.5008E+00	

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 8.3333

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	1.0571E+01	5.0943E-06	1.5555E+03	2.0720E+17	9.1241E+02	4.1150E-01	0.0000E+00	9.4339E-01	9.4339E-01
Co-60	1.2694E+01	1.1798E-04	1.8636E+03	2.4823E+17	1.0956E+03	4.9300E-01	0.0000E+00	1.1302E+00	1.1302E+00
Kr-85	8.7961E+05	2.2912E-06	6.3293E+06	8.4307E+20	0.0000E+00	1.6688E+03	8.1591E-02	3.8260E+03	3.8260E+03
Kr-85m	4.5079E+06	1.3523E-03	5.9431E+07	7.9468E+21	0.0000E+00	1.5755E+04	1.5084E+00	3.6123E+04	3.6123E+04
Kr-87	3.3270E+05	3.8182E-03	3.0465E+07	4.1137E+21	0.0000E+00	8.1682E+03	2.8333E+00	1.8733E+04	1.8733E+04
Kr-88	5.7534E+06	3.4959E-02	1.1267E+08	1.5099E+22	0.0000E+00	2.9953E+04	4.0384E+00	6.8679E+04	6.8679E+04
Rb-86	4.4944E+02	1.4126E-04	7.3557E+04	9.7982E+18	4.1342E+00	1.9453E+01	1.5341E-02	4.4632E+01	4.4632E+01
Sr-89	1.3477E+04	2.3671E-02	1.9850E+06	2.6441E+20	1.1632E+06	5.2512E+02	0.0000E+00	1.2039E+03	1.2039E+03
Sr-90	1.6094E+03	8.8296E-02	2.3627E+05	3.1471E+19	1.3891E+05	6.2502E+01	0.0000E+00	1.4329E+02	1.4329E+02
Sr-91	9.3667E+03	1.3333E-03	2.1032E+06	2.8066E+20	8.0844E+05	5.5744E+02	0.0000E+00	1.2780E+03	1.2780E+03
Sr-92	2.2260E+03	6.5779E-04	1.4996E+06	2.0102E+20	1.9213E+05	3.9929E+02	0.0000E+00	9.1541E+02	9.1541E+02
Y-90	1.3388E+02	1.4455E-05	5.9533E+03	7.7614E+17	1.1625E+04	1.5577E+00	0.0000E+00	3.5712E+00	3.5712E+00
Y-91	1.9317E+02	3.7130E-04	2.6418E+04	3.5160E+18	1.6687E+04	6.9857E+00	0.0000E+00	1.6015E+01	1.6015E+01
Y-92	3.8980E+03	9.5360E-05	3.6094E+05	4.6336E+19	3.3934E+05	9.3969E+01	0.0000E+00	2.1543E+02	2.1543E+02
Y-93	1.2405E+02	1.7223E-05	2.7154E+04	3.6232E+18	1.0707E+04	7.1961E+00	0.0000E+00	1.6498E+01	1.6498E+01
Zr-95	2.4604E+02	2.5034E-04	3.6213E+04	4.8237E+18	2.1236E+04	9.5799E+00	0.0000E+00	2.1963E+01	2.1963E+01
Zr-97	1.7784E+02	4.5753E-05	3.3116E+04	4.4156E+18	1.5349E+04	8.7698E+00	0.0000E+00	2.0105E+01	2.0105E+01
Nb-95	2.4860E+02	6.5162E-05	3.6498E+04	4.8615E+18	2.1457E+04	9.6552E+00	0.0000E+00	2.2135E+01	2.2135E+01
Mo-99	3.2543E+03	5.8950E-04	5.0759E+05	6.7628E+19	2.8088E+05	1.3431E+02	0.0000E+00	3.0792E+02	3.0792E+02
Tc-99m	3.0401E+03	1.2505E-05	4.5829E+05	6.0877E+19	2.6239E+05	1.2124E+02	0.0000E+00	2.7796E+02	2.7796E+02
Ru-103	2.9649E+03	1.1566E-03	4.3709E+05	5.8221E+19	2.5590E+05	1.1563E+02	0.0000E+00	2.6509E+02	2.6509E+02
Ru-105	5.7232E+02	5.2007E-05	2.1067E+05	2.8172E+19	4.9398E+04	5.5955E+01	0.0000E+00	1.2828E+02	1.2828E+02
Ru-106	1.2063E+03	2.4339E-02	1.7717E+05	2.3599E+19	1.0412E+05	4.6867E+01	0.0000E+00	1.0745E+02	1.0745E+02
Rh-105	1.8063E+03	8.0148E-05	2.8023E+05	3.7317E+19	1.5590E+05	7.4141E+01	0.0000E+00	1.6997E+02	1.6997E+02
Sb-127	3.9363E+03	1.1083E-03	6.0340E+05	8.0388E+19	3.3974E+05	1.5965E+02	0.0000E+00	3.6602E+02	3.6602E+02
Sb-129	3.2538E+03	4.9475E-04	1.2293E+06	1.6440E+20	2.8083E+05	3.2655E+02	0.0000E+00	7.4863E+02	7.4863E+02
Te-127	4.0694E+03	5.6698E-05	6.1428E+05	8.1689E+19	3.5123E+05	1.6252E+02	0.0000E+00	3.7259E+02	3.7259E+02
Te-127m	5.6369E+02	5.1169E-04	8.2713E+04	1.1017E+19	4.8652E+04	2.1881E+01	0.0000E+00	5.0163E+01	5.0163E+01
Te-129	4.6502E+03	4.2845E-05	1.3994E+06	1.8467E+20	4.0136E+05	3.7126E+02	0.0000E+00	8.5114E+02	8.5114E+02
Te-129m	1.8016E+03	1.8314E-03	2.6490E+05	3.5283E+19	1.5549E+05	7.0075E+01	0.0000E+00	1.6065E+02	1.6065E+02
Te-131m	4.5321E+03	1.5960E-03	7.6043E+05	1.0135E+20	3.9117E+05	2.0128E+02	0.0000E+00	4.6146E+02	4.6146E+02
Te-132	4.9614E+04	2.1052E-02	7.6656E+06	1.0213E+21	4.2822E+06	2.0283E+03	0.0000E+00	4.6501E+03	4.6501E+03
I-131	1.1501E+06	3.7455E-01	3.9342E+07	5.2407E+21	1.7996E+07	1.0400E+04	5.9740E+00	2.3856E+04	2.3856E+04
I-132	3.1317E+05	1.7677E-02	3.9250E+07	5.2521E+21	6.8196E+06	1.0442E+04	8.5765E+00	2.3959E+04	2.3959E+04
I-133	1.8172E+06	1.2992E-01	7.3332E+07	9.7759E+21	2.8429E+07	1.9401E+04	1.2087E+01	4.4506E+04	4.4506E+04
I-134	3.6173E+03	7.3992E-03	1.7078E+07	2.3202E+21	5.6592E+04	4.6029E+03	1.2841E+01	1.0582E+04	1.0582E+04
I-135	9.3754E+05	3.4443E-02	5.6857E+07	7.5933E+21	1.4668E+07	1.5072E+04	1.1285E+01	3.4579E+04	3.4579E+04
Xe-133	1.2281E+08	4.2553E-03	8.9671E+08	1.1945E+23	0.0000E+00	2.3646E+05	1.1726E+01	5.4213E+05	5.4213E+05
Xe-135	3.6762E+07	1.1229E-02	3.1019E+08	4.1322E+22	0.0000E+00	8.1909E+04	4.1642E+00	1.8779E+05	1.8779E+05
Cs-134	4.3950E+04	9.6519E-02	7.1289E+06	9.4958E+20	4.0428E+06	1.8852E+03	1.4816E+00	4.3254E+03	4.3254E+03
Cs-136	1.3812E+04	5.5160E-03	2.2694E+06	3.0230E+20	1.2706E+06	6.0017E+02	4.7405E-01	1.3770E+03	1.3770E+03
Cs-137	2.6378E+04	3.9660E-02	4.2777E+06	5.6979E+20	2.4264E+06	1.1312E+03	8.8893E-01	2.5955E+03	2.5955E+03
Ba-139	4.1159E+02	7.2648E-05	1.2972E+06	1.7498E+20	3.5525E+04	3.4759E+02	0.0000E+00	7.9688E+02	7.9688E+02
Ba-140	2.5651E+04	4.2021E-03	3.8151E+06	5.0820E+20	2.2139E+06	1.0093E+03	0.0000E+00	2.3139E+03	2.3139E+03
La-140	3.1973E+03	2.2589E-04	1.2903E+05	1.6757E+19	2.7768E+05	3.3699E+01	0.0000E+00	7.7257E+01	7.7257E+01
La-141	5.6925E+01	4.1287E-06	2.3670E+04	3.1668E+18	4.9132E+03	6.2901E+00	0.0000E+00	1.4420E+01	1.4420E+01
La-142	5.6307E+00	6.4705E-06	1.2666E+04	1.7062E+18	4.8599E+02	3.3892E+00	0.0000E+00	7.7700E+00	7.7700E+00
Ce-141	6.1695E+02	2.3529E-04	9.0952E+04	1.2115E+19	5.3248E+04	2.4061E+01	0.0000E+00	5.5161E+01	5.5161E+01
Ce-143	4.7869E+02	8.0495E-05	7.9344E+04	1.0574E+19	4.1316E+04	2.1001E+01	0.0000E+00	4.8147E+01	4.8147E+01



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Ce-144	5.0739E+02	8.0149E-03	7.4528E+04	9.9271E+18	4.3793E+04	1.9715E+01	0.0000E+00	4.5199E+01	4.5199E+01
Pr-143	2.2748E+02	7.6697E-05	3.2892E+04	4.3804E+18	1.9637E+04	8.7006E+00	0.0000E+00	1.9947E+01	1.9947E+01
Nd-147	2.4433E+02	7.2414E-05	3.6416E+04	4.8509E+18	2.1088E+04	9.6340E+00	0.0000E+00	2.2087E+01	2.2087E+01
Np-239	7.3407E+03	8.6203E-04	1.1567E+06	1.5412E+20	6.3358E+05	3.0609E+02	0.0000E+00	7.0173E+02	7.0173E+02
Pu-238	1.7760E+00	2.1624E-02	2.6072E+02	3.4727E+16	1.5329E+02	6.8969E-02	0.0000E+00	1.5812E-01	1.5812E-01
Pu-239	1.7920E-01	2.3312E-03	2.6285E+01	3.5011E+15	1.5466E+01	6.9533E-03	0.0000E+00	1.5941E-02	1.5941E-02
Pu-240	2.4558E-01	3.1974E-03	3.6052E+01	4.8021E+15	2.1196E+01	9.5370E-03	0.0000E+00	2.1864E-02	2.1864E-02
Pu-241	7.4088E+01	1.5517E-02	1.0876E+04	1.4487E+18	6.3946E+03	2.8772E+00	0.0000E+00	6.5963E+00	6.5963E+00
Am-241	3.8230E-02	7.1559E-04	5.6009E+00	7.4602E+14	3.2997E+00	1.4816E-03	0.0000E+00	3.3968E-03	3.3968E-03
Cm-242	9.5872E+00	7.0049E-03	1.4088E+03	1.8766E+17	8.2747E+02	3.7269E-01	0.0000E+00	8.5442E-01	8.5442E-01
Cm-244	6.1602E-01	6.4510E-03	9.0433E+01	1.2046E+16	5.3169E+01	2.3923E-02	0.0000E+00	5.4846E-02	5.4846E-02
Total	1.7551E+08	1.0000E+00	0.0000E+00	0.0000E+00	8.9203E+07	4.4483E+05	7.7975E+01	1.0200E+06	1.0200E+06

Dose Effective (Ci/cc) I-131 (Thyroid) 3.9563E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 4.6068E-04
 Total I (Ci) 4.2216E+06

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 8.3333	Atmosphere	Sump
Noble gases (atoms)	1.8926E+25	0.0000E+00
Elemental I (atoms)	4.1134E+22	0.0000E+00
Organic I (atoms)	1.2722E+21	0.0000E+00
Aerosol I (atoms)	8.8341E+21	0.0000E+00
All Aerosols (kg)	3.5780E-01	0.0000E+00

Time (h) = 8.3333	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
Aerosol I (atoms)	8.6315E+23	0.0000E+00
All Aerosols (kg)	3.2819E+01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 8.3333

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1		Pathway 2		Pathway 3		Pathway 12	
					Inflow	Outflow	Outflow	Inflow	Outflow	Inflow		
Co-58	5.2423E-06	2.9574E-06	7.5479E-04	1.0054E+11	4.1150E-01	6.7557E-03	1.4599E-03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Co-60	6.2948E-06	6.8492E-05	9.0430E-04	1.2045E+11	4.9300E-01	8.0939E-03	1.7489E-03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Kr-85	4.3583E-01	1.3482E-06	3.1130E+00	4.1465E+14	1.6688E+03	1.3885E+03	2.7901E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Kr-85m	2.2336E+00	7.9128E-04	2.9067E+01	3.8867E+15	1.5755E+04	1.3036E+04	2.6988E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Kr-87	1.6484E-01	2.1830E-03	1.4559E+01	1.9659E+15	8.1682E+03	6.6056E+03	1.5375E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Kr-88	2.8507E+00	2.0370E-02	5.4873E+01	7.3539E+15	2.9953E+04	2.4681E+04	5.2236E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Rb-86	2.2288E-04	7.9846E-05	3.4752E-02	4.6291E+12	1.9453E+01	3.1115E-01	7.7012E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Sr-89	6.6834E-03	1.3742E-02	9.6319E-01	1.2830E+14	5.2512E+02	8.6211E+00	1.8630E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Sr-90	7.9812E-04	5.1259E-02	1.1465E-01	1.5271E+13	6.2502E+01	1.0261E+00	2.2172E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Sr-91	4.6449E-03	7.7181E-04	1.0177E+00	1.3580E+14	5.5744E+02	9.1258E+00	1.9999E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Sr-92	1.1039E-03	3.7784E-04	7.1996E-01	9.6515E+13	3.9929E+02	6.4863E+00	1.4764E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Y-90	6.6390E-05	8.4876E-06	2.9218E-03	3.8101E+11	1.5577E+00	2.5870E-02	5.2790E-03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Y-91	9.5792E-05	2.1565E-04	1.2825E-02	1.7069E+12	6.9857E+00	1.1474E-01	2.4740E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Y-92	1.9330E-03	5.6228E-05	1.7789E-01	2.2862E+13	9.3969E+01	1.5678E+00	3.1238E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Y-93	6.1517E-05	9.9718E-06	1.3141E-02	1.7534E+12	7.1961E+00	1.1783E-01	2.5800E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Zr-95	1.2201E-04	1.4533E-04	1.7572E-02	2.3406E+12	9.5799E+00	1.5728E-01	3.3986E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Zr-97	8.8190E-05	2.6519E-05	1.6044E-02	2.1392E+12	8.7698E+00	1.4375E-01	3.1306E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Nb-95	1.2328E-04	3.7829E-05	1.7710E-02	2.3590E+12	9.6552E+00	1.5852E-01	3.4251E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Mo-99	1.6138E-03	3.4209E-04	2.4620E-01	3.2803E+13	1.3431E+02	2.2042E+00	4.7723E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Tc-99m	1.5076E-03	7.2592E-06	2.2236E-01	2.9537E+13	1.2124E+02	1.9904E+00	4.3025E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Ru-103	1.4703E-03	6.7143E-04	2.1209E-01	2.8251E+13	1.1563E+02	1.8983E+00	4.1023E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Ru-105	2.8381E-04	3.0003E-05	1.0159E-01	1.3585E+13	5.5955E+01	9.1292E-01	2.0346E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Ru-106	5.9821E-04	1.4130E-02	8.5968E-02	1.1451E+13	4.6867E+01	7.6946E-01	1.6626E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Rh-105	8.9574E-04	4.6522E-05	1.3596E-01	1.8105E+13	7.4141E+01	1.2170E+00	2.6317E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Sb-127	1.9520E-03	6.4323E-04	2.9271E-01	3.8996E+13	1.5965E+02	2.6204E+00	5.6701E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Sb-129	1.6135E-03	2.8537E-04	5.9268E-01	7.9262E+13	3.2655E+02	5.3267E+00	1.1882E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Te-127	2.0180E-03	3.2910E-05	2.9802E-01	3.9632E+13	1.6252E+02	2.6677E+00	5.7692E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Te-127m	2.7953E-04	2.9706E-04	4.0136E-02	5.3460E+12	2.1881E+01	3.5923E-01	7.7619E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Te-129	2.3060E-03	2.4766E-05	6.7610E-01	8.9226E+13	3.7126E+02	6.0690E+00	1.3395E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Te-129m	8.9339E-04	1.0632E-03	1.2854E-01	1.7121E+13	7.0075E+01	1.1505E+00	2.4858E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Te-131m	2.2475E-03	9.2570E-04	3.6867E-01	4.9135E+13	2.0128E+02	3.3017E+00	7.1656E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Te-132	2.4604E-02	1.2218E-02	3.7184E+00	4.9540E+14	2.0283E+03	3.3289E+01	7.2050E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
I-131	4.1331E+00	5.0948E-01	4.4729E+01	5.9585E+15	1.0400E+04	9.2629E+02	3.8063E+02	1.3980E+04	1.3980E+04	1.3980E+04	1.3980E+04	1.3980E+04
I-132	1.4728E+00	1.9906E-02	3.6944E+01	4.9507E+15	1.0442E+04	7.1152E+02	3.0024E+02	1.0156E+04	1.0156E+04	1.0156E+04	1.0156E+04	1.0156E+04
I-133	6.5296E+00	1.7094E-01	8.0646E+01	1.0751E+16	1.9401E+04	1.6506E+03	6.8115E+02	2.4700E+04	2.4700E+04	2.4700E+04	2.4700E+04	2.4700E+04



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I-134	1.2998E-02	6.1702E-03	1.1904E+01	1.6173E+15	4.6029E+03	2.0018E+02	1.0739E+02	2.6106E+03
I-135	3.3688E+00	4.2087E-02	5.8070E+01	7.7553E+15	1.5072E+04	1.1558E+03	4.8299E+02	1.6946E+04
Xe-133	6.1091E+01	2.5089E-03	4.4190E+02	5.8866E+16	2.3646E+05	1.9714E+05	3.9632E+04	4.9397E+02
Xe-135	1.9725E+01	6.9016E-03	1.5936E+02	2.1242E+16	8.1909E+04	7.1202E+04	1.4339E+04	3.7499E+03
Cs-134	2.1795E-02	5.4563E-02	3.3685E+00	4.4868E+14	1.8852E+03	3.0158E+01	7.4600E+00	0.0000E+00
Cs-136	6.8495E-03	3.1176E-03	1.0721E+00	1.4281E+14	6.0017E+02	9.5994E+00	2.3766E+00	0.0000E+00
Cs-137	1.3081E-02	2.2420E-02	2.0213E+00	2.6923E+14	1.1312E+03	1.8097E+01	4.4763E+00	0.0000E+00
Ba-139	2.0411E-04	4.1237E-05	6.1546E-01	8.3018E+13	3.4759E+02	5.5797E+00	1.3439E+00	0.0000E+00
Ba-140	1.2720E-02	2.4393E-03	1.8511E+00	2.4658E+14	1.0093E+03	1.6569E+01	3.5816E+00	0.0000E+00
La-140	1.5855E-03	1.3290E-04	6.3450E-02	8.2430E+12	3.3699E+01	5.6076E-01	1.1326E-01	0.0000E+00
La-141	2.8229E-05	2.3799E-06	1.1404E-02	1.5257E+12	6.2901E+00	1.0253E-01	2.2948E-02	0.0000E+00
La-142	2.7923E-06	3.6828E-06	6.0254E-03	8.1167E+11	3.3892E+00	5.4552E-02	1.2974E-02	0.0000E+00
Ce-141	3.0595E-04	1.3659E-04	4.4133E-02	5.8785E+12	2.4061E+01	3.9501E-01	8.5360E-02	0.0000E+00
Ce-143	2.3738E-04	4.6693E-05	3.8470E-02	5.1269E+12	2.1001E+01	3.4451E-01	7.4739E-02	0.0000E+00
Ce-144	2.5161E-04	4.6530E-03	3.6164E-02	4.8170E+12	1.9715E+01	3.2368E-01	6.9941E-02	0.0000E+00
Pr-143	1.1281E-04	4.4529E-05	1.5962E-02	2.1257E+12	8.7006E+00	1.4286E-01	3.0855E-02	0.0000E+00
Nd-147	1.2116E-04	4.2035E-05	1.7669E-02	2.3536E+12	9.6340E+00	1.5815E-01	3.4190E-02	0.0000E+00
Np-239	3.6402E-03	5.0021E-04	5.6101E-01	7.4750E+13	3.0609E+02	5.0229E+00	1.0879E+00	0.0000E+00
Pu-238	8.8074E-07	1.2554E-02	1.2651E-04	1.6851E+10	6.8969E-02	1.1323E-03	2.4467E-04	0.0000E+00
Pu-239	8.8863E-08	1.3534E-03	1.2755E-05	1.6989E+09	6.9533E-03	1.1416E-04	2.4666E-05	0.0000E+00
Pu-240	1.2178E-07	1.8562E-03	1.7494E-05	2.3302E+09	9.5370E-03	1.5658E-04	3.3832E-05	0.0000E+00
Pu-241	3.6740E-05	9.0085E-03	5.2777E-03	7.0299E+11	2.8772E+00	4.7238E-02	1.0207E-02	0.0000E+00
Am-241	1.8958E-08	4.1543E-04	2.7178E-06	3.6201E+08	1.4816E-03	2.4325E-05	5.2558E-06	0.0000E+00
Cm-242	4.7542E-06	4.0666E-03	6.8362E-04	9.1058E+10	3.7269E-01	6.1187E-03	1.3221E-03	0.0000E+00
Cm-244	3.0548E-07	3.7451E-03	4.3882E-05	5.8451E+09	2.3923E-02	3.9276E-04	8.4866E-05	0.0000E+00
Total	1.0214E+02	1.0000E+00	0.0000E+00	0.0000E+00	4.4483E+05	3.1887E+05	6.5703E+04	7.2636E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 9.4048E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.0969E-06
 Total I (Ci) 1.5517E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) =	8.3333	Atmosphere	Sump
Noble gases (atoms)	9.3860E+18	0.0000E+00	
Elemental I (atoms)	1.7451E+17	0.0000E+00	
Organic I (atoms)	5.3973E+15	0.0000E+00	
Aerosol I (atoms)	4.3807E+15	0.0000E+00	
All Aerosols (kg)	1.7743E-07	0.0000E+00	

Environment Integral Nuclide Release (Ci): at Time (h) = 8.3333

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	1.1924E-02	5.9584E-04	0.00000	0.00000	0.00000	0.00000
Co-60	1.4291E-02	7.1410E-04	0.00002	0.00000	0.00000	0.00001
Kr-85	1.8524E+03	9.2457E+01	0.00001	0.00000	0.00000	0.00000
Kr-85m	1.7042E+04	8.5121E+02	0.00766	0.00155	0.00000	0.00061
Kr-87	8.3583E+03	4.1768E+02	0.02915	0.00619	0.00001	0.00124
Kr-88	3.1941E+04	1.5958E+03	0.21381	0.04370	0.00002	0.01447
Rb-86	5.8359E-01	2.8772E-02	0.00002	0.00000	0.00000	0.00001
Sr-89	1.5215E+01	7.6026E-01	0.00387	0.00079	0.00000	0.00107
Sr-90	1.8119E+00	9.0535E-02	0.01441	0.00293	0.00000	0.00400
Sr-91	1.5223E+01	7.6079E-01	0.00023	0.00005	0.00000	0.00005
Sr-92	9.7690E+00	4.8837E-01	0.00012	0.00003	0.00000	0.00002
Y-90	6.2071E-02	3.0987E-03	0.00000	0.00000	0.00000	0.00000
Y-91	2.0511E-01	1.0248E-02	0.00006	0.00001	0.00000	0.00002
Y-92	3.3751E+00	1.6861E-01	0.00001	0.00000	0.00000	0.00001
Y-93	1.9715E-01	9.8532E-03	0.00000	0.00000	0.00000	0.00000
Zr-95	2.7760E-01	1.3871E-02	0.00004	0.00001	0.00000	0.00001
Zr-97	2.4552E-01	1.2269E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	2.7989E-01	1.3986E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	3.8577E+00	1.9277E-01	0.00010	0.00002	0.00000	0.00003
Tc-99m	3.5028E+00	1.7503E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	3.3497E+00	1.6738E-01	0.00019	0.00004	0.00000	0.00005
Ru-105	1.4445E+00	7.2203E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	1.3585E+00	6.7884E-02	0.00397	0.00081	0.00000	0.00110
Rh-105	2.1344E+00	1.0666E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	4.5976E+00	2.2974E-01	0.00018	0.00004	0.00000	0.00005
Sb-129	8.4076E+00	4.2026E-01	0.00009	0.00002	0.00000	0.00002
Te-127	4.6916E+00	2.3444E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	6.3434E-01	3.1697E-02	0.00008	0.00002	0.00000	0.00002
Te-129	9.8009E+00	4.8988E-01	0.00001	0.00000	0.00000	0.00000



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Te-129m	2.0311E+00	1.0149E-01	0.00030	0.00006	0.00000	0.00008
Te-131m	5.7191E+00	2.8579E-01	0.00026	0.00005	0.00000	0.00007
Te-132	5.8341E+01	2.9152E+00	0.00345	0.00070	0.00000	0.00093
I-131	1.4052E+03	6.9996E+01	0.22148	0.08519	0.00097	0.01738
I-132	1.0606E+03	5.2759E+01	0.00958	0.00366	0.00007	0.00055
I-133	2.4999E+03	1.2451E+02	0.07545	0.02900	0.00037	0.00568
I-134	3.1781E+02	1.5540E+01	0.00363	0.00150	0.00009	0.00013
I-135	1.7456E+03	8.6886E+01	0.01928	0.00740	0.00012	0.00131
Xe-133	2.6376E+05	1.3165E+04	0.02128	0.00424	0.00000	0.00224
Xe-135	1.0160E+05	5.0719E+03	0.05959	0.01187	0.00000	0.00703
Cs-134	5.6630E+01	2.7921E+00	0.01536	0.00334	0.00034	0.00464
Cs-136	1.7996E+01	8.8719E-01	0.00088	0.00019	0.00002	0.00026
Cs-137	3.3982E+01	1.6755E+00	0.00631	0.00137	0.00014	0.00191
Ba-139	7.7832E+00	3.8914E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	2.9199E+01	1.4590E+00	0.00069	0.00014	0.00000	0.00019
La-140	1.4012E+00	6.9942E-02	0.00003	0.00001	0.00000	0.00002
La-141	1.6043E-01	8.0197E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7046E-02	3.8521E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	6.9705E-01	3.4830E-02	0.00004	0.00001	0.00000	0.00001
Ce-143	5.9777E-01	2.9871E-02	0.00001	0.00000	0.00000	0.00000
Ce-144	5.7148E-01	2.8556E-02	0.00131	0.00027	0.00000	0.00036
Pr-143	2.5286E-01	1.2635E-02	0.00001	0.00000	0.00000	0.00000
Nd-147	2.7863E-01	1.3923E-02	0.00001	0.00000	0.00000	0.00000
Np-239	8.7780E+00	4.3863E-01	0.00014	0.00003	0.00000	0.00004
Pu-238	1.9994E-03	9.9904E-05	0.00353	0.00072	0.00000	0.00098
Pu-239	2.0159E-04	1.0073E-05	0.00038	0.00008	0.00000	0.00011
Pu-240	2.7647E-04	1.3815E-05	0.00052	0.00011	0.00000	0.00014
Pu-241	8.3407E-02	4.1677E-03	0.00253	0.00052	0.00000	0.00070
Am-241	4.2965E-05	2.1468E-06	0.00012	0.00002	0.00000	0.00003
Cm-242	1.0802E-02	5.3976E-04	0.00114	0.00023	0.00000	0.00032
Cm-244	6.9350E-04	3.4653E-05	0.00105	0.00021	0.00000	0.00029

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 8.3333		
Noble gases (atoms)	4.0043E+22	1.3348E+18
Elemental I (atoms)	4.8932E+19	1.6311E+15
Organic I (atoms)	4.0293E+18	1.3431E+14
Aerosol I (atoms)	1.1874E+19	3.9580E+14
All Aerosols (kg)	4.5808E-04	1.5269E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 8.3333

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.2453E+02	6.0607E-06	6.5837E+03	8.7696E+17	0.0000E+00
Co-60	1.1102E+03	1.4048E-04	7.8946E+03	1.0516E+18	0.0000E+00
Rb-86	4.1866E+04	1.6614E-04	3.0778E+05	4.0998E+19	0.0000E+00
Sr-89	1.1787E+06	2.8151E-02	8.3985E+06	1.1187E+21	0.0000E+00
Sr-90	1.4076E+05	1.0514E-01	1.0009E+06	1.3332E+20	0.0000E+00
Sr-91	8.1918E+05	1.3596E-03	7.6302E+06	1.0182E+21	0.0000E+00
Sr-92	1.9468E+05	4.8494E-04	3.9330E+06	5.2724E+20	0.0000E+00
Y-90	1.1779E+04	3.2702E-05	4.7914E+04	6.3118E+18	0.0000E+00
Y-91	1.6908E+04	4.5574E-04	1.1536E+05	1.5355E+19	0.0000E+00
Y-92	3.4383E+05	1.7155E-04	2.3100E+06	3.0402E+20	0.0000E+00
Y-93	1.0849E+04	1.7718E-05	9.9384E+04	1.3261E+19	0.0000E+00
Zr-95	2.1518E+04	2.9780E-04	1.5326E+05	2.0414E+19	0.0000E+00
Zr-97	1.5553E+04	4.9847E-05	1.2836E+05	1.7115E+19	0.0000E+00
Nb-95	2.1742E+04	7.7591E-05	1.5461E+05	2.0594E+19	0.0000E+00
Mo-99	2.8461E+05	6.8588E-04	2.1010E+06	2.7993E+20	0.0000E+00
Tc-99m	2.6588E+05	1.4762E-05	1.9247E+06	2.5569E+20	0.0000E+00
Ru-103	2.5930E+05	1.3750E-03	1.8486E+06	2.4624E+20	0.0000E+00
Ru-105	5.0054E+04	4.5236E-05	6.5193E+05	8.7176E+19	0.0000E+00
Ru-106	1.0550E+05	2.8977E-02	7.5041E+05	9.9954E+19	0.0000E+00
Rh-105	1.5797E+05	9.3762E-05	1.1663E+06	1.5534E+20	0.0000E+00
Sb-127	3.4425E+05	1.2980E-03	2.5142E+06	3.3495E+20	0.0000E+00
Sb-129	2.8457E+05	4.2701E-04	3.7747E+06	5.0481E+20	0.0000E+00
Te-127	3.5590E+05	6.6813E-05	2.5752E+06	3.4247E+20	0.0000E+00
Te-127m	4.9298E+04	6.0941E-04	3.5046E+05	4.6681E+19	0.0000E+00
Te-129	4.0669E+05	3.9717E-05	4.6149E+06	6.0925E+20	0.0000E+00
Te-129m	1.5756E+05	2.1799E-03	1.1217E+06	1.4941E+20	0.0000E+00
Te-131m	3.9637E+05	1.8066E-03	3.0624E+06	4.0815E+20	0.0000E+00



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Te-132	4.3391E+06	2.4582E-02	3.1844E+07	4.2426E+21	0.0000E+00
I-131	1.9236E+07	3.7944E-01	1.4179E+08	1.8888E+22	1.3980E+04
I-132	7.1565E+06	1.2951E-02	1.0230E+08	1.3665E+22	1.0156E+04
I-133	3.0389E+07	1.2461E-01	-2.5023E+08	3.3359E+22	2.4700E+04
I-134	6.0492E+04	3.1479E-03	2.5849E+07	3.5118E+21	2.6106E+03
I-135	1.5678E+07	2.9157E-02	1.7123E+08	2.2868E+22	1.6946E+04
Xe-133	1.3097E+06	6.7485E-06	5.0592E+06	6.6509E+20	4.9397E+02
Xe-135	8.2387E+06	3.8993E-04	3.8321E+07	5.0399E+21	3.7499E+03
Cs-134	4.0940E+06	1.1391E-01	2.9932E+07	3.9870E+21	0.0000E+00
Cs-136	1.2866E+06	6.4779E-03	9.4817E+06	1.2630E+21	0.0000E+00
Cs-137	2.4571E+06	4.6810E-02	1.7962E+07	2.3926E+21	0.0000E+00
Ba-139	3.5997E+04	3.9560E-05	2.5131E+06	3.3899E+20	0.0000E+00
Ba-140	2.2434E+06	4.9787E-03	1.6081E+07	2.1421E+21	0.0000E+00
La-140	2.8135E+05	5.4888E-04	1.1154E+06	1.4680E+20	0.0000E+00
La-141	4.9785E+03	3.4648E-06	7.0668E+04	9.4546E+18	0.0000E+00
La-142	4.9245E+02	3.7187E-06	2.5896E+04	3.4884E+18	0.0000E+00
Ce-141	5.3956E+04	2.7974E-04	3.8470E+05	5.1242E+19	0.0000E+00
Ce-143	4.1864E+04	9.1535E-05	3.2099E+05	4.2779E+19	0.0000E+00
Ce-144	4.4375E+04	9.5418E-03	3.1565E+05	4.2045E+19	0.0000E+00
Pr-143	1.9898E+04	9.1891E-05	1.4020E+05	1.8671E+19	0.0000E+00
Nd-147	2.1369E+04	8.5727E-05	1.5337E+05	2.0431E+19	0.0000E+00
Np-239	6.4200E+05	9.9910E-04	4.7694E+06	6.3548E+20	0.0000E+00
Pu-238	1.5533E+02	2.5749E-02	1.1045E+03	1.4712E+17	0.0000E+00
Pu-239	1.5672E+01	2.7768E-03	1.1139E+02	1.4836E+16	0.0000E+00
Pu-240	2.1478E+01	3.8074E-03	1.5273E+02	2.0343E+16	0.0000E+00
Pu-241	6.4795E+03	1.8477E-02	4.6076E+04	6.1373E+18	0.0000E+00
Am-241	3.3436E+00	8.5277E-04	2.3746E+01	3.1629E+15	0.0000E+00
Cm-242	8.3847E+02	8.3380E-03	5.9659E+03	7.9466E+17	0.0000E+00
Cm-244	5.3875E+01	7.6817E-03	3.8310E+02	5.1029E+16	0.0000E+00
Total	1.0358E+08	1.0000E+00	0.0000E+00	0.0000E+00	7.2636E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 9.0774E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.0590E-02
 Total I (Ci) 7.2520E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) =	8.3333	Atmosphere	Supp.
Noble gases (atoms)	4.6072E+22	0.0000E+00	
Elemental I (atoms)	8.3209E+23	0.0000E+00	
Organic I (atoms)	2.5735E+22	0.0000E+00	
Aerosol I (atoms)	0.0000E+00	0.0000E+00	
All Aerosols (kg)	3.3045E+01	0.0000E+00	

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 8.3333

Nuclide	Filter	Decays	Transported	Activity Pathway 2	Activity Pathway 3	Activity Pathway 7	Activity Pathway 11
Co-58	8.2150E-07	4.41E+08	1.6793E-08	1.482E-07	2.861E-08	0.000E+00	6.615E-07
Co-60	9.8644E-07	5.29E+08	2.0133E-08	1.775E-07	3.426E-08	0.000E+00	7.948E-07
Kr-85	0.0000E+00	0.00E+00	4.2115E-02	8.332E-03	1.608E-03	1.843E-04	3.199E-02
Kr-85m	0.0000E+00	0.00E+00	4.0445E-01	1.221E-01	2.357E-02	3.411E-03	2.553E-01
Kr-87	0.0000E+00	0.00E+00	2.4320E-01	1.280E-01	2.471E-02	6.420E-03	8.406E-02
Kr-88	0.0000E+00	0.00E+00	7.8734E-01	2.860E-01	5.521E-02	9.136E-03	4.370E-01
Rb-86	6.7972E-05	5.32E+10	6.7772E-06	6.788E-06	1.310E-06	3.464E-05	3.202E-05
Sr-89	1.0473E-03	5.62E+11	2.1423E-05	1.891E-04	3.651E-05	0.000E+00	8.431E-04
Sr-90	1.2507E-04	6.70E+10	2.5525E-06	2.250E-05	4.344E-06	0.000E+00	1.008E-04
Sr-91	7.2789E-04	4.76E+11	2.0180E-05	2.108E-04	4.069E-05	0.000E+00	4.993E-04
Sr-92	1.7298E-04	2.03E+11	1.1493E-05	1.651E-04	3.186E-05	0.000E+00	1.238E-04
Y-90	1.0605E-05	3.91E+09	1.1171E-07	4.146E-07	8.004E-08	0.000E+00	1.022E-05
Y-91	1.5052E-05	7.83E+09	2.9264E-07	2.493E-06	4.811E-07	0.000E+00	1.237E-05
Y-92	3.1125E-04	1.75E+11	5.5113E-06	2.733E-05	5.276E-06	0.000E+00	2.876E-04
Y-93	9.6402E-06	6.23E+09	2.6226E-07	2.714E-06	5.239E-07	0.000E+00	6.673E-06
Zr-95	1.9120E-05	1.03E+10	3.9092E-07	3.450E-06	6.660E-07	0.000E+00	1.539E-05
Zr-97	1.3820E-05	8.27E+09	3.3399E-07	3.249E-06	6.272E-07	0.000E+00	1.028E-05
Nb-95	1.9319E-05	1.04E+10	3.9429E-07	3.476E-06	6.710E-07	0.000E+00	1.557E-05
Mo-99	2.5289E-04	1.39E+11	5.3852E-06	4.873E-05	9.406E-06	0.000E+00	2.001E-04
Tc-99m	2.3625E-04	1.28E+11	4.9170E-06	4.376E-05	8.447E-06	0.000E+00	1.890E-04
Ru-103	2.3040E-04	1.24E+11	4.7160E-06	4.165E-05	8.040E-06	0.000E+00	1.854E-04
Ru-105	4.4476E-05	3.74E+10	1.8024E-06	2.216E-05	4.277E-06	0.000E+00	2.340E-05
Ru-106	9.3743E-05	5.02E+10	1.9137E-06	1.688E-05	3.257E-06	0.000E+00	7.552E-05
Rh-105	1.4037E-04	7.74E+10	2.9849E-06	2.682E-05	5.178E-06	0.000E+00	1.114E-04
Sb-127	3.0589E-04	1.67E+11	6.4348E-06	5.780E-05	1.116E-05	0.000E+00	2.434E-04



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Sb-129	2.5285E-04	2.16E+11	1.0461E-05	1.296E-04	2.501E-05	0.000E+00	1.320E-04
Te-127	3.1624E-04	1.71E+11	6.5821E-06	5.871E-05	1.133E-05	0.000E+00	2.528E-04
Te-127m	4.3804E-05	2.35E+10	8.9370E-07	7.877E-06	1.521E-06	0.000E+00	3.530E-05
Te-129	3.6137E-04	2.71E+11	1.2511E-05	1.445E-04	2.789E-05	0.000E+00	2.141E-04
Te-129m	1.4000E-04	7.51E+10	2.8608E-06	2.523E-05	4.870E-06	0.000E+00	1.128E-04
Te-131m	3.5219E-04	2.01E+11	7.8980E-06	7.368E-05	1.422E-05	0.000E+00	2.722E-04
Te-132	3.8556E-03	2.11E+12	8.1557E-05	7.350E-04	1.419E-04	0.000E+00	3.060E-03
I-131	3.6489E-02	2.79E+13	3.8080E-03	7.899E-03	2.597E-03	1.349E-02	1.632E-02
I-132	9.0660E-03	1.51E+13	4.8138E-03	7.989E-03	2.627E-03	1.920E-02	1.783E-02
I-133	5.7668E-02	4.90E+13	7.4599E-03	1.494E-02	4.912E-03	2.726E-02	1.877E-02
I-134	1.1479E-04	5.45E+12	5.8451E-03	2.228E-03	7.325E-04	2.834E-02	2.580E-02
I-135	2.9752E-02	3.31E+13	6.5294E-03	1.184E-02	3.894E-03	2.540E-02	8.099E-03
Xe-133	0.0000E+00	0.00E+00	5.9602E+00	1.195E+00	2.307E-01	2.649E-02	4.508E+00
Xe-135	0.0000E+00	0.00E+00	2.0130E+00	4.570E-01	8.822E-02	9.403E-03	1.458E+00
Cs-134	6.6469E-03	5.17E+12	6.5497E-04	6.588E-04	1.272E-04	3.345E-03	3.171E-03
Cs-136	2.0890E-03	1.64E+12	2.0935E-04	2.093E-04	4.040E-05	1.070E-03	9.786E-04
Cs-137	3.9894E-03	3.10E+12	3.9299E-04	3.953E-04	7.631E-05	2.007E-03	1.904E-03
Ba-139	3.1985E-05	1.00E+11	8.3899E-06	1.529E-04	2.952E-05	0.000E+00	2.139E-04
Ba-140	1.9933E-03	1.07E+12	4.1054E-05	3.640E-04	7.026E-05	0.000E+00	1.600E-03
La-140	2.5341E-04	9.22E+10	2.5814E-06	8.438E-06	1.629E-06	0.000E+00	2.459E-04
La-141	4.4237E-06	3.97E+09	1.9757E-07	2.515E-06	4.855E-07	0.000E+00	2.292E-06
La-142	4.3757E-07	1.09E+09	8.4132E-08	1.478E-06	2.853E-07	0.000E+00	1.939E-06
Ce-141	4.7940E-05	2.57E+10	9.8134E-07	8.667E-06	1.673E-06	0.000E+00	3.858E-05
Ce-143	3.7199E-05	2.11E+10	8.2698E-07	7.676E-06	1.482E-06	0.000E+00	2.887E-05
Ce-144	3.9429E-05	2.11E+10	8.0501E-07	7.099E-06	1.370E-06	0.000E+00	3.177E-05
Pr-143	1.7687E-05	9.41E+09	3.5714E-07	3.127E-06	6.036E-07	0.000E+00	1.431E-05
Nd-147	1.8987E-05	1.02E+10	3.9162E-07	3.475E-06	6.708E-07	0.000E+00	1.523E-05
Np-239	5.7045E-04	3.16E+11	1.2235E-05	1.112E-04	2.146E-05	0.000E+00	4.500E-04
Pu-238	1.3802E-07	7.40E+07	2.8166E-09	2.483E-08	4.793E-09	0.000E+00	1.112E-07
Pu-239	1.3925E-08	7.46E+06	2.8403E-10	2.503E-09	4.832E-10	0.000E+00	1.122E-08
Pu-240	1.9084E-08	1.02E+07	3.8948E-10	3.434E-09	6.628E-10	0.000E+00	1.538E-08
Pu-241	5.7574E-06	3.08E+09	1.1750E-07	1.036E-06	2.000E-07	0.000E+00	4.639E-06
Am-241	2.9710E-09	1.59E+06	6.0546E-11	5.333E-10	1.029E-10	0.000E+00	2.395E-09
Cm-242	7.4502E-07	3.99E+08	1.5215E-08	1.342E-07	2.590E-08	0.000E+00	6.001E-07
Cm-244	4.7871E-08	2.57E+07	9.7698E-10	8.613E-09	1.663E-09	0.000E+00	3.857E-08

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 8.3333	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	9.0040E+17
Elemental I (atoms)	3.5957E+14	4.8038E+13
Organic I (atoms)	6.4568E+13	8.0915E+12
Aerosol I (atoms)	1.2078E+15	9.4856E+13
All Aerosols (kg)	4.8207E-08	3.8960E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:06

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Exclusion Area Boundary Doses:

Time (h) = 10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0514E-02	1.1395E+00	7.8433E-02
Accumulated dose (rem)	5.6395E-01	1.7413E+01	1.2094E+00

Low Population Zone Doses:

Time (h) = 10.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0514E-02	1.1395E+00	7.8433E-02
Accumulated dose (rem)	1.0523E+00	3.3758E+01	2.2860E+00

Control Room Doses:

Time (h) = 10.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	5.6182E-03	1.8477E+00	9.8948E-02	2.5868E-01
Accumulated dose (rem)	4.2741E-02	1.8532E+01	8.8266E-01	1.7595E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 10.0000



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment	Pathway 1	Pathway 7	Pathway 8	Pathway 9
					Dep Surfaces	Outflow	Outflow	Outflow	Outflow
Co-58	4.9473E+00	4.9764E-06	1.5677E+03	2.0882E+17	9.1739E+02	4.1476E-01	0.0000E+00	9.5088E-01	9.5088E-01
Co-60	5.9446E+00	1.1525E-04	1.8783E+03	2.5019E+17	1.1023E+03	4.9692E-01	0.0000E+00	1.1392E+00	1.1392E+00
Kr-85	8.7745E+05	2.7345E-06	7.7935E+06	1.0381E+21	0.0000E+00	2.0562E+03	8.1591E-02	4.7142E+03	4.7142E+03
Kr-85m	3.4747E+06	1.4560E-03	6.6020E+07	8.8279E+21	0.0000E+00	1.7512E+04	1.5084E+00	4.0150E+04	4.0150E+04
Kr-87	1.3380E+05	3.7444E-03	3.0824E+07	4.1622E+21	0.0000E+00	8.2658E+03	2.8333E+00	1.8957E+04	1.8957E+04
Kr-88	3.8212E+06	3.6236E-02	1.2049E+08	1.6148E+22	0.0000E+00	3.2048E+04	4.0384E+00	7.3482E+04	7.3482E+04
Rb-86	2.0994E+02	1.3788E-04	7.4076E+04	9.8673E+18	4.1474E+04	1.9591E+01	1.5341E-02	4.4950E+01	4.4950E+01
Sr-89	6.3056E+03	2.3123E-02	2.0006E+06	2.6648E+20	1.1693E+06	5.2928E+02	0.0000E+00	1.2134E+03	1.2134E+03
Sr-90	7.5372E+02	8.6253E-02	2.3813E+05	3.1719E+19	1.3976E+05	6.2999E+01	0.0000E+00	1.4443E+02	1.4443E+02
Sr-91	3.8843E+03	1.2985E-03	2.1135E+06	2.8203E+20	7.2027E+05	5.6019E+02	0.0000E+00	1.2843E+03	1.2843E+03
Sr-92	6.8066E+02	6.3846E-04	1.5017E+06	2.0131E+20	1.2622E+05	3.9987E+02	0.0000E+00	9.1674E+02	9.1674E+02
Y-90	7.5062E+01	1.4407E-05	6.1217E+03	7.9846E+17	1.3988E+04	1.6026E+00	0.0000E+00	3.6740E+00	3.6740E+00
Y-91	9.1816E+01	3.6294E-04	2.6643E+04	3.5459E+18	1.7040E+04	7.0458E+00	0.0000E+00	1.6153E+01	1.6153E+01
Y-92	1.5519E+03	9.3504E-05	3.6515E+05	4.6896E+19	2.8988E+05	9.5100E+01	0.0000E+00	2.1802E+02	2.1802E+02
Y-93	5.1817E+01	1.6777E-05	2.7290E+04	3.6413E+18	9.6085E+03	7.2327E+00	0.0000E+00	1.6581E+01	1.6581E+01
Zr-95	1.1514E+02	2.4454E-04	3.6497E+04	4.8615E+18	2.1350E+04	9.6559E+00	0.0000E+00	2.2137E+01	2.2137E+01
Zr-97	7.7781E+01	4.4612E-05	3.3315E+04	4.4421E+18	1.4423E+04	8.8232E+00	0.0000E+00	2.0228E+01	2.0228E+01
Nb-95	1.1642E+02	6.3655E-05	3.6785E+04	4.8997E+18	2.1588E+04	9.7320E+00	0.0000E+00	2.2311E+01	2.2311E+01
Mo-99	1.4976E+03	5.7557E-04	5.1132E+05	6.8125E+19	2.7770E+05	1.3531E+02	0.0000E+00	3.1021E+02	3.1021E+02
Tc-99m	1.4079E+03	1.2213E-05	4.6179E+05	6.1341E+19	2.6106E+05	1.2218E+02	0.0000E+00	2.8011E+02	2.8011E+02
Ru-103	1.3868E+03	1.1298E-03	4.4051E+05	5.8677E+19	2.5715E+05	1.1654E+02	0.0000E+00	2.6719E+02	2.6719E+02
Ru-105	2.0662E+02	5.0548E-05	2.1126E+05	2.8250E+19	3.8315E+04	5.6114E+01	0.0000E+00	1.2865E+02	1.2865E+02
Ru-106	5.6486E+02	2.3776E-02	1.7856E+05	2.3784E+19	1.0474E+05	4.7240E+01	0.0000E+00	1.0830E+02	1.0830E+02
Rh-105	8.2631E+02	7.8256E-05	2.8229E+05	3.7592E+19	1.5322E+05	7.4694E+01	0.0000E+00	1.7124E+02	1.7124E+02
Sb-127	1.8205E+03	1.0823E-03	6.0792E+05	8.0990E+19	3.3758E+05	1.6086E+02	0.0000E+00	3.6879E+02	3.6879E+02
Sb-129	1.1662E+03	4.8083E-04	1.2327E+06	1.6485E+20	2.1626E+05	3.2745E+02	0.0000E+00	7.5070E+02	7.5070E+02
Te-127	1.8893E+03	5.5373E-05	6.1896E+05	8.2312E+19	3.5033E+05	1.6377E+02	0.0000E+00	3.7546E+02	3.7546E+02
Te-127m	2.6401E+02	4.9986E-04	8.3364E+04	1.1104E+19	4.8956E+04	2.2055E+01	0.0000E+00	5.0562E+01	5.0562E+01
Te-129	1.7999E+03	4.1674E-05	1.4043E+06	1.8532E+20	3.3376E+05	3.7259E+02	0.0000E+00	8.5418E+02	8.5418E+02
Te-129m	8.4291E+02	1.7890E-03	2.6698E+05	3.5560E+19	1.5630E+05	7.0631E+01	0.0000E+00	1.6193E+02	1.6193E+02
Te-131m	2.0423E+03	1.5573E-03	7.6558E+05	1.0203E+20	3.7870E+05	2.0266E+02	0.0000E+00	4.6462E+02	4.6462E+02
Te-132	2.2894E+04	2.0556E-02	7.7226E+06	1.0289E+21	4.2454E+06	2.0436E+03	0.0000E+00	4.6850E+03	4.6850E+03
I-131	1.0362E+06	3.7972E-01	4.1149E+07	5.4816E+21	1.7994E+07	1.0879E+04	5.9740E+00	2.4954E+04	2.4954E+04
I-132	1.8435E+05	1.7308E-02	3.9650E+07	5.3057E+21	5.8410E+06	1.0549E+04	8.5765E+00	2.4205E+04	2.4205E+04
I-133	1.5579E+06	1.3071E-01	7.6118E+07	1.0147E+22	2.7049E+07	2.0140E+04	1.2087E+01	4.6201E+04	4.6201E+04
I-134	8.7772E+02	7.1730E-03	1.7081E+07	2.3206E+21	1.5239E+04	4.6038E+03	1.2841E+01	1.0584E+04	1.0584E+04
I-135	7.1344E+05	3.4179E-02	5.8212E+07	7.7742E+21	1.2387E+07	1.5432E+04	1.1285E+01	3.5406E+04	3.5406E+04
Xe-133	1.2165E+08	5.0614E-03	1.1004E+09	1.4658E+23	0.0000E+00	2.9037E+05	1.1726E+01	6.6572E+05	6.6572E+05
Xe-135	3.3746E+07	1.2942E-02	3.6885E+08	4.9141E+22	0.0000E+00	9.7470E+04	4.1642E+00	2.2347E+05	2.2347E+05
Cs-134	2.0581E+04	9.4217E-02	7.1797E+06	9.5634E+20	4.0659E+06	1.8988E+03	1.4816E+00	4.3566E+03	4.3566E+03
Cs-136	6.4448E+03	5.3839E-03	2.2854E+06	3.0443E+20	1.2732E+06	6.0444E+02	4.7405E-01	1.3868E+03	1.3868E+03
Cs-137	1.2353E+04	3.8714E-02	4.3082E+06	5.7385E+20	2.4404E+06	1.1394E+03	8.8893E-01	2.6142E+03	2.6142E+03
Ba-139	8.3369E+01	7.0432E-05	1.2976E+06	1.7502E+20	1.5459E+04	3.4768E+02	0.0000E+00	7.9709E+02	7.9709E+02
Ba-140	1.1967E+04	4.1044E-03	3.8447E+06	5.1214E+20	2.2191E+06	1.0172E+03	0.0000E+00	2.3320E+03	2.3320E+03
La-140	1.7942E+03	2.2578E-04	1.3306E+05	1.7290E+19	3.3437E+05	3.4770E+01	0.0000E+00	7.9713E+01	7.9713E+01
La-141	1.9869E+01	4.0115E-06	2.3728E+04	3.1745E+18	3.6844E+03	6.3056E+00	0.0000E+00	1.4456E+01	1.4456E+01
La-142	1.2464E+00	6.2739E-06	1.2670E+04	1.7068E+18	2.3113E+02	3.3905E+00	0.0000E+00	7.7729E+00	7.7729E+00
Ce-141	2.8853E+02	2.2984E-04	9.1664E+04	1.2210E+19	5.3502E+04	2.4251E+01	0.0000E+00	5.5598E+01	5.5598E+01
Ce-143	2.1646E+02	7.8555E-05	7.9889E+04	1.0647E+19	4.0139E+04	2.1147E+01	0.0000E+00	4.8481E+01	4.8481E+01
Ce-144	2.3758E+02	7.8295E-03	7.5114E+04	1.0005E+19	4.4054E+04	1.9872E+01	0.0000E+00	4.5559E+01	4.5559E+01
Pr-143	1.0694E+02	7.4933E-05	3.3156E+04	4.4154E+18	1.9832E+04	8.7710E+00	0.0000E+00	2.0108E+01	2.0108E+01
Nd-147	1.1392E+02	7.0729E-05	3.6697E+04	4.8884E+18	2.1125E+04	9.7094E+00	0.0000E+00	2.2260E+01	2.2260E+01
Np-239	3.3682E+03	8.4159E-04	1.1651E+06	1.5524E+20	6.2457E+05	3.0834E+02	0.0000E+00	7.0688E+02	7.0688E+02
Pu-238	8.3175E-01	2.1124E-02	2.6277E+02	3.5001E+16	1.5423E+02	6.9518E-02	0.0000E+00	1.5938E-01	1.5938E-01
Pu-239	8.3939E-02	2.2773E-03	2.6492E+01	3.5287E+15	1.5565E+01	7.0087E-03	0.0000E+00	1.6068E-02	1.6068E-02
Pu-240	1.1501E-01	3.1234E-03	3.6335E+01	4.8398E+15	2.1327E+01	9.6129E-03	0.0000E+00	2.2038E-02	2.2038E-02
Pu-241	3.4696E+01	1.5158E-02	1.0962E+04	1.4601E+18	6.4338E+03	2.9001E+00	0.0000E+00	6.6488E+00	6.6488E+00
Am-241	1.7914E-02	6.9905E-04	5.6450E+00	7.5191E+14	3.3219E+00	1.4935E-03	0.0000E+00	3.4239E-03	3.4239E-03
Cm-242	4.4885E+00	6.8428E-03	1.4199E+03	1.8913E+17	8.3231E+02	3.7565E-01	0.0000E+00	8.6122E-01	8.6122E-01
Cm-244	2.8849E-01	6.3018E-03	9.1145E+01	1.2140E+16	5.3495E+01	2.4113E-02	0.0000E+00	5.5282E-02	5.5282E-02
Total	1.6731E+08	1.0000E+00	0.0000E+00	0.0000E+00	8.4195E+07	5.2040E+05	7.7975E+01	1.1932E+06	1.1932E+06

Dose Effective (Ci/cc) I-131 (Thyroid) 3.5174E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 4.0551E-04
 Total I (Ci) 3.4928E+06

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 10.0000 Atmosphere Sump
 Noble gases (atoms) 1.8852E+25 0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Elemental I (atoms) 4.0323E+22 0.0000E+00
 Organic I (atoms) 1.2471E+21 0.0000E+00
 Aerosol I (atoms) 4.0656E+21 0.0000E+00
 All Aerosols (kg) 1.6754E-01 0.0000E+00

	Deposition	Recirculating
	Surfaces	Filter
Time (h) = 10.0000		
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
Aerosol I (atoms)	8.6780E+23	0.0000E+00
All Aerosols (kg)	3.3009E+01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 10.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	2.4534E-06	2.6858E-06	7.6084E-04	1.0134E+11	4.1476E-01	6.8105E-03	1.4704E-03	0.0000E+00
Co-60	2.9479E-06	6.2202E-05	9.1157E-04	1.2142E+11	4.9692E-01	8.1597E-03	1.7616E-03	0.0000E+00
Kr-85	4.3475E-01	1.4977E-06	3.8384E+00	5.1128E+14	2.0562E+03	1.7132E+03	3.4170E+02	0.0000E+00
Kr-85m	1.7216E+00	7.9295E-04	3.2332E+01	4.3232E+15	1.7512E+04	1.4509E+04	2.9831E+03	0.0000E+00
Kr-87	6.6293E-02	1.9908E-03	1.4737E+01	1.9899E+15	8.2658E+03	6.6874E+03	1.5533E+03	0.0000E+00
Kr-88	1.8933E+00	1.9648E-02	5.8749E+01	7.8732E+15	3.2048E+04	2.6437E+04	5.5625E+03	0.0000E+00
Rb-86	1.0411E-04	7.2467E-05	3.5009E-02	4.6634E+12	1.9591E+01	3.1348E-01	7.7461E-02	0.0000E+00
Sr-89	3.1270E-03	1.2479E-02	9.7090E-01	1.2933E+14	5.2928E+02	8.6909E+00	1.8765E+00	0.0000E+00
Sr-90	3.7377E-04	4.6552E-02	1.1557E-01	1.5394E+13	6.2999E+01	1.0345E+00	2.2333E-01	0.0000E+00
Sr-91	1.9262E-03	6.9881E-04	1.0228E+00	1.3648E+14	5.6019E+02	9.1720E+00	2.0088E+00	0.0000E+00
Sr-92	3.3754E-04	3.4091E-04	7.2102E-01	9.6657E+13	3.9987E+02	6.4960E+00	1.4783E+00	0.0000E+00
Y-90	3.7223E-05	7.8653E-06	3.0053E-03	3.9208E+11	1.6026E+00	2.6622E-02	5.4242E-03	0.0000E+00
Y-91	4.5531E-05	1.9597E-04	1.2936E-02	1.7217E+12	7.0458E+00	1.1575E-01	2.4935E-02	0.0000E+00
Y-92	7.6960E-04	5.1251E-05	1.7997E-01	2.3139E+13	9.5100E+01	1.5868E+00	3.1604E-01	0.0000E+00
Y-93	2.5696E-05	9.0300E-06	1.3209E-02	1.7624E+12	7.2327E+00	1.1844E-01	2.5918E-02	0.0000E+00
Zr-95	5.7097E-05	1.3198E-04	1.7713E-02	2.3594E+12	9.6559E+00	1.5855E-01	3.4233E-02	0.0000E+00
Zr-97	3.8572E-05	2.4039E-05	1.6143E-02	2.1524E+12	8.8232E+00	1.4465E-01	3.1479E-02	0.0000E+00
Nb-95	5.7733E-05	3.4355E-05	1.7853E-02	2.3780E+12	9.7320E+00	1.5981E-01	3.4500E-02	0.0000E+00
Mo-99	7.4265E-04	3.1051E-04	2.4805E-01	3.3049E+13	1.3531E+02	2.2210E+00	4.8046E-01	0.0000E+00
Tc-99m	6.9816E-04	6.5909E-06	2.2410E-01	2.9768E+13	1.2218E+02	2.0061E+00	4.3328E-01	0.0000E+00
Ru-103	6.8770E-04	6.0974E-04	2.1378E-01	2.8477E+13	1.1654E+02	1.9137E+00	4.1320E-01	0.0000E+00
Ru-105	1.0246E-04	2.7108E-05	1.0188E-01	1.3624E+13	5.6114E+01	9.1559E-01	2.0397E-01	0.0000E+00
Ru-106	2.8011E-04	1.2832E-02	8.6659E-02	1.1543E+13	4.7240E+01	7.7571E-01	1.6747E-01	0.0000E+00
Rh-105	4.0976E-04	4.2228E-05	1.3698E-01	1.8242E+13	7.4694E+01	1.2263E+00	2.6496E-01	0.0000E+00
Sb-127	9.0278E-04	5.8394E-04	2.9495E-01	3.9295E+13	1.6086E+02	2.6407E+00	5.7093E-01	0.0000E+00
Sb-129	5.7833E-04	2.5782E-04	5.9434E-01	7.9484E+13	3.2745E+02	5.3418E+00	1.1911E+00	0.0000E+00
Te-127	9.3689E-04	2.9880E-05	3.0034E-01	3.9941E+13	1.6377E+02	2.6888E+00	5.8098E-01	0.0000E+00
Te-127m	1.3092E-04	2.6978E-04	4.0459E-02	5.3890E+12	2.2055E+01	3.6215E-01	7.8184E-02	0.0000E+00
Te-129	8.9256E-04	2.2393E-05	6.7854E-01	8.9549E+13	3.7259E+02	6.0913E+00	1.3438E+00	0.0000E+00
Te-129m	4.1800E-04	9.6555E-04	1.2957E-01	1.7258E+13	7.0631E+01	1.1598E+00	2.5039E-01	0.0000E+00
Te-131m	1.0128E-03	8.3975E-04	3.7122E-01	4.9475E+13	2.0266E+02	3.3248E+00	7.2103E-01	0.0000E+00
Te-132	1.1353E-02	1.1091E-02	3.7467E+00	4.9916E+14	2.0436E+03	3.3545E+01	7.2544E+00	0.0000E+00
I-131	4.0551E+00	5.2895E-01	5.1545E+01	6.8664E+15	1.0879E+04	1.1074E+03	4.5499E+02	1.7142E+04
I-132	1.1986E+00	1.9000E-02	3.9141E+01	5.2455E+15	1.0549E+04	7.7049E+02	3.2445E+02	1.1240E+04
I-133	6.0961E+00	1.7405E-01	9.1145E+01	1.2151E+16	2.0140E+04	1.9299E+03	7.9584E+02	2.9577E+04
I-134	3.4345E-03	5.5643E-03	1.1915E+01	1.6189E+15	4.6038E+03	2.0051E+02	1.0753E+02	2.6162E+03
I-135	2.7916E+00	4.1247E-02	6.3171E+01	8.4364E+15	1.5432E+04	1.2920E+03	5.3890E+02	1.9323E+04
Xe-133	6.0561E+01	2.7788E-03	5.4326E+02	7.2369E+16	2.9037E+05	2.4252E+05	4.8392E+04	7.3009E+02
Xe-135	1.8314E+01	7.4531E-03	1.9102E+02	2.5464E+16	9.7470E+04	8.5412E+04	1.7082E+04	5.1506E+03
Cs-134	1.0206E-02	4.9524E-02	3.3936E+00	4.5203E+14	1.8988E+03	3.0386E+01	7.5040E+00	0.0000E+00
Cs-136	3.1960E-03	2.8294E-03	1.0800E+00	1.4387E+14	6.0444E+02	9.6709E+00	2.3904E+00	0.0000E+00
Cs-137	6.1259E-03	2.0350E-02	2.0364E+00	2.7124E+14	1.1394E+03	1.8233E+01	4.5027E+00	0.0000E+00
Ba-139	4.1342E-05	3.7161E-05	6.1562E-01	8.3041E+13	3.4768E+02	5.5812E+00	1.3442E+00	0.0000E+00
Ba-140	5.9346E-03	2.2150E-03	1.8657E+00	2.4853E+14	1.0172E+03	1.6702E+01	3.6073E+00	0.0000E+00
La-140	8.8974E-04	1.2350E-04	6.5447E-02	8.5073E+12	3.4770E+01	5.7874E-01	1.1673E-01	0.0000E+00
La-141	9.8530E-06	2.1494E-06	1.1433E-02	1.5296E+12	6.3056E+00	1.0280E-01	2.2998E-02	0.0000E+00
La-142	6.1810E-07	3.3192E-06	6.0278E-03	8.1199E+11	3.3905E+00	5.4574E-02	1.2978E-02	0.0000E+00
Ce-141	1.4308E-04	1.2405E-04	4.4486E-02	5.9256E+12	2.4251E+01	3.9821E-01	8.5978E-02	0.0000E+00
Ce-143	1.0734E-04	4.2362E-05	3.8740E-02	5.1629E+12	2.1147E+01	3.4696E-01	7.5211E-02	0.0000E+00
Ce-144	1.1781E-04	4.2256E-03	3.6454E-02	4.8557E+12	1.9872E+01	3.2631E-01	7.0449E-02	0.0000E+00
Pr-143	5.3029E-05	4.0445E-05	1.6093E-02	2.1431E+12	8.7710E+00	1.4404E-01	3.1083E-02	0.0000E+00
Nd-147	5.6494E-05	3.8169E-05	1.7808E-02	2.3722E+12	9.7094E+00	1.5942E-01	3.4434E-02	0.0000E+00
Np-239	1.6703E-03	4.5400E-04	5.6518E-01	7.3305E+13	3.0834E+02	5.0606E+00	1.0951E+00	0.0000E+00
Pu-238	4.1246E-07	1.1401E-02	1.2753E-04	1.6987E+10	6.9518E-02	1.1415E-03	2.4644E-04	0.0000E+00
Pu-239	4.1625E-08	1.2291E-03	1.2857E-05	1.7126E+09	7.0087E-03	1.1509E-04	2.4845E-05	0.0000E+00
Pu-240	5.7033E-08	1.6857E-03	1.7634E-05	2.3489E+09	9.6129E-03	1.5785E-04	3.4078E-05	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Pu-241	1.7206E-05	8.1811E-03	5.3201E-03	7.0864E+11	2.9001E+00	4.7622E-02	1.0281E-02	0.0000E+00
Am-241	8.8837E-09	3.7729E-04	2.7397E-06	3.6492E+08	1.4935E-03	2.4524E-05	5.2941E-06	0.0000E+00
Cm-242	2.2258E-06	3.6931E-03	6.8911E-04	9.1790E+10	3.7565E-01	6.1684E-03	1.3317E-03	0.0000E+00
Cm-244	1.4306E-07	3.4012E-03	4.4235E-05	5.8921E+09	2.4113E-02	3.9596E-04	8.5483E-05	0.0000E+00
Total	9.7191E+01	1.0000E+00	0.0000E+00	0.0000E+00	5.2040E+05	3.8276E+05	7.8177E+04	8.5779E+04

Dose Effective (Ci/cc) I-131 (Thyroid) 9.1072E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.0524E-06
 Total I (Ci) 1.4145E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) = 10.0000	Atmosphere	Sump
Noble gases (atoms)	9.3504E+18	0.0000E+00
Elemental I (atoms)	1.7149E+17	0.0000E+00
Organic I (atoms)	5.3037E+15	0.0000E+00
Aerosol I (atoms)	2.0161E+15	0.0000E+00
All Aerosols (kg)	8.3084E-08	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 10.0000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	1.3036E-02	6.5106E-04	0.00000	0.00000	0.00000	0.00000
Co-60	1.5627E-02	7.8043E-04	0.00002	0.00000	0.00000	0.00001
Kr-85	2.3342E+03	1.1639E+02	0.00001	0.00000	0.00000	0.00000
Kr-85m	1.9208E+04	9.5871E+02	0.00748	0.00151	0.00000	0.00070
Kr-87	8.4761E+03	4.2351E+02	0.02664	0.00565	0.00001	0.00117
Kr-88	3.4511E+04	1.7233E+03	0.20267	0.04133	0.00002	0.01559
Rb-86	6.3542E-01	3.1346E-02	0.00002	0.00000	0.00000	0.00001
Sr-89	1.6632E+01	8.3064E-01	0.00352	0.00072	0.00000	0.00122
Sr-90	1.9812E+00	9.8945E-02	0.01314	0.00267	0.00000	0.00456
Sr-91	1.6149E+01	8.0679E-01	0.00021	0.00004	0.00000	0.00006
Sr-92	9.9588E+00	4.9778E-01	0.00011	0.00002	0.00000	0.00002
Y-90	7.7753E-02	3.8778E-03	0.00000	0.00000	0.00000	0.00000
Y-91	2.2563E-01	1.1267E-02	0.00005	0.00001	0.00000	0.00002
Y-92	3.7604E+00	1.8774E-01	0.00001	0.00000	0.00000	0.00001
Y-93	2.0947E-01	1.0465E-02	0.00000	0.00000	0.00000	0.00000
Zr-95	3.0348E-01	1.5156E-02	0.00004	0.00001	0.00000	0.00001
Zr-97	2.6359E-01	1.3167E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	3.0605E-01	1.5285E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	4.1971E+00	2.0962E-01	0.00009	0.00002	0.00000	0.00003
Tc-99m	3.8209E+00	1.9082E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	3.6615E+00	1.8286E-01	0.00017	0.00004	0.00000	0.00006
Ru-105	1.4973E+00	7.4826E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	1.4855E+00	7.4186E-02	0.00362	0.00074	0.00000	0.00126
Rh-105	2.3223E+00	1.1598E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	5.0091E+00	2.5017E-01	0.00017	0.00003	0.00000	0.00006
Sb-129	8.7071E+00	4.3512E-01	0.00008	0.00002	0.00000	0.00002
Te-127	5.1179E+00	2.5560E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	6.9365E-01	3.4642E-02	0.00008	0.00002	0.00000	0.00003
Te-129	1.0245E+01	5.1192E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	2.2206E+00	1.1090E-01	0.00027	0.00006	0.00000	0.00009
Te-131m	6.1867E+00	3.0901E-01	0.00024	0.00005	0.00000	0.00008
Te-132	6.3522E+01	3.1725E+00	0.00315	0.00064	0.00000	0.00106
I-131	1.6900E+03	8.4141E+01	0.22793	0.08836	0.00088	0.02014
I-132	1.1522E+03	5.7305E+01	0.00911	0.00349	0.00006	0.00056
I-133	2.9386E+03	1.4629E+02	0.07622	0.02949	0.00033	0.00641
I-134	3.1830E+02	1.5564E+01	0.00330	0.00136	0.00009	0.00012
I-135	1.9586E+03	9.7463E+01	0.01879	0.00725	0.00011	0.00140
Xe-133	3.3134E+05	1.6522E+04	0.02267	0.00449	0.00000	0.00301
Xe-135	1.2425E+05	6.1965E+03	0.06211	0.01232	0.00000	0.00898
Cs-134	6.1704E+01	3.0441E+00	0.01400	0.00305	0.00031	0.00522
Cs-136	1.9587E+01	9.6624E-01	0.00080	0.00017	0.00002	0.00030
Cs-137	3.7028E+01	1.8267E+00	0.00575	0.00125	0.00013	0.00215
Ba-139	7.8122E+00	3.9058E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	3.1893E+01	1.5928E+00	0.00063	0.00013	0.00000	0.00022
La-140	1.7760E+00	8.8569E-02	0.00003	0.00001	0.00000	0.00003
La-141	1.6561E-01	8.2763E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7459E-02	3.8726E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	7.6192E-01	3.8051E-02	0.00004	0.00001	0.00000	0.00001
Ce-143	6.4725E-01	3.2328E-02	0.00001	0.00000	0.00000	0.00000
Ce-144	6.2486E-01	3.1207E-02	0.00119	0.00024	0.00000	0.00041



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

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Pr-143	2.7685E-01	1.3826E-02	0.00001	0.00000	0.00000	0.00000
Nd-147	3.0428E-01	1.5196E-02	0.00001	0.00000	0.00000	0.00000
Np-239	9.5424E+00	4.7659E-01	0.00013	0.00003	0.00000	0.00004
Pu-238	2.1862E-03	1.0918E-04	0.00322	0.00065	0.00000	0.00112
Pu-239	2.2045E-04	1.1010E-05	0.00035	0.00007	0.00000	0.00012
Pu-240	3.0231E-04	1.5098E-05	0.00048	0.00010	0.00000	0.00016
Pu-241	9.1203E-02	4.5548E-03	0.00231	0.00047	0.00000	0.00080
Am-241	4.6989E-05	2.3467E-06	0.00011	0.00002	0.00000	0.00004
Cm-242	1.1811E-02	5.8985E-04	0.00104	0.00021	0.00000	0.00036
Cm-244	7.5832E-04	3.7872E-05	0.00096	0.00020	0.00000	0.00033

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 10.0000		
Noble gases (atoms)	5.0420E+22	1.4006E+18
Elemental I (atoms)	5.9638E+19	1.6566E+15
Organic I (atoms)	4.9527E+18	1.3758E+14
Aerosol I (atoms)	1.2870E+19	3.5750E+14
All Aerosols (kg)	4.9920E-04	1.3867E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 10.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.2375E+02	6.1317E-06	8.1239E+03	1.0821E+18	0.0000E+00
Co-60	1.1100E+03	1.4218E-04	9.7447E+03	1.2980E+18	0.0000E+00
Rb-86	4.1751E+04	1.6706E-04	3.7746E+05	5.0280E+19	0.0000E+00
Sr-89	1.1774E+06	2.8477E-02	1.0362E+07	1.3802E+21	0.0000E+00
Sr-90	1.4073E+05	1.0641E-01	1.2355E+06	1.6457E+20	0.0000E+00
Sr-91	7.2527E+05	1.3022E-03	8.9133E+06	1.1894E+21	0.0000E+00
Sr-92	1.2709E+05	4.2414E-04	4.1955E+06	5.6243E+20	0.0000E+00
Y-90	1.4084E+04	3.8908E-05	6.9530E+04	9.1750E+18	0.0000E+00
Y-91	1.7158E+04	4.6565E-04	1.4376E+05	1.9136E+19	0.0000E+00
Y-92	2.9188E+05	1.7287E-04	2.8392E+06	3.7450E+20	0.0000E+00
Y-93	9.6751E+03	1.7020E-05	1.1644E+05	1.5536E+19	0.0000E+00
Zr-95	2.1499E+04	3.0128E-04	1.8910E+05	2.5189E+19	0.0000E+00
Zr-97	1.4523E+04	4.8839E-05	1.5339E+05	2.0452E+19	0.0000E+00
Nb-95	2.1738E+04	7.8526E-05	1.9085E+05	2.5420E+19	0.0000E+00
Mo-99	2.7963E+05	6.8817E-04	2.5711E+06	3.4256E+20	0.0000E+00
Tc-99m	2.6287E+05	1.4875E-05	2.3653E+06	3.1423E+20	0.0000E+00
Ru-103	2.5894E+05	1.3907E-03	2.2805E+06	3.0377E+20	0.0000E+00
Ru-105	3.8580E+04	4.1252E-05	7.2509E+05	9.6959E+19	0.0000E+00
Ru-106	1.0547E+05	2.9325E-02	9.2621E+05	1.2337E+20	0.0000E+00
Rh-105	1.5429E+05	9.4025E-05	1.4265E+06	1.9000E+20	0.0000E+00
Sb-127	3.3992E+05	1.3056E-03	3.0842E+06	4.1089E+20	0.0000E+00
Sb-129	2.1776E+05	3.8855E-04	4.1891E+06	5.6023E+20	0.0000E+00
Te-127	3.5277E+05	6.7341E-05	3.1657E+06	4.2100E+20	0.0000E+00
Te-127m	4.9296E+04	6.1680E-04	4.3262E+05	5.7625E+19	0.0000E+00
Te-129	3.3607E+05	3.6901E-05	5.2296E+06	6.9038E+20	0.0000E+00
Te-129m	1.5739E+05	2.2055E-03	1.3842E+06	1.8437E+20	0.0000E+00
Te-131m	3.8133E+05	1.7945E-03	3.7100E+06	4.9446E+20	0.0000E+00
Te-132	4.2748E+06	2.4698E-02	3.9021E+07	5.1987E+21	0.0000E+00
I-131	1.9120E+07	3.8123E-01	1.7375E+08	2.3145E+22	1.7142E+04
I-132	6.0422E+06	1.1749E-02	1.1320E+08	1.5114E+22	1.1240E+04
I-133	2.8742E+07	1.2227E-01	2.9945E+08	3.9920E+22	2.9577E+04
I-134	1.6193E+04	2.5865E-03	2.5903E+07	3.5193E+21	2.6162E+03
I-135	1.3162E+07	2.7244E-02	1.9514E+08	2.6061E+22	1.9323E+04
Xe-133	1.5594E+06	8.1574E-06	7.4587E+06	9.8300E+20	7.3009E+02
Xe-135	8.7133E+06	4.3804E-04	5.2506E+07	6.9226E+21	5.1506E+03
Cs-134	4.0931E+06	1.1468E-01	3.6755E+07	4.8957E+21	0.0000E+00
Cs-136	1.2817E+06	6.5101E-03	1.1622E+07	1.5481E+21	0.0000E+00
Cs-137	2.4567E+06	4.7129E-02	2.2057E+07	2.9380E+21	0.0000E+00
Ba-139	1.5567E+04	3.2953E-05	2.5532E+06	3.4440E+20	0.0000E+00
Ba-140	2.2345E+06	5.0292E-03	1.9812E+07	2.6391E+21	0.0000E+00
La-140	3.3669E+05	6.5849E-04	1.6321E+06	2.1522E+20	0.0000E+00
La-141	3.7099E+03	3.1286E-06	7.7826E+04	1.0412E+19	0.0000E+00
La-142	2.3273E+02	3.1162E-06	2.6467E+04	3.5654E+18	0.0000E+00
Ce-141	5.3873E+04	2.8294E-04	4.7455E+05	6.3211E+19	0.0000E+00
Ce-143	4.0418E+04	9.1072E-05	3.8952E+05	5.1911E+19	0.0000E+00
Ce-144	4.4360E+04	9.6561E-03	3.8960E+05	5.1895E+19	0.0000E+00
Pr-143	1.9970E+04	9.3197E-05	1.7343E+05	2.3096E+19	0.0000E+00
Nd-147	2.1272E+04	8.6571E-05	1.8890E+05	2.5164E+19	0.0000E+00



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Calc. No.: ALION-CAL-NPPD-3236-002

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Np-239	6.2891E+05	1.0010E-03	5.8281E+06	7.7654E+20	0.0000E+00
Pu-238	1.5530E+02	2.6060E-02	1.3634E+03	1.8160E+17	0.0000E+00
Pu-239	1.5673E+01	2.8106E-03	1.3751E+02	1.8316E+16	0.0000E+00
Pu-240	2.1475E+01	3.8533E-03	1.8852E+02	2.5111E+16	0.0000E+00
Pu-241	6.4784E+03	1.8700E-02	5.6874E+04	7.5756E+18	0.0000E+00
Am-241	3.3450E+00	8.6332E-04	2.9320E+01	3.9053E+15	0.0000E+00
Cm-242	8.3808E+02	8.4373E-03	7.3630E+03	9.8076E+17	0.0000E+00
Cm-244	5.3866E+01	7.7743E-03	4.7289E+02	6.2988E+16	0.0000E+00
Total	9.8408E+07	1.0000E+00	0.0000E+00	0.0000E+00	8.5779E+04

Dose Effective (Ci/cc) I-131 (Thyroid)	8.9054E-03
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	1.0295E-02
Total I (Ci)	6.7082E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 10.0000	Atmosphere	Sump
Noble gases (atoms)	5.2943E+22	0.0000E+00
Elemental I (atoms)	8.1795E+23	0.0000E+00
Organic I (atoms)	2.5297E+22	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	3.3039E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 10.0000

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	9.1187E-07	6.33E+08	1.8649E-08	1.482E-07	2.861E-08	0.000E+00	7.537E-07
Co-60	1.0957E-06	7.60E+08	2.2362E-08	1.775E-07	3.426E-08	0.000E+00	9.063E-07
Kr-85	0.0000E+00	0.00E+00	5.0508E-02	8.334E-03	1.609E-03	1.843E-04	4.038E-02
Kr-85m	0.0000E+00	0.00E+00	4.4235E-01	1.221E-01	2.358E-02	3.411E-03	2.932E-01
Kr-87	0.0000E+00	0.00E+00	2.4528E-01	1.280E-01	2.471E-02	6.420E-03	8.614E-02
Kr-88	0.0000E+00	0.00E+00	8.3241E-01	2.860E-01	5.521E-02	9.136E-03	4.820E-01
Rb-86	7.2055E-05	6.87E+10	6.8642E-06	6.788E-06	1.310E-06	3.464E-05	3.619E-05
Sr-89	1.1622E-03	8.08E+11	2.3790E-05	1.891E-04	3.651E-05	0.000E+00	9.604E-04
Sr-90	1.3892E-04	9.64E+10	2.8352E-06	2.250E-05	4.344E-06	0.000E+00	1.149E-04
Sr-91	7.1594E-04	6.37E+11	2.1733E-05	2.108E-04	4.069E-05	0.000E+00	5.129E-04
Sr-92	1.2546E-04	2.36E+11	1.1813E-05	1.651E-04	3.186E-05	0.000E+00	1.717E-04
Y-90	1.4047E-05	6.64E+09	1.3778E-07	4.147E-07	8.004E-08	0.000E+00	1.369E-05
Y-91	1.6966E-05	1.14E+10	3.2688E-07	2.493E-06	4.811E-07	0.000E+00	1.432E-05
Y-92	2.9251E-04	2.42E+11	6.1580E-06	2.733E-05	5.276E-06	0.000E+00	3.070E-04
Y-93	9.5506E-06	8.37E+09	2.8289E-07	2.714E-06	5.239E-07	0.000E+00	6.784E-06
Zr-95	2.1222E-05	1.47E+10	4.3412E-07	3.450E-06	6.660E-07	0.000E+00	1.754E-05
Zr-97	1.4336E-05	1.14E+10	3.6422E-07	3.249E-06	6.272E-07	0.000E+00	1.082E-05
Nb-95	2.1458E-05	1.49E+10	4.3796E-07	3.476E-06	6.710E-07	0.000E+00	1.775E-05
Mo-99	2.7603E-04	1.98E+11	5.9521E-06	4.873E-05	9.406E-06	0.000E+00	2.238E-04
Tc-99m	2.5949E-04	1.83E+11	5.4482E-06	4.376E-05	8.447E-06	0.000E+00	2.127E-04
Ru-103	2.5561E-04	1.78E+11	5.2365E-06	4.165E-05	8.040E-06	0.000E+00	2.111E-04
Ru-105	3.8084E-05	4.66E+10	1.8913E-06	2.216E-05	4.277E-06	0.000E+00	2.988E-05
Ru-106	1.0411E-04	7.22E+10	2.1256E-06	1.688E-05	3.257E-06	0.000E+00	8.611E-05
Rh-105	1.5230E-04	1.10E+11	3.2987E-06	2.682E-05	5.178E-06	0.000E+00	1.236E-04
Sb-127	3.3555E-04	2.38E+11	7.1220E-06	5.780E-05	1.116E-05	0.000E+00	2.737E-04
Sb-129	2.1496E-04	2.68E+11	1.0964E-05	1.296E-04	2.501E-05	0.000E+00	1.704E-04
Te-127	3.4823E-04	2.45E+11	7.2940E-06	5.871E-05	1.133E-05	0.000E+00	2.855E-04
Te-127m	4.8662E-05	3.37E+10	9.9272E-07	7.877E-06	1.521E-06	0.000E+00	4.026E-05
Te-129	3.3175E-04	3.47E+11	1.3256E-05	1.445E-04	2.789E-05	0.000E+00	2.444E-04
Te-129m	1.5536E-04	1.08E+11	3.1771E-06	2.523E-05	4.870E-06	0.000E+00	1.284E-04
Te-131m	3.7642E-04	2.82E+11	8.6794E-06	7.368E-05	1.422E-05	0.000E+00	2.972E-04
Te-132	4.2198E-03	3.01E+12	9.0210E-05	7.350E-04	1.419E-04	0.000E+00	3.433E-03
I-131	3.8763E-02	3.63E+13	3.9261E-03	7.900E-03	2.598E-03	1.349E-02	1.871E-02
I-132	7.6980E-03	1.69E+13	4.8501E-03	7.990E-03	2.627E-03	1.920E-02	1.924E-02
I-133	5.8296E-02	6.19E+13	7.6420E-03	1.494E-02	4.912E-03	2.726E-02	1.958E-02
I-134	3.2843E-05	5.47E+12	5.8453E-03	2.228E-03	7.325E-04	2.834E-02	2.589E-02
I-135	2.6696E-02	3.94E+13	6.6181E-03	1.185E-02	3.895E-03	2.540E-02	1.124E-02
Xe-133	0.0000E+00	0.00E+00	7.1240E+00	1.195E+00	2.308E-01	2.649E-02	5.671E+00
Xe-135	0.0000E+00	0.00E+00	2.3264E+00	4.571E-01	8.823E-02	9.403E-03	1.772E+00
Cs-134	7.0639E-03	6.70E+12	6.6349E-04	6.588E-04	1.272E-04	3.345E-03	3.596E-03
Cs-136	2.2120E-03	2.12E+12	2.1203E-04	2.093E-04	4.040E-05	1.070E-03	1.104E-03
Cs-137	4.2399E-03	4.02E+12	3.9810E-04	3.953E-04	7.631E-05	2.007E-03	2.159E-03
Ba-139	1.5366E-05	1.05E+11	8.4395E-06	1.529E-04	2.952E-05	0.000E+00	2.305E-04
Ba-140	2.2058E-03	1.54E+12	4.5551E-05	3.640E-04	7.026E-05	0.000E+00	1.817E-03
La-140	3.3587E-04	1.57E+11	3.2048E-06	8.438E-06	1.629E-06	0.000E+00	3.290E-04
La-141	3.6622E-06	4.87E+09	2.0627E-07	2.515E-06	4.855E-07	0.000E+00	3.062E-06



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La-142	2.2974E-07	1.16E+09	8.4836E-08	1.478E-06	2.853E-07	0.000E+00	2.147E-06
Ce-141	5.3178E-05	3.70E+10	1.0896E-06	8.667E-06	1.673E-06	0.000E+00	4.393E-05
Ce-143	3.9898E-05	2.96E+10	9.0966E-07	7.676E-06	1.482E-06	0.000E+00	3.165E-05
Ce-144	4.3789E-05	3.04E+10	8.9413E-07	7.099E-06	1.370E-06	0.000E+00	3.621E-05
Pr-143	1.9719E-05	1.36E+10	3.9719E-07	3.127E-06	6.036E-07	0.000E+00	1.639E-05
Nd-147	2.0998E-05	1.47E+10	4.3445E-07	3.475E-06	6.708E-07	0.000E+00	1.729E-05
Np-239	6.2082E-04	4.48E+11	1.3512E-05	1.112E-04	2.146E-05	0.000E+00	5.017E-04
Pu-238	1.5331E-07	1.06E+08	3.1286E-09	2.483E-08	4.793E-09	0.000E+00	1.268E-07
Pu-239	1.5471E-08	1.07E+07	3.1551E-10	2.503E-09	4.832E-10	0.000E+00	1.280E-08
Pu-240	2.1198E-08	1.47E+07	4.3262E-10	3.434E-09	6.628E-10	0.000E+00	1.753E-08
Pu-241	6.3950E-06	4.44E+09	1.3051E-07	1.036E-06	2.000E-07	0.000E+00	5.290E-06
Am-241	3.3020E-09	2.29E+06	6.7264E-11	5.333E-10	1.029E-10	0.000E+00	2.733E-09
Cm-242	8.2730E-07	5.74E+08	1.6899E-08	1.342E-07	2.590E-08	0.000E+00	6.841E-07
Cm-244	5.3173E-08	3.69E+07	1.0852E-09	8.613E-09	1.663E-09	0.000E+00	4.398E-08

Filtered Environment to Control Room Transport Group Inventory:

	Pathway	
	Filtered	Transported
Time (h) = 10.0000		
Noble gases (atoms)	0.0000E+00	1.0807E+18
Elemental I (atoms)	3.7749E+14	5.0252E+13
Organic I (atoms)	7.5407E+13	9.4312E+12
Aerosol I (atoms)	1.2897E+15	9.6527E+13
All Aerosols (kg)	5.1588E-08	3.9650E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:06

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Exclusion Area Boundary Doses:

Time (h) = 12.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.6395E-01	1.7413E+01	1.2094E+00

Low Population Zone Doses:

Time (h) = 12.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	4.0892E-02	1.3437E+00	8.5479E-02
Accumulated dose (rem)	1.0932E+00	3.5101E+01	2.3714E+00

Control Room Doses:

Time (h) = 12.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	5.2979E-03	1.7709E+00	9.4021E-02	2.5881E-01
Accumulated dose (rem)	4.8039E-02	2.0303E+01	9.7668E-01	2.0183E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 12.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1	Pathway 7	Pathway 8	Pathway 9
						Outflow	Outflow	Outflow	Outflow
Co-58	1.9891E+00	4.8463E-06	1.5741E+03	2.0967E+17	9.1959E+02	4.1648E-01	0.0000E+00	9.5482E-01	9.5482E-01
Co-60	2.3919E+00	1.1224E-04	1.8860E+03	2.5121E+17	1.1058E+03	4.9898E-01	0.0000E+00	1.1440E+00	1.1440E+00
Kr-85	8.7485E+05	3.2484E-06	9.5457E+06	1.2715E+21	0.0000E+00	2.5198E+03	8.1591E-02	5.7771E+03	5.7771E+03
Kr-85m	2.5424E+06	1.5392E-03	7.1957E+07	9.6229E+21	0.0000E+00	1.9099E+04	1.5084E+00	4.3790E+04	4.3790E+04
Kr-87	4.4845E+04	3.6505E-03	3.0984E+07	4.1838E+21	0.0000E+00	8.3096E+03	2.8333E+00	1.9057E+04	1.9057E+04
Kr-88	2.3384E+06	3.6893E-02	1.2648E+08	1.6952E+22	0.0000E+00	3.3659E+04	4.0384E+00	7.7175E+04	7.7175E+04
Rb-86	8.4215E+01	1.3422E-04	7.4347E+04	9.9034E+18	4.1470E+04	1.9664E+01	1.5341E-02	4.5117E+01	4.5117E+01
Sr-89	2.5344E+03	2.2518E-02	2.0087E+06	2.6757E+20	1.1717E+05	5.3147E+02	0.0000E+00	1.2184E+03	1.2184E+03
Sr-90	3.0329E+02	8.3999E-02	2.3910E+05	3.1848E+19	1.4021E+05	6.3261E+01	0.0000E+00	1.4503E+02	1.4503E+02
Sr-91	1.3508E+03	1.2623E-03	2.1182E+06	2.8266E+20	6.2447E+05	5.6146E+02	0.0000E+00	1.2872E+03	1.2872E+03
Sr-92	1.6421E+02	6.1954E-04	1.5024E+06	2.0140E+20	7.5918E+04	4.0007E+02	0.0000E+00	9.1719E+02	9.1719E+02
Y-90	3.6058E+01	1.4214E-05	6.2271E+03	8.1241E+17	1.6737E+04	1.6307E+00	0.0000E+00	3.7386E+00	3.7386E+00
Y-91	3.7512E+01	3.5360E-04	2.6762E+04	3.5619E+18	1.7356E+04	7.0779E+00	0.0000E+00	1.6227E+01	1.6227E+01
Y-92	4.9092E+02	9.1140E-05	3.6696E+05	4.7138E+19	2.2837E+05	9.5591E+01	0.0000E+00	2.1915E+02	2.1915E+02
Y-93	1.8176E+01	1.6309E-05	2.7354E+04	3.6498E+18	8.4030E+03	7.2497E+00	0.0000E+00	1.6621E+01	1.6621E+01
Zr-95	4.6289E+01	2.3815E-04	3.6646E+04	4.8813E+18	2.1400E+04	9.6959E+00	0.0000E+00	2.2229E+01	2.2229E+01
Zr-97	2.8833E+01	4.3395E-05	3.3412E+04	4.4551E+18	1.3330E+04	8.8493E+00	0.0000E+00	2.0288E+01	2.0288E+01
Nb-95	4.6845E+01	6.1991E-05	3.6936E+04	4.9198E+18	2.1657E+04	9.7725E+00	0.0000E+00	2.2404E+01	2.2404E+01



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Mo-99	5.9009E+02	5.6033E-04	5.1324E+05	6.8381E+19	2.7280E+05	1.3583E+02	0.0000E+00	3.1139E+02	3.1139E+02
Tc-99m	5.5832E+02	1.1892E-05	4.6360E+05	6.1581E+19	2.5812E+05	1.2267E+02	0.0000E+00	2.8122E+02	2.8122E+02
Ru-103	5.5720E+02	1.1002E-03	4.4230E+05	5.8916E+19	2.5760E+05	1.1703E+02	0.0000E+00	2.6829E+02	2.6829E+02
Ru-105	6.0845E+01	4.9081E-05	2.1150E+05	2.8282E+19	2.8129E+04	5.6178E+01	0.0000E+00	1.2879E+02	1.2879E+02
Ru-106	2.2726E+02	2.3154E-02	1.7929E+05	2.3882E+19	1.0506E+05	4.7437E+01	0.0000E+00	1.0875E+02	1.0875E+02
Rh-105	3.2246E+02	7.6183E-05	2.8335E+05	3.7733E+19	1.4908E+05	7.4978E+01	0.0000E+00	1.7189E+02	1.7189E+02
Sb-127	7.2164E+02	1.0537E-03	6.1026E+05	8.1302E+19	3.3362E+05	1.6149E+02	0.0000E+00	3.7023E+02	3.7023E+02
Sb-129	3.4046E+02	4.6686E-04	1.2340E+06	1.6503E+20	1.5740E+05	3.2780E+02	0.0000E+00	7.5152E+02	7.5152E+02
Te-127	7.5221E+02	5.3917E-05	6.2139E+05	8.2635E+19	3.4775E+05	1.6443E+02	0.0000E+00	3.7696E+02	3.7696E+02
Te-127m	1.0625E+02	4.8679E-04	8.3705E+04	1.1149E+19	4.9119E+04	2.2147E+01	0.0000E+00	5.0773E+01	5.0773E+01
Te-129	5.9003E+02	4.0480E-05	1.4064E+06	1.8560E+20	2.7278E+05	3.7316E+02	0.0000E+00	8.5550E+02	8.5550E+02
Te-129m	3.3875E+02	1.7422E-03	2.6806E+05	3.5705E+19	1.5661E+05	7.0924E+01	0.0000E+00	1.6260E+02	1.6260E+02
Te-131m	7.8468E+02	1.5156E-03	7.6816E+05	1.0238E+20	3.6276E+05	2.0336E+02	0.0000E+00	4.6621E+02	4.6621E+02
Te-132	9.0506E+03	2.0013E-02	7.7519E+06	1.0328E+21	4.1842E+06	2.0515E+03	0.0000E+00	4.7031E+03	4.7031E+03
I-131	9.7121E+05	3.8616E-01	4.3146E+07	5.7476E+21	1.7921E+07	1.1408E+04	5.9740E+00	2.6167E+04	2.6167E+04
I-132	1.0151E+05	1.6903E-02	3.9925E+07	5.3426E+21	5.1306E+06	1.0623E+04	8.5765E+00	2.4375E+04	2.4375E+04
I-133	1.3760E+06	1.3162E-01	7.9031E+07	1.0536E+22	2.5381E+07	2.0913E+04	1.2087E+01	4.7974E+04	4.7974E+04
I-134	1.7045E+02	6.9574E-03	1.7082E+07	2.3207E+21	3.1442E+03	4.6040E+03	1.2841E+01	1.0585E+04	1.0585E+04
I-135	5.4611E+05	3.3857E-02	5.9454E+07	7.9402E+21	1.0074E+07	1.5764E+04	1.1285E+01	3.6165E+04	3.6165E+04
Xe-133	1.2026E+08	5.9880E-03	1.3423E+09	1.7880E+23	0.0000E+00	3.5438E+05	1.1726E+01	8.1248E+05	8.1248E+05
Xe-135	3.0306E+07	1.4727E-02	4.3275E+08	5.7660E+22	0.0000E+00	1.1444E+05	4.1642E+00	2.6237E+05	2.6237E+05
Cs-134	8.2810E+03	9.1719E-02	7.2063E+06	9.5988E+20	4.0778E+06	1.9060E+03	1.4816E+00	4.3730E+03	4.3730E+03
Cs-136	2.5819E+03	5.2408E-03	2.2937E+06	3.0553E+20	1.2714E+06	6.0667E+02	4.7405E-01	1.3919E+03	1.3919E+03
Cs-137	4.9707E+03	3.7688E-02	4.3242E+06	5.7598E+20	2.4477E+06	1.1437E+03	8.8893E-01	2.6240E+03	2.6240E+03
Ba-139	1.2270E+01	6.8316E-05	1.2976E+06	1.7503E+20	5.6726E+03	3.4770E+02	0.0000E+00	7.9713E+02	7.9713E+02
Ba-140	4.7937E+03	3.9969E-03	3.8601E+06	5.1420E+20	2.2162E+06	1.0214E+03	0.0000E+00	2.3415E+03	2.3415E+03
La-140	8.6021E+02	2.2312E-04	1.3558E+05	1.7623E+19	3.9930E+05	3.5443E+01	0.0000E+00	8.1255E+01	8.1255E+01
La-141	5.6186E+00	3.8944E-06	2.3750E+04	3.1775E+18	2.5975E+03	6.3117E+00	0.0000E+00	1.4470E+01	1.4470E+01
La-142	2.0407E-01	6.0856E-06	1.2672E+04	1.7070E+18	9.4345E+01	3.3908E+00	0.0000E+00	7.7737E+00	7.7737E+00
Ce-141	1.1591E+02	2.2383E-04	9.2037E+04	1.2259E+19	5.3584E+04	2.4351E+01	0.0000E+00	5.5827E+01	5.5827E+01
Ce-143	8.3519E+01	7.6452E-05	8.0163E+04	1.0683E+19	3.8612E+04	2.1221E+01	0.0000E+00	4.8650E+01	4.8650E+01
Ce-144	9.5578E+01	7.6249E-03	7.5421E+04	1.0046E+19	4.4187E+04	1.9955E+01	0.0000E+00	4.5748E+01	4.5748E+01
Pr-143	4.3209E+01	7.2981E-05	3.3294E+04	4.4339E+18	1.9979E+04	8.8082E+00	0.0000E+00	2.0194E+01	2.0194E+01
Nd-147	4.5601E+01	6.8875E-05	3.6844E+04	4.9080E+18	2.1082E+04	9.7489E+00	0.0000E+00	2.2350E+01	2.2350E+01
Np-239	1.3225E+03	8.1927E-04	1.1694E+06	1.5581E+20	6.1140E+05	3.0949E+02	0.0000E+00	7.0954E+02	7.0954E+02
Pu-238	3.3469E-01	2.0572E-02	2.6384E+02	3.5144E+16	1.5473E+02	6.9807E-02	0.0000E+00	1.6004E-01	1.6004E-01
Pu-239	3.3785E-02	2.2178E-03	2.6600E+01	3.5431E+15	1.5619E+01	7.0378E-03	0.0000E+00	1.6135E-02	1.6135E-02
Pu-240	4.6279E-02	3.0418E-03	3.6484E+01	4.8597E+15	2.1395E+01	9.6529E-03	0.0000E+00	2.2130E-02	2.2130E-02
Pu-241	1.3961E+01	1.4762E-02	1.1007E+04	1.4661E+18	6.4544E+03	2.9122E+00	0.0000E+00	6.6764E+00	6.6764E+00
Am-241	7.2137E-03	6.8079E-04	5.6682E+00	7.5499E+14	3.3350E+00	1.4997E-03	0.0000E+00	3.4381E-03	3.4381E-03
Cm-242	1.8055E+00	6.6640E-03	1.4257E+03	1.8991E+17	8.3468E+02	3.7721E-01	0.0000E+00	8.6479E-01	8.6479E-01
Cm-244	1.1608E-01	6.1372E-03	9.1518E+01	1.2190E+16	5.3666E+01	2.4214E-02	0.0000E+00	5.5512E-02	5.5512E-02
Total	1.5940E+08	1.0000E+00	0.0000E+00	0.0000E+00	7.9045E+07	6.0683E+05	7.7975E+01	1.3914E+06	1.3914E+06

Dose Effective (Ci/cc) I-131 (Thyroid)	3.2488E-04
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)	3.7066E-04
Total I (Ci)	2.9950E+06

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 12.0000	Atmosphere	Sump
Noble gases (atoms)	1.8764E+25	0.0000E+00
Elemental I (atoms)	3.9428E+22	0.0000E+00
Organic I (atoms)	1.2194E+21	0.0000E+00
Aerosol I (atoms)	1.6043E+21	0.0000E+00
All Aerosols (kg)	6.7409E-02	0.0000E+00

Time (h) = 12.0000	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
Aerosol I (atoms)	8.7020E+23	0.0000E+00
All Aerosols (kg)	3.3108E+01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 12.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	9.8640E-07	2.4228E-06	7.6401E-04	1.0177E+11	4.1648E-01	6.8394E-03	1.4760E-03	0.0000E+00
Co-60	1.1862E-06	5.6113E-05	9.1538E-04	1.2193E+11	4.9898E-01	8.1944E-03	1.7683E-03	0.0000E+00
Kr-85	4.3347E-01	1.6498E-06	4.7066E+00	6.2692E+14	2.5198E+03	2.1019E+03	4.1671E+02	0.0000E+00
Kr-85m	1.2597E+00	7.7716E-04	3.5273E+01	4.7171E+15	1.9099E+04	1.5839E+04	3.2400E+03	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Kr-87	2.2220E-02	1.7980E-03	1.4816E+01	2.0007E+15	8.3096E+03	6.7241E+03	1.5604E+03	0.0000E+00
Kr-88	1.1586E+00	1.8542E-02	6.1716E+01	8.2717E+15	3.3659E+04	2.7787E+04	5.8231E+03	0.0000E+00
Rb-86	4.1762E-05	6.5351E-05	3.5143E-02	4.6813E+12	1.9664E+01	3.1470E-01	7.7697E-02	0.0000E+00
Sr-89	1.2568E-03	1.1258E-02	9.7495E-01	1.2986E+14	5.3147E+02	8.7277E+00	1.8836E+00	0.0000E+00
Sr-90	1.5040E-04	4.1995E-02	1.1605E-01	1.5458E+13	6.3261E+01	1.0389E+00	2.2418E-01	0.0000E+00
Sr-91	6.6984E-04	6.2921E-04	1.0251E+00	1.3679E+14	5.6146E+02	9.1933E+00	2.0129E+00	0.0000E+00
Sr-92	8.1433E-05	3.0640E-04	7.2137E-01	9.6704E+13	4.0007E+02	6.4993E+00	1.4789E+00	0.0000E+00
Y-90	1.7881E-05	7.1887E-06	3.0576E-03	3.9900E+11	1.6307E+00	2.7094E-02	5.5154E-03	0.0000E+00
Y-91	1.8602E-05	1.7686E-04	1.2995E-02	1.7296E+12	7.0779E+00	1.1629E-01	2.5039E-02	0.0000E+00
Y-92	2.4345E-04	4.6272E-05	1.8088E-01	2.3260E+13	9.5591E+01	1.5950E+00	3.1763E-01	0.0000E+00
Y-93	9.0135E-06	8.1313E-06	1.3240E-02	1.7666E+12	7.2497E+00	1.1873E-01	2.5973E-02	0.0000E+00
Zr-95	2.2954E-05	1.1906E-04	1.7787E-02	2.3692E+12	9.6959E+00	1.5922E-01	3.4362E-02	0.0000E+00
Zr-97	1.4298E-05	2.1660E-05	1.6191E-02	2.1588E+12	8.8493E+00	1.4509E-01	3.1564E-02	0.0000E+00
Nb-95	2.3230E-05	3.0992E-05	1.7928E-02	2.3879E+12	9.7725E+00	1.6048E-01	3.4631E-02	0.0000E+00
Mo-99	2.9262E-04	2.8002E-04	2.4900E-01	3.3176E+13	1.3583E+02	2.2296E+00	4.8213E-01	0.0000E+00
Tc-99m	2.7687E-04	5.9447E-06	2.2499E-01	2.9887E+13	1.2267E+02	2.0142E+00	4.3486E-01	0.0000E+00
Ru-103	2.7632E-04	5.5004E-04	2.1467E-01	2.8595E+13	1.1703E+02	1.9218E+00	4.1476E-01	0.0000E+00
Ru-105	3.0173E-05	2.4381E-05	1.0200E-01	1.3639E+13	5.6178E+01	9.1665E-01	2.0418E-01	0.0000E+00
Ru-106	1.1270E-04	1.1576E-02	8.7022E-02	1.1591E+13	4.7437E+01	7.7900E-01	1.6810E-01	0.0000E+00
Rh-105	1.5991E-04	3.8081E-05	1.3750E-01	1.8311E+13	7.4978E+01	1.2311E+00	2.6588E-01	0.0000E+00
Sb-127	3.5786E-04	5.2665E-04	2.9611E-01	3.9450E+13	1.6149E+02	2.6513E+00	5.7296E-01	0.0000E+00
Sb-129	1.6883E-04	2.3187E-04	5.9499E-01	7.9571E+13	3.2780E+02	5.3478E+00	1.1923E+00	0.0000E+00
Te-127	3.7302E-04	2.6951E-05	3.0155E-01	4.0101E+13	1.6443E+02	2.6997E+00	5.8309E-01	0.0000E+00
Te-127m	5.2688E-05	2.4337E-04	4.0628E-02	5.4116E+12	2.2147E+01	3.6369E-01	7.8481E-02	0.0000E+00
Te-129	2.9259E-04	2.0148E-05	6.7959E-01	8.9688E+13	3.7316E+02	6.1009E+00	1.3457E+00	0.0000E+00
Te-129m	1.6798E-04	8.7102E-04	1.3011E-01	1.7330E+13	7.0924E+01	1.1647E+00	2.5133E-01	0.0000E+00
Te-131m	3.8912E-04	7.5701E-04	3.7250E-01	4.9646E+13	2.0336E+02	3.3365E+00	7.2328E-01	0.0000E+00
Te-132	4.4881E-03	1.0002E-02	3.7612E+00	5.0111E+14	2.0515E+03	3.3677E+01	7.2800E+00	0.0000E+00
I-131	3.9972E+00	5.4936E-01	5.9591E+01	7.9383E+15	1.1408E+04	1.3225E+03	5.4345E+02	2.0911E+04
I-132	9.9816E-01	1.8017E-02	4.1316E+01	5.5381E+15	1.0623E+04	8.2939E+02	3.4867E+02	1.2351E+04
I-133	5.6616E+00	1.7648E-01	1.0288E+02	1.3715E+16	2.0913E+04	2.2442E+03	9.2509E+02	3.5084E+04
I-134	7.0135E-04	5.0002E-03	1.1919E+01	1.6193E+15	4.6040E+03	2.0060E+02	1.0756E+02	2.6179E+03
I-135	2.2470E+00	3.9986E-02	6.8169E+01	9.1045E+15	1.5764E+04	1.4265E+03	5.9423E+02	2.1680E+04
Xe-133	5.9919E+01	3.0498E-03	6.6372E+02	8.8417E+16	3.5438E+05	2.9645E+05	5.8804E+04	1.0655E+03
Xe-135	1.6633E+01	7.9183E-03	2.2590E+02	3.0120E+16	1.1444E+05	1.0109E+05	2.0108E+04	6.8987E+03
Cs-134	4.1065E-03	4.4663E-02	3.4068E+00	4.5379E+14	1.9060E+03	3.0506E+01	7.5271E+00	0.0000E+00
Cs-136	1.2804E-03	2.5515E-03	1.0841E+00	1.4442E+14	6.0667E+02	9.7084E+00	2.3976E+00	0.0000E+00
Cs-137	2.4650E-03	1.8352E-02	2.0443E+00	2.7230E+14	1.1437E+03	1.8305E+01	4.5166E+00	0.0000E+00
Ba-139	6.0847E-06	3.3386E-05	6.1566E-01	8.3046E+13	3.4770E+02	5.5816E+00	1.3443E+00	0.0000E+00
Ba-140	2.3772E-03	1.9980E-03	1.8734E+00	2.4955E+14	1.0214E+03	1.6771E+01	3.6207E+00	0.0000E+00
La-140	4.2657E-04	1.1306E-04	6.6696E-02	8.6726E+12	3.5443E+01	5.9002E-01	1.1891E-01	0.0000E+00
La-141	2.7862E-06	1.9328E-06	1.1444E-02	1.5310E+12	6.3117E+00	1.0290E-01	2.3018E-02	0.0000E+00
La-142	1.0120E-07	2.9821E-06	6.0283E-03	8.1207E+11	3.3908E+00	5.4579E-02	1.2979E-02	0.0000E+00
Ce-141	5.7479E-05	1.1190E-04	4.4671E-02	5.9502E+12	2.4351E+01	3.9989E-01	8.6302E-02	0.0000E+00
Ce-143	4.1417E-05	3.8190E-05	3.8876E-02	5.1811E+12	2.1221E+01	3.4820E-01	7.5450E-02	0.0000E+00
Ce-144	4.7397E-05	3.8120E-03	3.6607E-02	4.8760E+12	1.9955E+01	3.2770E-01	7.0716E-02	0.0000E+00
Pr-143	2.1427E-05	3.6489E-05	1.6161E-02	2.1522E+12	8.8082E+00	1.4466E-01	3.1204E-02	0.0000E+00
Nd-147	2.2613E-05	3.4430E-05	1.7881E-02	2.3819E+12	9.7489E+00	1.6008E-01	3.4562E-02	0.0000E+00
Np-239	6.5582E-04	4.0939E-04	5.6732E-01	7.5590E+13	3.0949E+02	5.0801E+00	1.0989E+00	0.0000E+00
Pu-238	1.6597E-07	1.0285E-02	1.2806E-04	1.7058E+10	6.9807E-02	1.1464E-03	2.4738E-04	0.0000E+00
Pu-239	1.6754E-08	1.1088E-03	1.2911E-05	1.7197E+09	7.0378E-03	1.1558E-04	2.4940E-05	0.0000E+00
Pu-240	2.2949E-08	1.5207E-03	1.7708E-05	2.3587E+09	9.6529E-03	1.5852E-04	3.4207E-05	0.0000E+00
Pu-241	6.9233E-06	7.3803E-03	5.3424E-03	7.1160E+11	2.9122E+00	4.7824E-02	1.0320E-02	0.0000E+00
Am-241	3.5772E-09	3.4036E-04	2.7512E-06	3.6645E+08	1.4997E-03	2.4628E-05	5.3142E-06	0.0000E+00
Cm-242	8.9533E-07	3.3316E-03	6.9199E-04	9.2173E+10	3.7721E-01	6.1946E-03	1.3368E-03	0.0000E+00
Cm-244	5.7565E-08	3.0682E-03	4.4420E-05	5.9167E+09	2.4214E-02	3.9764E-04	8.5807E-05	0.0000E+00
Total	9.2352E+01	1.0000E+00	0.0000E+00	0.0000E+00	6.0683E+05	4.5620E+05	9.2512E+04	1.0061E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 8.8473E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.0124E-06
 Total I (Ci) 1.2905E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) = 12.0000	Atmosphere	Sump
Noble gases (atoms)	9.3079E+18	0.0000E+00
Elemental I (atoms)	1.6815E+17	0.0000E+00
Organic I (atoms)	5.2005E+15	0.0000E+00
Aerosol I (atoms)	7.9554E+14	0.0000E+00
All Aerosols (kg)	3.3428E-08	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 12.0000



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Nuclide	Compartment Atmosphere	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	1.4318E-02	7.4050E-04	0.00000	0.00000	0.00000	0.00000
Co-60	1.7167E-02	8.8795E-04	0.00002	0.00000	0.00000	0.00001
Kr-85	2.9360E+03	1.5867E+02	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.1245E+04	1.0980E+03	0.00748	0.00151	0.00000	0.00070
Kr-87	8.5308E+03	4.2701E+02	0.02664	0.00565	0.00001	0.00117
Kr-88	3.6564E+04	1.8615E+03	0.20267	0.04133	0.00002	0.01559
Rb-86	6.9516E-01	3.5516E-02	0.00002	0.00000	0.00000	0.00001
Sr-89	1.8265E+01	9.4462E-01	0.00352	0.00072	0.00000	0.00122
Sr-90	2.1765E+00	1.1258E-01	0.01314	0.00267	0.00000	0.00456
Sr-91	1.7084E+01	8.7119E-01	0.00021	0.00004	0.00000	0.00006
Sr-92	1.0096E+01	5.0693E-01	0.00011	0.00002	0.00000	0.00002
Y-90	9.9348E-02	5.4084E-03	0.00000	0.00000	0.00000	0.00000
Y-91	2.4965E-01	1.2947E-02	0.00005	0.00001	0.00000	0.00002
Y-92	4.1228E+00	2.1249E-01	0.00001	0.00000	0.00000	0.00001
Y-93	2.2199E-01	1.1328E-02	0.00000	0.00000	0.00000	0.00000
Zr-95	3.3330E-01	1.7238E-02	0.00004	0.00001	0.00000	0.00001
Zr-97	2.8292E-01	1.4506E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	3.3621E-01	1.7390E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	4.5810E+00	2.3637E-01	0.00009	0.00002	0.00000	0.00003
Tc-99m	4.1830E+00	2.1607E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	4.0206E+00	2.0792E-01	0.00017	0.00004	0.00000	0.00006
Ru-105	1.5431E+00	7.7936E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	1.6318E+00	8.4403E-02	0.00362	0.00074	0.00000	0.00126
Rh-105	2.5331E+00	1.3066E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	5.4772E+00	2.8281E-01	0.00017	0.00003	0.00000	0.00006
Sb-129	8.9644E+00	4.5258E-01	0.00008	0.00002	0.00000	0.00002
Te-127	5.6048E+00	2.8956E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	7.6207E-01	3.9418E-02	0.00008	0.00002	0.00000	0.00003
Te-129	1.0664E+01	5.4065E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	2.4388E+00	1.2613E-01	0.00027	0.00006	0.00000	0.00009
Te-131m	6.7035E+00	3.4494E-01	0.00024	0.00005	0.00000	0.00008
Te-132	6.9400E+01	3.5822E+00	0.00315	0.00064	0.00000	0.00106
I-131	2.0305E+03	1.0797E+02	0.22793	0.08836	0.00088	0.02014
I-132	1.2436E+03	6.3603E+01	0.00911	0.00349	0.00006	0.00056
I-133	3.4351E+03	1.8085E+02	0.07622	0.02949	0.00033	0.00641
I-134	3.1844E+02	1.5572E+01	0.00330	0.00136	0.00009	0.00012
I-135	2.1701E+03	1.1200E+02	0.01879	0.00725	0.00011	0.00140
Xe-133	4.1516E+05	2.2406E+04	0.02267	0.00449	0.00000	0.00301
Xe-135	1.5004E+05	7.9921E+03	0.06211	0.01232	0.00000	0.00898
Cs-134	6.7571E+01	3.4537E+00	0.01400	0.00305	0.00031	0.00522
Cs-136	2.1420E+01	1.0942E+00	0.00080	0.00017	0.00002	0.00030
Cs-137	4.0549E+01	2.0725E+00	0.00575	0.00125	0.00013	0.00215
Ba-139	7.8257E+00	3.9144E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	3.4987E+01	1.8087E+00	0.00063	0.00013	0.00000	0.00022
La-140	2.2919E+00	1.2512E-01	0.00003	0.00001	0.00000	0.00003
La-141	1.6992E-01	8.5685E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7670E-02	3.8861E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	8.3661E-01	4.3265E-02	0.00004	0.00001	0.00000	0.00001
Ce-143	7.0214E-01	3.6146E-02	0.00001	0.00000	0.00000	0.00000
Ce-144	6.8642E-01	3.5503E-02	0.00119	0.00024	0.00000	0.00041
Pr-143	3.0463E-01	1.5766E-02	0.00001	0.00000	0.00000	0.00000
Nd-147	3.3372E-01	1.7250E-02	0.00001	0.00000	0.00000	0.00000
Np-239	1.0404E+01	5.3662E-01	0.00013	0.00003	0.00000	0.00004
Pu-238	2.4018E-03	1.2423E-04	0.00322	0.00065	0.00000	0.00112
Pu-239	2.4220E-04	1.2528E-05	0.00035	0.00007	0.00000	0.00012
Pu-240	3.3211E-04	1.7178E-05	0.00048	0.00010	0.00000	0.00016
Pu-241	1.0019E-01	5.1824E-03	0.00231	0.00047	0.00000	0.00080
Am-241	5.1632E-05	2.6709E-06	0.00011	0.00002	0.00000	0.00004
Cm-242	1.2974E-02	6.7102E-04	0.00104	0.00021	0.00000	0.00036
Cm-244	8.3307E-04	4.3090E-05	0.00096	0.00020	0.00000	0.00033

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 12.0000		
Noble gases (atoms)	6.3364E+22	1.4668E+18
Elemental I (atoms)	7.2306E+19	1.6738E+15
Organic I (atoms)	6.0756E+18	1.4064E+14
Aerosol I (atoms)	1.4000E+19	3.2408E+14
All Aerosols (kg)	5.4673E-04	1.2656E-08



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 12.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.2282E+02	6.2038E-06	9.9704E+03	1.3281E+18	0.0000E+00
Co-60	1.1097E+03	1.4390E-04	1.1964E+04	1.5937E+18	0.0000E+00
Rb-86	4.1614E+04	1.6814E-04	4.6082E+05	6.1384E+19	0.0000E+00
Sr-89	1.1758E+06	2.8807E-02	1.2715E+07	1.6937E+21	0.0000E+00
Sr-90	1.4070E+05	1.0770E-01	1.5169E+06	2.0205E+20	0.0000E+00
Sr-91	6.2667E+05	1.2356E-03	1.0259E+07	1.3692E+21	0.0000E+00
Sr-92	7.6185E+04	3.6609E-04	4.3928E+06	5.8893E+20	0.0000E+00
Y-90	1.6796E+04	4.6369E-05	1.0052E+05	1.3275E+19	0.0000E+00
Y-91	1.7417E+04	4.7624E-04	1.7835E+05	2.3741E+19	0.0000E+00
Y-92	2.2918E+05	1.6852E-04	3.3572E+06	4.4362E+20	0.0000E+00
Y-93	8.4326E+03	1.6205E-05	1.3448E+05	1.7944E+19	0.0000E+00
Zr-95	2.1475E+04	3.0481E-04	2.3208E+05	3.0913E+19	0.0000E+00
Zr-97	1.3377E+04	4.7570E-05	1.8123E+05	2.4166E+19	0.0000E+00
Nb-95	2.1733E+04	7.9480E-05	2.3432E+05	3.1211E+19	0.0000E+00
Mo-99	2.7376E+05	6.8936E-04	3.1243E+06	4.1627E+20	0.0000E+00
Tc-99m	2.5902E+05	1.4967E-05	2.8871E+06	3.8349E+20	0.0000E+00
Ru-103	2.5851E+05	1.4066E-03	2.7979E+06	3.7269E+20	0.0000E+00
Ru-105	2.8228E+04	3.7098E-05	7.9101E+05	1.0579E+20	0.0000E+00
Ru-106	1.0543E+05	2.9679E-02	1.1371E+06	1.5146E+20	0.0000E+00
Rh-105	1.4960E+05	9.4017E-05	1.7302E+06	2.3048E+20	0.0000E+00
Sb-127	3.3479E+05	1.3117E-03	3.7587E+06	5.0076E+20	0.0000E+00
Sb-129	1.5795E+05	3.4864E-04	4.5596E+06	6.0985E+20	0.0000E+00
Te-127	3.4898E+05	6.7818E-05	3.8673E+06	5.1424E+20	0.0000E+00
Te-127m	4.9292E+04	6.2435E-04	5.3121E+05	7.0756E+19	0.0000E+00
Te-129	2.7373E+05	3.3932E-05	5.8332E+06	7.6970E+20	0.0000E+00
Te-129m	1.5716E+05	2.2313E-03	1.6987E+06	2.2627E+20	0.0000E+00
Te-131m	3.6404E+05	1.7763E-04	4.4547E+06	5.9373E+20	0.0000E+00
Te-132	4.1989E+06	2.4780E-02	4.7492E+07	6.3274E+21	0.0000E+00
I-131	1.8981E+07	3.8318E-01	2.1184E+08	2.8220E+22	2.0911E+04
I-132	5.2436E+06	1.0643E-02	1.2438E+08	1.6595E+22	1.2351E+04
I-133	2.6884E+07	1.1949E-01	3.5499E+08	4.7327E+22	3.5084E+04
I-134	3.3303E+03	2.1335E-03	2.5919E+07	3.5214E+21	2.6179E+03
I-135	1.0670E+07	2.5182E-02	2.1880E+08	2.9224E+22	2.1680E+04
Xe-133	1.8374E+06	9.7994E-06	1.0869E+07	1.4346E+21	1.0655E+03
Xe-135	8.9067E+06	4.8273E-04	7.0189E+07	9.2703E+21	6.8987E+03
Cs-134	4.0919E+06	1.1560E-01	4.4940E+07	5.9860E+21	0.0000E+00
Cs-136	1.2758E+06	6.5477E-03	1.4179E+07	1.8888E+21	0.0000E+00
Cs-137	2.4562E+06	4.7506E-02	2.6970E+07	3.5924E+21	0.0000E+00
Ba-139	5.6925E+03	2.7371E-05	2.5725E+06	3.4701E+20	0.0000E+00
Ba-140	2.2240E+06	5.0789E-03	2.4270E+07	3.2330E+21	0.0000E+00
La-140	4.0070E+05	7.8899E-04	2.3721E+06	3.1314E+20	0.0000E+00
La-141	2.6067E+03	2.7850E-06	8.4040E+04	1.1245E+19	0.0000E+00
La-142	9.4676E+01	2.5983E-06	2.6770E+04	3.6063E+18	0.0000E+00
Ce-141	5.3773E+04	2.8615E-04	5.8220E+05	7.7550E+19	0.0000E+00
Ce-143	3.8747E+04	9.0323E-05	4.6861E+05	6.2454E+19	0.0000E+00
Ce-144	4.4342E+04	9.7726E-03	4.7830E+05	6.3710E+19	0.0000E+00
Pr-143	2.0049E+04	9.4560E-05	2.1345E+05	2.8426E+19	0.0000E+00
Nd-147	2.1156E+04	8.7395E-05	2.3133E+05	3.0815E+19	0.0000E+00
Np-239	6.1355E+05	1.0010E-03	7.0700E+06	9.4203E+20	0.0000E+00
Pu-238	1.5527E+02	2.6377E-02	1.6739E+03	2.2297E+17	0.0000E+00
Pu-239	1.5674E+01	2.8452E-03	1.6885E+02	2.2491E+16	0.0000E+00
Pu-240	2.1470E+01	3.9002E-03	2.3146E+02	3.0831E+16	0.0000E+00
Pu-241	6.4770E+03	1.8928E-02	6.9829E+04	9.3012E+18	0.0000E+00
Am-241	3.3467E+00	8.7413E-04	3.6011E+01	4.7966E+15	0.0000E+00
Cm-242	8.3762E+02	8.5384E-03	9.0387E+03	1.2040E+18	0.0000E+00
Cm-244	5.3855E+01	7.8689E-03	5.8061E+02	7.7337E+16	0.0000E+00
Total	9.3133E+07	1.0000E+00	0.0000E+00	0.0000E+00	1.0061E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 8.7132E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 9.9757E-03
 Total I (Ci) 6.1782E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 12.0000	Atmosphere	Sump
Noble gases (atoms)	6.0005E+22	0.0000E+00
Elemental I (atoms)	8.0234E+23	0.0000E+00
Organic I (atoms)	2.4815E+22	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

All Aerosols (kg) 3.3031E+01 0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 12.0000

Nuclide	Filter	Decays	Transported	Activity Pathway 2	Activity Pathway 3	Activity Pathway 7	Activity Pathway 11
Co-58	1.0194E-06	8.91E+08	2.0861E-08	1.482E-07	2.861E-08	0.000E+00	8.635E-07
Co-60	1.2259E-06	1.07E+09	2.5021E-08	1.775E-07	3.426E-08	0.000E+00	1.039E-06
Kr-85	0.0000E+00	0.00E+00	6.2809E-02	8.336E-03	1.609E-03	1.843E-04	5.268E-02
Kr-85m	0.0000E+00	0.00E+00	4.8426E-01	1.221E-01	2.358E-02	3.411E-03	3.351E-01
Kr-87	0.0000E+00	0.00E+00	2.4643E-01	1.280E-01	2.471E-02	6.420E-03	8.728E-02
Kr-88	0.0000E+00	0.00E+00	8.7481E-01	2.860E-01	5.522E-02	9.136E-03	5.244E-01
Rb-86	7.6890E-05	8.86E+10	6.9676E-06	6.788E-06	1.310E-06	3.464E-05	4.113E-05
Sr-89	1.2989E-03	1.14E+12	2.6608E-05	1.891E-04	3.651E-05	0.000E+00	1.100E-03
Sr-90	1.5544E-04	1.36E+11	3.1723E-06	2.250E-05	4.344E-06	0.000E+00	1.318E-04
Sr-91	6.9229E-04	8.25E+11	2.3353E-05	2.108E-04	4.069E-05	0.000E+00	5.381E-04
Sr-92	8.4162E-05	2.64E+11	1.2054E-05	1.651E-04	3.186E-05	0.000E+00	2.132E-04
Y-90	1.8705E-05	1.10E+10	1.7485E-07	4.147E-07	8.004E-08	0.000E+00	1.839E-05
Y-91	1.9272E-05	1.62E+10	3.6833E-07	2.493E-06	4.811E-07	0.000E+00	1.667E-05
Y-92	2.5633E-04	3.16E+11	6.7887E-06	2.733E-05	5.276E-06	0.000E+00	3.438E-04
Y-93	9.3156E-06	1.09E+10	3.0460E-07	2.714E-06	5.239E-07	0.000E+00	7.040E-06
Zr-95	2.3724E-05	2.07E+10	4.8559E-07	3.450E-06	6.660E-07	0.000E+00	2.009E-05
Zr-97	1.4778E-05	1.53E+10	3.9767E-07	3.249E-06	6.272E-07	0.000E+00	1.130E-05
Nb-95	2.4009E-05	2.10E+10	4.9003E-07	3.476E-06	6.710E-07	0.000E+00	2.035E-05
Mo-99	3.0243E-04	2.75E+11	6.6151E-06	4.873E-05	9.406E-06	0.000E+00	2.509E-04
Tc-99m	2.8615E-04	2.56E+11	6.0734E-06	4.376E-05	8.447E-06	0.000E+00	2.400E-04
Ru-103	2.8558E-04	2.50E+11	5.8562E-06	4.165E-05	8.040E-06	0.000E+00	2.417E-04
Ru-105	3.1184E-05	5.58E+10	1.9711E-06	2.216E-05	4.277E-06	0.000E+00	3.686E-05
Ru-106	1.1647E-04	1.02E+11	2.3782E-06	1.688E-05	3.257E-06	0.000E+00	9.872E-05
Rh-105	1.6526E-04	1.52E+11	3.6629E-06	2.682E-05	5.178E-06	0.000E+00	1.369E-04
Sb-127	3.6985E-04	3.33E+11	7.9303E-06	5.780E-05	1.116E-05	0.000E+00	3.088E-04
Sb-129	1.7449E-04	3.19E+11	1.1413E-05	1.296E-04	2.501E-05	0.000E+00	2.113E-04
Te-127	3.8552E-04	3.43E+11	8.1346E-06	5.871E-05	1.133E-05	0.000E+00	3.236E-04
Te-127m	5.4454E-05	4.75E+10	1.1108E-06	7.877E-06	1.521E-06	0.000E+00	4.617E-05
Te-129	3.0240E-04	4.30E+11	1.3984E-05	1.445E-04	2.789E-05	0.000E+00	2.745E-04
Te-129m	1.7361E-04	1.52E+11	3.5539E-06	2.523E-05	4.870E-06	0.000E+00	1.471E-04
Te-131m	4.0216E-04	3.86E+11	9.5727E-06	7.368E-05	1.422E-05	0.000E+00	3.238E-04
Te-132	4.6385E-03	4.20E+12	1.0036E-04	7.350E-04	1.419E-04	0.000E+00	3.862E-03
I-131	4.1608E-02	4.70E+13	4.0875E-03	7.901E-03	2.598E-03	1.349E-02	1.272E-02
I-132	6.8366E-03	1.88E+13	4.8907E-03	7.990E-03	2.627E-03	1.920E-02	2.014E-02
I-133	5.8957E-02	7.75E+13	7.8776E-03	1.494E-02	4.912E-03	2.726E-02	2.047E-02
I-134	7.3034E-06	5.47E+12	5.8454E-03	2.228E-03	7.325E-04	2.834E-02	2.591E-02
I-135	2.3399E-02	4.60E+13	6.7188E-03	1.185E-02	3.895E-03	2.540E-02	1.464E-02
Xe-133	0.0000E+00	0.00E+00	8.8150E+00	1.196E+00	2.308E-01	2.649E-02	7.362E+00
Xe-135	0.0000E+00	0.00E+00	2.7380E+00	4.572E-01	8.824E-02	9.403E-03	2.183E+00
Cs-134	7.5607E-03	8.65E+12	6.7364E-04	6.588E-04	1.272E-04	3.345E-03	4.103E-03
Cs-136	2.3573E-03	2.73E+12	2.1520E-04	2.093E-04	4.040E-05	1.070E-03	1.253E-03
Cs-137	4.5384E-03	5.19E+12	4.0419E-04	3.953E-04	7.631E-05	2.007E-03	2.464E-03
Ba-139	6.2886E-06	1.08E+11	8.4634E-06	1.529E-04	2.952E-05	0.000E+00	2.396E-04
Ba-140	2.4569E-03	2.16E+12	5.0892E-05	3.640E-04	7.026E-05	0.000E+00	2.074E-03
La-140	4.4627E-04	2.61E+11	4.0902E-06	8.438E-06	1.629E-06	0.000E+00	4.403E-04
La-141	2.8796E-06	5.74E+09	2.1380E-07	2.515E-06	4.855E-07	0.000E+00	3.852E-06
La-142	1.0459E-07	1.21E+09	8.5209E-08	1.478E-06	2.853E-07	0.000E+00	2.273E-06
Ce-141	5.9401E-05	5.20E+10	1.2186E-06	8.667E-06	1.673E-06	0.000E+00	5.028E-05
Ce-143	4.2805E-05	4.07E+10	1.0045E-06	7.676E-06	1.482E-06	0.000E+00	3.465E-05
Ce-144	4.8985E-05	4.28E+10	1.0004E-06	7.099E-06	1.370E-06	0.000E+00	4.152E-05
Pr-143	2.2156E-05	1.92E+10	4.4513E-07	3.127E-06	6.036E-07	0.000E+00	1.887E-05
Nd-147	2.3371E-05	2.06E+10	4.8527E-07	3.475E-06	6.708E-07	0.000E+00	1.971E-05
Np-239	6.7779E-04	6.22E+11	1.5001E-05	1.112E-04	2.146E-05	0.000E+00	5.601E-04
Pu-238	1.7153E-07	1.50E+08	3.5006E-09	2.483E-08	4.793E-09	0.000E+00	1.454E-07
Pu-239	1.7315E-08	1.51E+07	3.5306E-10	2.503E-09	4.832E-10	0.000E+00	1.468E-08
Pu-240	2.3718E-08	2.07E+07	4.8405E-10	3.434E-09	6.628E-10	0.000E+00	2.011E-08
Pu-241	7.1553E-06	6.24E+09	1.4603E-07	1.036E-06	2.000E-07	0.000E+00	6.065E-06
Am-241	3.6972E-09	3.22E+06	7.5278E-11	5.333E-10	1.029E-10	0.000E+00	3.136E-09
Cm-242	9.2533E-07	8.08E+08	1.8906E-08	1.342E-07	2.590E-08	0.000E+00	7.841E-07
Cm-244	5.9494E-08	5.19E+07	1.2142E-09	8.613E-09	1.663E-09	0.000E+00	5.043E-08

Filtered Environment to Control Room Transport Group Inventory:

	Pathway Filtered	Transported
Time (h) = 12.0000		
Noble gases (atoms)	0.0000E+00	1.3448E+18
Elemental I (atoms)	4.0319E+14	5.3428E+13



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Organic I (atoms)	9.0959E+13	1.1353E+13
Aerosol I (atoms)	1.3856E+15	9.8484E+13
All Aerosols (kg)	5.5618E-08	4.0472E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:07

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Exclusion Area Boundary Doses:

Time (h) = 19.4444	Whole Body	Thyroid	TEDE
Delta dose (rem)	0.0000E+00	0.0000E+00	0.0000E+00
Accumulated dose (rem)	5.6395E-01	1.7413E+01	1.2094E+00

Low Population Zone Doses:

Time (h) = 19.4444	Whole Body	Thyroid	TEDE
Delta dose (rem)	1.1182E-01	4.8207E+00	2.7121E-01
Accumulated dose (rem)	1.2050E+00	3.9922E+01	2.6426E+00

Control Room Doses:

Time (h) = 19.4444	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.7325E-02	6.0759E+00	3.0941E-01	9.5061E-01
Accumulated dose (rem)	6.5364E-02	2.6379E+01	1.2861E+00	2.9689E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 19.4444

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	9.1791E-02	4.4515E-06	1.5786E+03	2.1027E+17	9.1868E+02	4.1770E-01	0.0000E+00	9.5760E-01	9.5760E-01
Co-60	1.1070E-01	1.0310E-04	1.8914E+03	2.5193E+17	1.1080E+03	5.0045E-01	0.0000E+00	1.1473E+00	1.1473E+00
Kr-85	8.6525E+05	4.9940E-06	1.6022E+07	2.1342E+21	0.0000E+00	4.2335E+03	8.1591E-02	9.7059E+03	9.7059E+03
Kr-85m	7.9477E+05	1.6273E-03	8.3058E+07	1.1113E+22	0.0000E+00	2.2082E+04	1.5084E+00	5.0629E+04	5.0629E+04
Kr-87	7.6681E+02	3.3520E-03	3.1062E+07	4.1946E+21	0.0000E+00	8.3315E+03	2.8333E+04	1.9107E+04	1.9107E+04
Kr-88	3.7589E+05	3.5900E-02	1.3437E+08	1.8016E+22	0.0000E+00	3.5799E+04	4.0384E+00	8.2082E+04	8.2082E+04
Rb-86	3.8534E+00	1.2325E-04	7.4537E+04	9.9287E+18	4.1074E+04	1.9716E+01	1.5341E-02	4.5235E+01	4.5235E+01
Sr-89	1.1681E+02	2.0684E-02	2.0145E+06	2.6833E+20	1.1691E+06	5.3302E+02	0.0000E+00	1.2220E+03	1.2220E+03
Sr-90	1.4038E+01	7.7158E-02	2.3979E+05	3.1940E+19	1.4050E+05	6.3447E+01	0.0000E+00	1.4546E+02	1.4546E+02
Sr-91	3.6320E+01	1.1576E-03	2.1208E+06	2.8301E+20	3.6351E+05	5.6218E+02	0.0000E+00	1.2888E+03	1.2888E+03
Sr-92	1.1322E+00	5.6754E-04	1.5026E+06	2.0144E+20	1.1332E+04	4.0013E+02	0.0000E+00	9.1734E+02	9.1734E+02
Y-90	2.6277E+00	1.3218E-05	6.3223E+03	8.2500E+17	2.6362E+04	1.6563E+00	0.0000E+00	3.7971E+00	3.7971E+00
Y-91	1.8042E+00	3.2491E-04	2.6848E+04	3.5733E+18	1.8072E+04	7.1011E+00	0.0000E+00	1.6280E+01	1.6280E+01
Y-92	7.3903E+00	8.3670E-05	3.6781E+05	4.7252E+19	7.4295E+04	9.5824E+01	0.0000E+00	2.1968E+02	2.1968E+02
Y-93	5.0475E-01	1.4958E-05	2.7389E+04	3.6546E+18	5.0518E+03	7.2594E+00	0.0000E+00	1.6643E+01	1.6643E+01
Zr-95	2.1354E+00	2.1875E-04	3.6751E+04	4.8953E+18	2.1372E+04	9.7242E+00	0.0000E+00	2.2293E+01	2.2293E+01
Zr-97	9.8344E-01	3.9818E-05	3.3472E+04	4.4631E+18	9.8427E+03	8.8656E+00	0.0000E+00	2.0325E+01	2.0325E+01
Nb-95	2.1680E+00	5.6942E-05	3.7042E+04	4.9339E+18	2.1698E+04	9.8011E+00	0.0000E+00	2.2470E+01	2.2470E+01
Mo-99	2.5259E+01	5.1453E-04	5.1454E+05	6.8555E+19	2.5280E+05	1.3618E+02	0.0000E+00	3.1220E+02	3.1220E+02
Tc-99m	2.4278E+01	1.0921E-05	4.6484E+05	6.1746E+19	2.4299E+05	1.2300E+02	0.0000E+00	2.8199E+02	2.8199E+02
Ru-103	2.5650E+01	1.0106E-03	4.4356E+05	5.9084E+19	2.5672E+05	1.1737E+02	0.0000E+00	2.6907E+02	2.6907E+02
Ru-105	8.8095E-01	4.4976E-05	2.1160E+05	2.8295E+19	8.8170E+03	5.6206E+01	0.0000E+00	1.2886E+02	1.2886E+02
Ru-106	1.0513E+01	2.1268E-02	1.7980E+05	2.3950E+19	1.0522E+05	4.7575E+01	0.0000E+00	1.0907E+02	1.0907E+02
Rh-105	1.3122E+01	6.9951E-05	2.8405E+05	3.7827E+19	1.3133E+05	7.5168E+01	0.0000E+00	1.7233E+02	1.7233E+02
Sb-127	3.1588E+01	9.6767E-04	6.1187E+05	8.1516E+19	3.1615E+05	1.6193E+02	0.0000E+00	3.7123E+02	3.7123E+02
Sb-129	4.7728E+00	4.2780E-04	1.2345E+06	1.6510E+20	4.7768E+04	3.2796E+02	0.0000E+00	7.5187E+02	7.5187E+02
Te-127	3.3414E+01	4.9518E-05	6.2308E+05	8.2859E+19	3.3442E+05	1.6488E+02	0.0000E+00	3.7800E+02	3.7800E+02
Te-127m	4.9197E+00	4.4715E-04	8.3946E+04	1.1181E+19	4.9239E+04	2.2212E+01	0.0000E+00	5.0922E+01	5.0922E+01
Te-129	1.5621E+01	3.7106E-05	1.4075E+06	1.8575E+20	1.5634E+05	3.7347E+02	0.0000E+00	8.5620E+02	8.5620E+02
Te-129m	1.5592E+01	1.6003E-03	2.6883E+05	3.5807E+19	1.5606E+05	7.1131E+01	0.0000E+00	1.6307E+02	1.6307E+02
Te-131m	3.0581E+01	1.3912E-03	7.6986E+05	1.0260E+20	3.0607E+05	2.0382E+02	0.0000E+00	4.6727E+02	4.6727E+02
Te-132	3.9217E+02	1.8378E-02	7.7721E+06	1.0355E+21	3.9250E+06	2.0569E+03	0.0000E+00	4.7156E+03	4.7156E+03
I-131	9.0139E+05	4.1031E-01	5.0053E+07	6.6678E+21	1.7488E+07	1.3236E+04	5.9740E+00	3.0359E+04	3.0359E+04
I-132	1.1654E+04	1.5600E-02	4.0230E+07	5.3837E+21	4.1832E+06	1.0706E+04	8.5765E+00	2.4565E+04	2.4565E+04
I-133	1.0235E+06	1.3395E-01	8.7807E+07	1.1707E+22	1.9843E+07	2.3244E+04	1.2087E+01	5.3317E+04	5.3317E+04
I-134	4.5138E-01	6.3725E-03	1.7082E+07	2.3208E+21	8.7511E+00	4.6041E+03	1.2841E+01	1.0585E+04	1.0585E+04
I-135	2.3848E+05	3.2433E-02	6.2180E+07	8.3052E+21	4.6236E+06	1.6493E+04	1.1285E+01	3.7836E+04	3.7836E+04
Xe-133	1.1508E+08	9.0627E-03	2.2180E+09	2.9547E+23	0.0000E+00	5.8620E+05	1.1726E+01	1.3439E+06	1.3439E+06
Xe-135	1.9601E+07	1.9195E-02	6.1585E+08	8.2095E+22	0.0000E+00	1.6316E+05	4.1642E+00	3.7407E+05	3.7407E+05



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Cs-134	3.8319E+02	8.4226E-02	7.2251E+06	9.6238E+20	4.0845E+06	1.9110E+03	1.4816E+00	4.3846E+03	4.3846E+03
Cs-136	1.1756E+02	4.8123E-03	2.2995E+06	3.0631E+20	1.2531E+06	6.0824E+02	4.7405E-01	1.3955E+03	1.3955E+03
Cs-137	2.3007E+02	3.4609E-02	4.3354E+06	5.7748E+20	2.4524E+06	1.1467E+03	8.8893E-01	2.6310E+03	2.6310E+03
Ba-139	1.3441E-02	6.2572E-05	1.2976E+06	1.7504E+20	1.3452E+02	3.4770E+02	0.0000E+00	7.9714E+02	7.9714E+02
Ba-140	2.1817E+02	3.6711E-03	3.8709E+06	5.1563E+20	2.1836E+06	1.0243E+03	0.0000E+00	2.3482E+03	2.3482E+03
La-140	6.1506E+01	2.0777E-04	1.3784E+05	1.7922E+19	6.1701E+05	3.6049E+01	0.0000E+00	8.2645E+01	8.2645E+01
La-141	6.9961E-02	3.5683E-06	2.3759E+04	3.1787E+18	7.0020E+02	6.3142E+00	0.0000E+00	1.4476E+01	1.4476E+01
La-142	3.3237E-04	5.5740E-06	1.2672E+04	1.7070E+18	3.3265E+00	3.3909E+00	0.0000E+00	7.7738E+00	7.7738E+00
Ce-141	5.3306E+00	2.0559E-04	9.2299E+04	1.2294E+19	5.3350E+04	2.4422E+01	0.0000E+00	5.5990E+01	5.5990E+01
Ce-143	3.3062E+00	7.0182E-05	8.0344E+04	1.0708E+19	3.3090E+04	2.1270E+01	0.0000E+00	4.8763E+01	4.8763E+01
Ce-144	4.4207E+00	7.0038E-03	7.5637E+04	1.0075E+19	4.4244E+04	2.0013E+01	0.0000E+00	4.5882E+01	4.5882E+01
Pr-143	2.0249E+00	6.7042E-05	3.3392E+04	4.4469E+18	2.0269E+04	8.8348E+00	0.0000E+00	2.0254E+01	2.0254E+01
Nd-147	2.0698E+00	6.3260E-05	3.6947E+04	4.9217E+18	2.0715E+04	9.7766E+00	0.0000E+00	2.2414E+01	2.2414E+01
Np-239	5.5873E+01	7.5226E-04	1.1723E+06	1.5620E+20	5.5920E+05	3.1028E+02	0.0000E+00	7.1135E+02	7.1135E+02
Pu-238	1.5492E-02	1.8896E-02	2.6460E+02	3.5245E+16	1.5505E+02	7.0012E-02	0.0000E+00	1.6051E-01	1.6051E-01
Pu-239	1.5652E-03	2.0371E-03	2.6677E+01	3.5533E+15	1.5665E+01	7.0585E-03	0.0000E+00	1.6182E-02	1.6182E-02
Pu-240	2.1421E-03	2.7941E-03	3.6589E+01	4.8736E+15	2.1439E+01	9.6812E-03	0.0000E+00	2.2195E-02	2.2195E-02
Pu-241	6.4619E-01	1.3560E-02	1.1038E+04	1.4703E+18	6.4674E+03	2.9207E+00	0.0000E+00	6.6960E+00	6.6960E+00
Am-241	3.3478E-04	6.2535E-04	5.6846E+00	7.5717E+14	3.3506E+00	1.5041E-03	0.0000E+00	3.4482E-03	3.4482E-03
Cm-242	8.3459E-02	6.1211E-03	1.4298E+03	1.9045E+17	8.3530E+02	3.7832E-01	0.0000E+00	8.6732E-01	8.6732E-01
Cm-244	5.3729E-03	5.6373E-03	9.1781E+01	1.2225E+16	5.3775E+01	2.4285E-02	0.0000E+00	5.5675E-02	5.5675E-02
Total	1.3890E+08	1.0000E+00	0.0000E+00	0.0000E+00	6.5661E+07	8.9923E+05	7.7975E+01	2.0617E+06	2.0617E+06

Dose Effective (Ci/cc) I-131 (Thyroid) 2.8805E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 3.1916E-04
 Total I (Ci) 2.1750E+06

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 19.4444	Atmosphere	Sump
Noble gases (atoms)	1.8444E+25	0.0000E+00
Elemental I (atoms)	3.6621E+22	0.0000E+00
Organic I (atoms)	1.1326E+21	0.0000E+00
Aerosol I (atoms)	6.9735E+19	0.0000E+00
All Aerosols (kg)	3.1188E-03	0.0000E+00

Time (h) = 19.4444	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
Aerosol I (atoms)	8.7170E+23	0.0000E+00
All Aerosols (kg)	3.3173E+01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 19.4444

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	4.5515E-08	1.7998E-06	7.6624E-04	1.0206E+11	4.1770E-01	6.8598E-03	1.4799E-03	0.0000E+00
Co-60	5.4893E-08	4.1683E-05	9.1807E-04	1.2229E+11	5.0045E-01	8.2189E-03	1.7730E-03	0.0000E+00
Kr-85	4.2871E-01	2.0550E-06	7.9156E+00	1.0544E+15	4.2335E+03	3.5383E+03	6.9399E+02	0.0000E+00
Kr-85m	3.9379E-01	6.6539E-04	4.0774E+01	5.4555E+15	2.2082E+04	1.8340E+04	3.7226E+03	0.0000E+00
Kr-87	3.7993E-04	1.3353E-03	1.4855E+01	2.0060E+15	8.3315E+03	6.7425E+03	1.5639E+03	0.0000E+00
Kr-88	1.8624E-01	1.4604E-02	6.5628E+01	8.7992E+15	3.5799E+04	2.9582E+04	6.1695E+03	0.0000E+00
Rb-86	1.9107E-06	4.8533E-05	3.5237E-02	4.6938E+12	1.9716E+01	3.1556E-01	7.7864E-02	0.0000E+00
Sr-89	5.7922E-05	8.3624E-03	9.7779E-01	1.3024E+14	5.3302E+02	8.7536E+00	1.8886E+00	0.0000E+00
Sr-90	6.9608E-06	3.1196E-02	1.1639E-01	1.5504E+13	6.3447E+01	1.0420E+00	2.2478E-01	0.0000E+00
Sr-91	1.8009E-05	4.6663E-04	1.0264E+00	1.3697E+14	5.6218E+02	9.2054E+00	2.0153E+00	0.0000E+00
Sr-92	5.6142E-07	2.2698E-04	7.2149E-01	9.6720E+13	4.0013E+02	6.5004E+00	1.4791E+00	0.0000E+00
Y-90	1.3030E-06	5.4067E-06	3.1048E-03	4.0524E+11	1.6563E+00	2.7523E-02	5.5981E-03	0.0000E+00
Y-91	8.9465E-07	1.3142E-04	1.3038E-02	1.7353E+12	7.1011E+00	1.1668E-01	2.5114E-02	0.0000E+00
Y-92	3.6645E-06	3.4352E-05	1.8130E-01	2.3316E+13	9.5824E+01	1.5989E+00	3.1838E-01	0.0000E+00
Y-93	2.5029E-07	6.0307E-06	1.3258E-02	1.7690E+12	7.2594E+00	1.1889E-01	2.6005E-02	0.0000E+00
Zr-95	1.0588E-06	8.8441E-05	1.7838E-02	2.3761E+12	9.7242E+00	1.5970E-01	3.4454E-02	0.0000E+00
Zr-97	4.8765E-07	1.6072E-05	1.6221E-02	2.1628E+12	8.8656E+00	1.4536E-01	3.1617E-02	0.0000E+00
Nb-95	1.0750E-06	2.3022E-05	1.7980E-02	2.3949E+12	9.8011E+00	1.6096E-01	3.4724E-02	0.0000E+00
Mo-99	1.2525E-05	2.0794E-04	2.4965E-01	3.3262E+13	1.3618E+02	2.2356E+00	4.8328E-01	0.0000E+00
Tc-99m	1.2039E-05	4.4151E-06	2.2561E-01	2.9969E+13	1.2300E+02	2.0199E+00	4.3595E-01	0.0000E+00
Ru-103	1.2719E-05	4.0858E-04	2.1530E-01	2.8678E+13	1.1737E+02	1.9275E+00	4.1586E-01	0.0000E+00
Ru-105	4.3683E-07	1.8067E-05	1.0205E-01	1.3646E+13	5.6206E+01	9.1712E-01	2.0427E-01	0.0000E+00
Ru-106	5.2129E-06	8.5990E-03	8.7277E-02	1.1625E+13	4.7575E+01	7.8133E-01	1.6855E-01	0.0000E+00
Rh-105	6.5067E-06	2.8277E-05	1.3785E-01	1.8358E+13	7.5168E+01	1.2343E+00	2.6650E-01	0.0000E+00
Sb-127	1.5663E-05	3.9112E-04	2.9691E-01	3.9556E+13	1.6193E+02	2.6585E+00	5.7437E-01	0.0000E+00



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Sb-129	2.3666E-06	1.7182E-04	5.9527E-01	7.9609E+13	3.2796E+02	5.3504E+00	1.1928E+00	0.0000E+00
Te-127	1.6568E-05	2.0017E-05	3.0239E-01	4.0212E+13	1.6488E+02	2.7074E+00	5.8457E-01	0.0000E+00
Te-127m	2.4395E-06	1.8079E-04	4.0747E-02	5.4275E+12	2.2212E+01	3.6478E-01	7.8691E-02	0.0000E+00
Te-129	7.7459E-06	1.4935E-05	6.8015E-01	8.9760E+13	3.7347E+02	6.1061E+00	1.3467E+00	0.0000E+00
Te-129m	7.7316E-06	6.4702E-04	1.3049E-01	1.7381E+13	7.1131E+01	1.1682E+00	2.5200E-01	0.0000E+00
Te-131m	1.5164E-05	5.6196E-04	3.7334E-01	4.9758E+13	2.0382E+02	3.3442E+00	7.2476E-01	0.0000E+00
Te-132	1.9446E-04	7.4279E-03	3.7712E+00	5.0244E+14	2.0569E+03	3.3769E+01	7.2976E+00	0.0000E+00
I-131	3.8686E+00	6.0655E-01	8.8832E+01	1.1834E+16	1.3236E+04	2.1074E+03	8.6658E+02	3.4703E+04
I-132	7.7366E-01	1.5380E-02	4.7615E+01	6.3899E+15	1.0706E+04	1.0013E+03	4.1944E+02	1.5734E+04
I-133	4.3900E+00	1.7787E-01	1.3999E+02	1.8667E+16	2.3244E+04	3.2433E+03	1.3364E+03	5.2639E+04
I-134	1.9361E-06	3.7037E-03	1.1920E+01	1.6194E+15	4.6041E+03	2.0062E+02	1.0757E+02	2.6183E+03
I-135	1.0229E+00	3.4616E-02	7.9676E+01	1.0645E+16	1.6493E+04	1.7385E+03	7.2266E+02	2.7161E+04
Xe-133	5.7517E+01	3.7463E-03	1.1007E+03	1.4664E+17	5.8620E+05	4.9216E+05	9.6581E+04	2.7444E+03
Xe-135	1.1128E+01	8.5186E-03	3.2812E+02	4.3777E+16	1.6316E+05	1.4712E+05	2.8994E+04	1.3138E+04
Cs-134	1.9001E-04	3.3171E-02	3.4161E+00	4.5503E+14	1.9110E+03	3.0591E+01	7.5435E+00	0.0000E+00
Cs-136	5.8295E-05	1.8949E-03	1.0870E+00	1.4480E+14	6.0824E+02	9.7348E+00	2.4027E+00	0.0000E+00
Cs-137	1.1408E-04	1.3630E-02	2.0499E+00	2.7304E+14	1.1467E+03	1.8356E+01	4.5265E+00	0.0000E+00
Ba-139	6.6647E-09	2.4728E-05	6.1567E-01	8.3046E+13	3.4770E+02	5.5816E+00	1.3443E+00	0.0000E+00
Ba-140	1.0818E-04	1.4841E-03	1.8788E+00	2.5026E+14	1.0243E+03	1.6820E+01	3.6302E+00	0.0000E+00
La-140	3.0498E-05	8.5147E-05	6.7816E-02	8.8208E+12	3.6049E+01	6.0020E-01	1.2088E-01	0.0000E+00
La-141	3.4691E-08	1.4321E-06	1.1448E-02	1.5316E+12	6.3142E+00	1.0294E-01	2.3026E-02	0.0000E+00
La-142	1.6481E-10	2.2088E-06	6.0284E-03	8.1208E+11	3.3909E+00	5.4580E-02	1.2980E-02	0.0000E+00
Ce-141	2.6432E-06	8.3122E-05	4.4801E-02	5.9675E+12	2.4422E+01	4.0108E-01	8.6531E-02	0.0000E+00
Ce-143	1.6394E-06	2.8351E-05	3.8966E-02	5.1930E+12	2.1270E+01	3.4902E-01	7.5609E-02	0.0000E+00
Ce-144	2.1920E-06	2.8317E-03	3.6714E-02	4.8903E+12	2.0013E+01	3.2868E-01	7.0905E-02	0.0000E+00
Pr-143	1.0040E-06	2.7108E-05	1.6210E-02	2.1587E+12	8.8348E+00	1.4511E-01	3.1290E-02	0.0000E+00
Nd-147	1.0263E-06	2.5574E-05	1.7932E-02	2.3887E+12	9.7766E+00	1.6055E-01	3.4652E-02	0.0000E+00
Np-239	2.7705E-05	3.0400E-04	5.6876E-01	7.5782E+13	3.1028E+02	5.0933E+00	1.1014E+00	0.0000E+00
Pu-238	7.6819E-09	7.6399E-03	1.2844E-04	1.7108E+10	7.0012E-02	1.1498E-03	2.4804E-04	0.0000E+00
Pu-239	7.7613E-10	8.2364E-04	1.2949E-05	1.7248E+09	7.0585E-03	1.1592E-04	2.5007E-05	0.0000E+00
Pu-240	1.0622E-09	1.1297E-03	1.7760E-05	2.3656E+09	9.6812E-03	1.5899E-04	3.4299E-05	0.0000E+00
Pu-241	3.2042E-07	5.4824E-03	5.3580E-03	7.1369E+11	2.9207E+00	4.7967E-02	1.0348E-02	0.0000E+00
Am-241	1.6600E-10	2.5284E-04	2.7593E-06	3.6753E+08	1.5041E-03	2.4702E-05	5.3285E-06	0.0000E+00
Cm-242	4.1384E-08	2.4748E-03	6.9401E-04	9.2443E+10	3.7832E-01	6.2131E-03	1.3404E-03	0.0000E+00
Cm-244	2.6642E-09	2.2792E-03	4.4550E-05	5.9341E+09	2.4285E-02	3.9883E-04	8.6037E-05	0.0000E+00
Total	7.9710E+01	1.0000E+00	0.0000E+00	0.0000E+00	8.9923E+05	7.0596E+05	1.4122E+05	1.4874E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 8.1815E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 9.1025E-07
 Total I (Ci) 1.0055E+01

Reactor Building Compartment Group Inventory Distribution:

Time (h) = 19.4444	Atmosphere	Sump
Noble gases (atoms)	9.1530E+18	0.0000E+00
Elemental I (atoms)	1.5773E+17	0.0000E+00
Organic I (atoms)	4.8781E+15	0.0000E+00
Aerosol I (atoms)	3.4578E+13	0.0000E+00
All Aerosols (kg)	1.5465E-09	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 19.4444

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	1.8847E-02	1.1920E-03	0.00000	0.00000	0.00000	0.00000
Co-60	2.2622E-02	1.4317E-03	0.00002	0.00000	0.00000	0.00001
Kr-85	5.3967E+03	4.0387E+02	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.5403E+04	1.5130E+03	0.00748	0.00151	0.00000	0.00070
Kr-87	8.5594E+03	4.2987E+02	0.02664	0.00565	0.00001	0.00117
Kr-88	3.9499E+04	2.1546E+03	0.20267	0.04133	0.00002	0.01559
Rb-86	9.0556E-01	5.6488E-02	0.00002	0.00000	0.00000	0.00001
Sr-89	2.4033E+01	1.5195E+00	0.00352	0.00072	0.00000	0.00122
Sr-90	2.8682E+00	1.8152E-01	0.01314	0.00267	0.00000	0.00456
Sr-91	1.9459E+01	1.1081E+00	0.00021	0.00004	0.00000	0.00006
Sr-92	1.0263E+01	5.2360E-01	0.00011	0.00002	0.00000	0.00002
Y-90	2.0627E-01	1.6059E-02	0.00000	0.00000	0.00000	0.00000
Y-91	3.3719E-01	2.1672E-02	0.00005	0.00001	0.00000	0.00002
Y-92	4.8168E+00	2.8177E-01	0.00001	0.00000	0.00000	0.00001
Y-93	2.5443E-01	1.4564E-02	0.00000	0.00000	0.00000	0.00000
Zr-95	4.3869E-01	2.7743E-02	0.00004	0.00001	0.00000	0.00001
Zr-97	3.3956E-01	2.0155E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	4.4304E-01	2.8039E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	5.8753E+00	3.6540E-01	0.00009	0.00002	0.00000	0.00003



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Tc-99m	5.4185E+00	3.3924E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	5.2879E+00	3.3425E-01	0.00017	0.00004	0.00000	0.00006
Ru-105	1.6250E+00	8.6111E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	2.1500E+00	1.3605E-01	0.00362	0.00074	0.00000	0.00126
Rh-105	3.2240E+00	1.9954E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	7.0778E+00	4.4236E-01	0.00017	0.00003	0.00000	0.00006
Sb-129	9.4167E+00	4.9774E-01	0.00008	0.00002	0.00000	0.00002
Te-127	7.2858E+00	4.5713E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	1.0044E+00	6.3576E-02	0.00008	0.00002	0.00000	0.00003
Te-129	1.1668E+01	6.4080E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	3.2093E+00	2.0293E-01	0.00027	0.00006	0.00000	0.00009
Te-131m	8.3472E+00	5.0882E-01	0.00024	0.00005	0.00000	0.00008
Te-132	8.9373E+01	5.5733E+00	0.00315	0.00064	0.00000	0.00106
I-131	3.2906E+03	2.3356E+02	0.22793	0.08836	0.00088	0.02014
I-132	1.5097E+03	9.0131E+01	0.00911	0.00349	0.00006	0.00056
I-133	5.0337E+03	3.4025E+02	0.07622	0.02949	0.00033	0.00641
I-134	3.1848E+02	1.5576E+01	0.00330	0.00136	0.00009	0.00012
I-135	2.6653E+03	1.6141E+02	0.01879	0.00725	0.00011	0.00140
Xe-133	7.5086E+05	5.5860E+04	0.02267	0.00449	0.00000	0.00301
Xe-135	2.3092E+05	1.6057E+04	0.06211	0.01232	0.00000	0.00898
Cs-134	8.8377E+01	5.5276E+00	0.01400	0.00305	0.00031	0.00522
Cs-136	2.7855E+01	1.7356E+00	0.00080	0.00017	0.00002	0.00030
Cs-137	5.3039E+01	3.3176E+00	0.00575	0.00125	0.00013	0.00215
Ba-139	7.8329E+00	3.9217E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	4.5828E+01	2.8893E+00	0.00063	0.00013	0.00000	0.00022
La-140	4.8190E+00	3.7685E-01	0.00003	0.00001	0.00000	0.00003
La-141	1.7704E-01	9.2792E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7803E-02	3.8995E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	1.1001E+00	6.9529E-02	0.00004	0.00001	0.00000	0.00001
Ce-143	8.7843E-01	5.3722E-02	0.00001	0.00000	0.00000	0.00000
Ce-144	9.0431E-01	5.7223E-02	0.00119	0.00024	0.00000	0.00041
Pr-143	4.0386E-01	2.5657E-02	0.00001	0.00000	0.00000	0.00000
Nd-147	4.3670E-01	2.7516E-02	0.00001	0.00000	0.00000	0.00000
Np-239	1.3286E+01	8.2395E-01	0.00013	0.00003	0.00000	0.00004
Pu-238	3.1651E-03	2.0031E-04	0.00322	0.00065	0.00000	0.00112
Pu-239	3.1929E-04	2.0212E-05	0.00035	0.00007	0.00000	0.00012
Pu-240	4.3765E-04	2.7698E-05	0.00048	0.00010	0.00000	0.00016
Pu-241	1.3203E-01	8.3561E-03	0.00231	0.00047	0.00000	0.00080
Am-241	6.8106E-05	4.3129E-06	0.00011	0.00002	0.00000	0.00004
Cm-242	1.7089E-02	1.0812E-03	0.00104	0.00021	0.00000	0.00036
Cm-244	1.0978E-03	6.9478E-05	0.00096	0.00020	0.00000	0.00033

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 19.4444		
Noble gases (atoms)	1.1607E+23	1.6581E+18
Elemental I (atoms)	1.1800E+20	1.6858E+15
Organic I (atoms)	1.0392E+19	1.4846E+14
Aerosol I (atoms)	1.7847E+19	2.5496E+14
All Aerosols (kg)	7.1526E-04	1.0218E-08

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 19.4444

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.1934E+02	6.4090E-06	1.6827E+04	2.2414E+18	0.0000E+00
Co-60	1.1088E+03	1.4888E-04	2.0222E+04	2.6936E+18	0.0000E+00
Rb-86	4.1107E+04	1.7168E-04	7.6869E+05	1.0240E+20	0.0000E+00
Sr-89	1.1699E+06	2.9742E-02	2.1446E+07	2.8567E+21	0.0000E+00
Sr-90	1.4060E+05	1.1143E-01	2.5640E+06	3.4152E+20	0.0000E+00
Sr-91	3.6377E+05	1.0206E-03	1.3845E+07	1.8485E+21	0.0000E+00
Sr-92	1.1340E+04	2.3686E-04	4.6430E+06	6.2268E+20	0.0000E+00
Y-90	2.6381E+04	7.4038E-05	2.6220E+05	3.4672E+19	0.0000E+00
Y-91	1.8085E+04	5.0798E-04	3.1078E+05	4.1372E+19	0.0000E+00
Y-92	7.4350E+04	1.3506E-04	4.3957E+06	5.8263E+20	0.0000E+00
Y-93	5.0554E+03	1.3531E-05	1.8345E+05	2.4490E+19	0.0000E+00
Zr-95	2.1387E+04	3.1484E-04	3.9161E+05	5.2164E+19	0.0000E+00
Zr-97	9.8498E+03	4.2874E-05	2.6684E+05	3.5593E+19	0.0000E+00
Nb-95	2.1714E+04	8.2229E-05	3.9604E+05	5.2751E+19	0.0000E+00
Mo-99	2.5299E+05	6.8651E-04	5.0829E+06	6.7729E+20	0.0000E+00
Tc-99m	2.4316E+05	1.5095E-05	4.7569E+06	6.3132E+20	0.0000E+00
Ru-103	2.5691E+05	1.4514E-03	4.7163E+06	6.2823E+20	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Ru-105	8.8233E+03	2.6247E-05	9.1426E+05	1.2233E+20	0.0000E+00
Ru-106	1.0529E+05	3.0699E-02	1.9215E+06	2.5594E+20	0.0000E+00
Rh-105	1.3143E+05	9.2315E-05	2.7754E+06	3.6980E+20	0.0000E+00
Sb-127	3.1638E+05	1.3203E-03	6.1809E+06	8.2352E+20	0.0000E+00
Sb-129	4.7803E+04	2.4526E-04	5.2402E+06	7.0124E+20	0.0000E+00
Te-127	3.3466E+05	6.8823E-05	6.4116E+06	8.5207E+20	0.0000E+00
Te-127m	4.9274E+04	6.4614E-04	8.9810E+05	1.1962E+20	0.0000E+00
Te-129	1.5646E+05	2.6166E-05	7.3485E+06	9.6716E+20	0.0000E+00
Te-129m	1.5617E+05	2.3036E-03	2.8650E+06	3.8163E+20	0.0000E+00
Te-131m	3.0629E+05	1.6941E-03	6.9407E+06	9.2525E+20	0.0000E+00
Te-132	3.9278E+06	2.4822E-02	7.7716E+07	1.0355E+22	0.0000E+00
I-131	1.8474E+07	3.8888E-01	3.5122E+08	4.6789E+22	3.4703E+04
I-132	4.1980E+06	8.3008E-03	1.5848E+08	2.1083E+22	1.5734E+04
I-133	2.0962E+07	1.0959E-01	5.3188E+08	7.0927E+22	5.2639E+04
I-134	9.2446E+00	1.3062E-03	2.5923E+07	3.5220E+21	2.6183E+03
I-135	4.8844E+06	1.9278E-02	2.7363E+08	3.6566E+22	2.7161E+04
Xe-133	2.6886E+06	1.5412E-05	2.7926E+07	3.6947E+21	2.7444E+03
Xe-135	7.6816E+06	5.6052E-04	1.3314E+08	1.7640E+22	1.3138E+04
Cs-134	4.0878E+06	1.1870E-01	7.5386E+07	1.0041E+22	0.0000E+00
Cs-136	1.2541E+06	6.6695E-03	2.3595E+07	3.1431E+21	0.0000E+00
Cs-137	2.4544E+06	4.8787E-02	4.5248E+07	6.0271E+21	0.0000E+00
Ba-139	1.3462E+02	1.6825E-05	2.5833E+06	3.4848E+20	0.0000E+00
Ba-140	2.1852E+06	5.2109E-03	4.0680E+07	5.4190E+21	0.0000E+00
La-140	6.1745E+05	1.2609E-03	6.1931E+06	8.1878E+20	0.0000E+00
La-141	7.0070E+02	1.9220E-06	9.4745E+04	1.2683E+19	0.0000E+00
La-142	3.3289E+00	1.6023E-06	2.6969E+04	3.6333E+18	0.0000E+00
Ce-141	5.3388E+04	2.9516E-04	9.8106E+05	1.3068E+20	0.0000E+00
Ce-143	3.3114E+04	8.6750E-05	7.3527E+05	9.8010E+19	0.0000E+00
Ce-144	4.4276E+04	1.0107E-02	8.0815E+05	1.0765E+20	0.0000E+00
Pr-143	2.0283E+04	9.8612E-05	3.6365E+05	4.8427E+19	0.0000E+00
Nd-147	2.0730E+04	8.9545E-05	3.8721E+05	5.1581E+19	0.0000E+00
Np-239	5.5960E+05	9.9073E-04	1.1431E+07	1.5233E+21	0.0000E+00
Pu-238	1.5516E+02	2.7292E-02	2.8294E+03	3.7688E+17	0.0000E+00
Pu-239	1.5677E+01	2.9452E-03	2.8555E+02	3.8035E+16	0.0000E+00
Pu-240	2.1454E+01	4.0354E-03	3.9124E+02	5.2113E+16	0.0000E+00
Pu-241	6.4720E+03	1.9583E-02	1.1803E+05	1.5721E+19	0.0000E+00
Am-241	3.3530E+00	9.0562E-04	6.0949E+01	8.1183E+15	0.0000E+00
Cm-242	8.3590E+02	8.8285E-03	1.5268E+04	2.0337E+18	0.0000E+00
Cm-244	5.3813E+01	8.1414E-03	9.8137E+02	1.3072E+17	0.0000E+00
Total	7.8426E+07	1.0000E+00	0.0000E+00	0.0000E+00	1.4874E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 8.1028E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 9.0202E-03
 Total I (Ci) 4.8518E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 19.4444	Atmosphere	Sump
Noble gases (atoms)	7.8456E+22	0.0000E+00
Elemental I (atoms)	7.5355E+23	0.0000E+00
Organic I (atoms)	2.3306E+22	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	3.3004E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 19.4444

Nuclide	Filter	Decays	Transported	Activity Pathway 2	Activity Pathway 3	Activity Pathway 7	Activity Pathway 11
Co-58	1.4072E-06	2.10E+09	2.8850E-08	1.482E-07	2.861E-08	0.000E+00	1.259E-06
Co-60	1.6971E-06	2.52E+09	3.4642E-08	1.775E-07	3.426E-08	0.000E+00	1.520E-06
Kr-85	0.0000E+00	0.00E+00	1.2927E-01	8.344E-03	1.611E-03	1.843E-04	1.191E-01
Kr-85m	0.0000E+00	0.00E+00	5.9461E-01	1.222E-01	2.358E-02	3.411E-03	4.455E-01
Kr-87	0.0000E+00	0.00E+00	2.4716E-01	1.280E-01	2.471E-02	6.420E-03	8.802E-02
Kr-88	0.0000E+00	0.00E+00	9.5196E-01	2.861E-01	5.522E-02	9.136E-03	6.015E-01
Rb-86	9.4097E-05	1.74E+11	7.3389E-06	6.788E-06	1.310E-06	3.464E-05	5.870E-05
Sr-89	1.7908E-03	2.67E+12	3.6781E-05	1.891E-04	3.651E-05	0.000E+00	1.602E-03
Sr-90	2.1521E-04	3.20E+11	4.3922E-06	2.250E-05	4.344E-06	0.000E+00	1.928E-04
Sr-91	5.5681E-04	1.45E+12	2.7570E-05	2.108E-04	4.069E-05	0.000E+00	6.778E-04
Sr-92	1.7358E-05	3.06E+11	1.2355E-05	1.651E-04	3.186E-05	0.000E+00	2.803E-04
Y-90	4.0549E-05	3.98E+10	3.6242E-07	4.147E-07	8.004E-08	0.000E+00	4.042E-05
Y-91	2.7720E-05	3.96E+10	5.2265E-07	2.493E-06	4.811E-07	0.000E+00	2.527E-05
Y-92	1.1470E-04	4.96E+11	8.0293E-06	2.733E-05	5.276E-06	0.000E+00	4.867E-04
Y-93	7.7382E-06	1.94E+10	3.6216E-07	2.714E-06	5.239E-07	0.000E+00	8.675E-06



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Zr-95	3.2737E-05	4.88E+10	6.7147E-07	3.450E-06	6.660E-07	0.000E+00	2.929E-05
Zr-97	1.5077E-05	3.03E+10	4.9794E-07	3.249E-06	6.272E-07	0.000E+00	1.189E-05
Nb-95	3.3237E-05	4.94E+10	6.7844E-07	3.476E-06	6.710E-07	0.000E+00	2.977E-05
Mo-99	3.8724E-04	6.20E+11	8.9001E-06	4.873E-05	9.406E-06	0.000E+00	3.380E-04
Tc-99m	3.7220E-04	5.83E+11	8.2542E-06	4.376E-05	8.447E-06	0.000E+00	3.282E-04
Ru-103	3.9324E-04	5.88E+11	8.0915E-06	4.165E-05	8.040E-06	0.000E+00	3.516E-04
Ru-105	1.3506E-05	7.70E+10	2.1176E-06	2.216E-05	4.277E-06	0.000E+00	5.468E-05
Ru-106	1.6117E-04	2.40E+11	3.2921E-06	1.688E-05	3.257E-06	0.000E+00	1.443E-04
Rh-105	2.0117E-04	3.36E+11	4.8833E-06	2.682E-05	5.178E-06	0.000E+00	1.741E-04
Sb-127	4.8427E-04	7.59E+11	1.0755E-05	5.780E-05	1.116E-05	0.000E+00	4.261E-04
Sb-129	7.3170E-05	4.36E+11	1.2223E-05	1.296E-04	2.501E-05	0.000E+00	3.135E-04
Te-127	5.1225E-04	7.89E+11	1.1101E-05	5.871E-05	1.133E-05	0.000E+00	4.533E-04
Te-127m	7.5422E-05	1.12E+11	1.5382E-06	7.877E-06	1.521E-06	0.000E+00	6.756E-05
Te-129	2.3948E-04	6.87E+11	1.5767E-05	1.445E-04	2.789E-05	0.000E+00	3.392E-04
Te-129m	2.3904E-04	3.57E+11	4.9128E-06	2.523E-05	4.870E-06	0.000E+00	2.139E-04
Te-131m	4.6882E-04	8.22E+11	1.2478E-05	7.368E-05	1.422E-05	0.000E+00	3.934E-04
Te-132	6.0122E-03	9.51E+12	1.3562E-04	7.350E-04	1.419E-04	0.000E+00	5.271E-03
I-131	5.3126E-02	9.39E+13	4.8632E-03	7.904E-03	2.600E-03	1.349E-02	3.401E-02
I-132	6.6697E-03	2.52E+13	5.0303E-03	7.990E-03	2.627E-03	1.920E-02	2.093E-02
I-133	6.0314E-02	1.37E+14	8.8584E-03	1.494E-02	4.912E-03	2.726E-02	2.281E-02
I-134	2.6600E-08	5.47E+12	5.8454E-03	2.228E-03	7.325E-04	2.834E-02	2.592E-02
I-135	1.4054E-02	6.43E+13	7.0200E-03	1.185E-02	3.897E-03	2.540E-02	2.428E-02
Xe-133	0.0000E+00	0.00E+00	1.7734E+01	1.197E+00	2.310E-01	2.649E-02	1.628E+01
Xe-135	0.0000E+00	0.00E+00	4.3817E+00	4.573E-01	8.828E-02	9.403E-03	3.827E+00
Cs-134	9.3572E-03	1.71E+13	7.1035E-04	6.588E-04	1.272E-04	3.345E-03	5.936E-03
Cs-136	2.8708E-03	5.32E+12	2.2656E-04	2.093E-04	4.040E-05	1.070E-03	1.778E-03
Cs-137	5.6182E-03	1.02E+13	4.2623E-04	3.953E-04	7.631E-05	2.007E-03	3.566E-03
Ba-139	2.0606E-07	1.10E+11	8.4768E-06	1.529E-04	2.952E-05	0.000E+00	2.457E-04
Ba-140	3.3447E-03	5.05E+12	7.0015E-05	3.640E-04	7.026E-05	0.000E+00	2.981E-03
La-140	9.4899E-04	9.41E+11	8.5244E-06	8.438E-06	1.629E-06	0.000E+00	9.474E-04
La-141	1.0725E-06	7.57E+09	2.2656E-07	2.515E-06	4.855E-07	0.000E+00	5.672E-06
La-142	5.0954E-09	1.24E+09	8.5454E-08	1.478E-06	2.853E-07	0.000E+00	2.373E-06
Ce-141	8.1717E-05	1.22E+11	1.6833E-06	8.667E-06	1.673E-06	0.000E+00	7.306E-05
Ce-143	5.0687E-05	8.75E+10	1.3160E-06	7.676E-06	1.482E-06	0.000E+00	4.285E-05
Ce-144	6.7772E-05	1.01E+11	1.3847E-06	7.099E-06	1.370E-06	0.000E+00	6.069E-05
Pr-143	3.1055E-05	4.56E+10	6.2011E-07	3.127E-06	6.036E-07	0.000E+00	2.794E-05
Nd-147	3.1731E-05	4.81E+10	6.6694E-07	3.475E-06	6.708E-07	0.000E+00	2.825E-05
Np-239	8.5657E-04	1.39E+12	2.0089E-05	1.112E-04	2.146E-05	0.000E+00	7.440E-04
Pu-238	2.3751E-07	3.53E+08	4.8468E-09	2.483E-08	4.793E-09	0.000E+00	2.127E-07
Pu-239	2.3996E-08	3.57E+07	4.8901E-10	2.503E-09	4.832E-10	0.000E+00	2.150E-08
Pu-240	3.2840E-08	4.88E+07	6.7020E-10	3.434E-09	6.628E-10	0.000E+00	2.941E-08
Pu-241	9.9065E-06	1.47E+10	2.0219E-07	1.036E-06	2.000E-07	0.000E+00	8.873E-06
Am-241	5.1325E-09	7.61E+06	1.0433E-10	5.333E-10	1.029E-10	0.000E+00	4.601E-09
Cm-242	1.2795E-06	1.91E+09	2.6164E-08	1.342E-07	2.590E-08	0.000E+00	1.146E-06
Cm-244	8.2371E-08	1.23E+08	1.6811E-09	8.613E-09	1.663E-09	0.000E+00	7.378E-08

Filtered Environment to Control Room Transport Group Inventory:

	Pathway	
Time (h) = 19.4444	Filtered	Transported
Noble gases (atoms)	0.0000E+00	2.7670E+18
Elemental I (atoms)	5.3548E+14	6.9779E+13
Organic I (atoms)	1.7107E+14	2.1255E+13
Aerosol I (atoms)	1.7185E+15	1.0528E+14
All Aerosols (kg)	7.0194E-08	4.3447E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:07

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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)	5.6395E-01	1.7413E+01	1.2094E+00

Low Population Zone Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	5.2204E-02	2.8322E+00	1.4556E-01
Accumulated dose (rem)	1.2572E+00	4.2754E+01	2.7882E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Control Room Doses:

Time (h) = 24.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	1.0360E-02	3.9570E+00	1.9179E-01	6.2178E-01
Accumulated dose (rem)	7.5724E-02	3.0336E+01	1.4779E+00	3.5907E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 24.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	1.5428E-02	4.2597E-06	1.5788E+03	2.1030E+17	9.1705E+02	4.1775E-01	0.0000E+00	9.5772E-01	9.5772E-01
Co-60	1.8640E-02	9.8656E-05	1.8916E+03	2.5196E+17	1.1080E+03	5.0051E-01	0.0000E+00	1.1475E+00	1.1475E+00
Kr-85	8.5942E+05	5.9497E-06	1.9950E+07	2.6574E+21	0.0000E+00	5.2729E+03	8.1591E-02	1.2089E+04	1.2089E+04
Kr-85m	3.9013E+05	1.6052E-03	8.5629E+07	1.1458E+22	0.0000E+00	2.2773E+04	1.5084E+00	5.2213E+04	5.2213E+04
Kr-87	6.3587E+01	3.2074E-03	3.1064E+07	4.1948E+21	0.0000E+00	8.3319E+03	2.8333E+00	1.9108E+04	1.9108E+04
Kr-88	1.2282E+05	3.4610E-02	1.3539E+08	1.8154E+22	0.0000E+00	3.6075E+04	4.0384E+00	8.2715E+04	8.2715E+04
Rb-86	6.4431E-01	1.1794E-04	7.4545E+04	9.9298E+18	4.0789E+04	1.9718E+01	1.5341E-02	4.5240E+01	4.5240E+01
Sr-89	1.9619E+01	1.9793E-02	2.0147E+06	2.6836E+20	1.1662E+06	5.3308E+02	0.0000E+00	1.2221E+03	1.2221E+03
Sr-90	2.3638E+00	7.3834E-02	2.3982E+05	3.1944E+19	1.4051E+05	6.3455E+01	0.0000E+00	1.4547E+02	1.4547E+02
Sr-91	4.3863E+00	1.1076E-03	2.1209E+06	2.8302E+20	2.6073E+05	5.6220E+02	0.0000E+00	1.2889E+03	1.2889E+03
Sr-92	5.9457E-02	5.4302E-04	1.5026E+06	2.0144E+20	3.5342E+03	4.0013E+02	0.0000E+00	9.1734E+02	9.1734E+02
Y-90	5.3504E-01	1.2659E-05	6.3282E+03	8.2578E+17	3.1862E+04	1.6579E+00	0.0000E+00	3.8008E+00	3.8008E+00
Y-91	3.0804E-01	3.1092E-04	2.6852E+04	3.5738E+18	1.8324E+04	7.1021E+00	0.0000E+00	1.6282E+01	1.6282E+01
Y-92	5.7160E-01	8.0059E-05	3.6782E+05	4.7253E+19	3.4112E+04	9.5827E+01	0.0000E+00	2.1969E+02	2.1969E+02
Y-93	6.2175E-02	1.4312E-05	2.7390E+04	3.6547E+18	3.6958E+03	7.2597E+00	0.0000E+00	1.6643E+01	1.6643E+01
Zr-95	3.5883E-01	2.0933E-04	3.6755E+04	4.8959E+18	2.1330E+04	9.7254E+00	0.0000E+00	2.2296E+01	2.2296E+01
Zr-97	1.3738E-01	3.8100E-05	3.3474E+04	4.4634E+18	8.1660E+03	8.8661E+00	0.0000E+00	2.0326E+01	2.0326E+01
Nb-95	3.6503E-01	5.4490E-05	3.7047E+04	4.9345E+18	2.1698E+04	9.8023E+00	0.0000E+00	2.2473E+01	2.2473E+01
Mo-99	4.0546E+00	4.9236E-04	5.1459E+05	6.8562E+19	2.4101E+05	1.3619E+02	0.0000E+00	3.1224E+02	3.1224E+02
Tc-99m	3.9167E+00	1.0451E-05	4.6489E+05	6.1753E+19	2.3282E+05	1.2301E+02	0.0000E+00	2.8202E+02	2.8202E+02
Ru-103	4.3048E+00	9.6707E-04	4.4362E+05	5.9091E+19	2.5588E+05	1.1738E+02	0.0000E+00	2.6910E+02	2.6910E+02
Ru-105	7.2845E-02	4.3034E-05	2.1160E+05	2.8296E+19	4.3300E+03	5.6206E+01	0.0000E+00	1.2886E+02	1.2886E+02
Ru-106	1.7696E+00	2.0352E-02	1.7983E+05	2.3953E+19	1.0519E+05	4.7581E+01	0.0000E+00	1.0908E+02	1.0908E+02
Rh-105	2.0299E+00	6.6936E-05	2.8408E+05	3.7830E+19	1.2066E+05	7.5175E+01	0.0000E+00	1.7235E+02	1.7235E+02
Sb-127	5.1404E+00	9.2597E-04	6.1193E+05	8.1525E+19	3.0555E+05	1.6194E+02	0.0000E+00	3.7127E+02	3.7127E+02
Sb-129	3.8694E-01	4.0933E-04	1.2346E+06	1.6510E+20	2.3000E+04	3.2796E+02	0.0000E+00	7.5188E+02	7.5188E+02
Te-127	5.4798E+00	4.7384E-05	6.2315E+05	8.2868E+19	3.2573E+05	1.6490E+02	0.0000E+00	3.7805E+02	3.7805E+02
Te-127m	8.2856E-01	4.2789E-04	8.3956E+04	1.1183E+19	4.9251E+04	2.2214E+01	0.0000E+00	5.0928E+01	5.0928E+01
Te-129	2.1735E+00	3.5505E-05	1.4076E+06	1.8575E+20	1.2919E+05	3.7347E+02	0.0000E+00	8.5622E+02	8.5622E+02
Te-129m	2.6158E+00	1.5314E-03	2.6886E+05	3.5812E+19	1.5549E+05	7.1140E+01	0.0000E+00	1.6309E+02	1.6309E+02
Te-131m	4.6350E+00	1.3312E-03	7.6992E+05	1.0261E+20	2.7551E+05	2.0383E+02	0.0000E+00	4.6730E+02	4.6730E+02
Te-132	6.3424E+01	1.7586E-02	7.7729E+06	1.0356E+21	3.7700E+06	2.0571E+03	0.0000E+00	4.7161E+03	4.7161E+03
I-131	8.7946E+05	4.2439E-01	5.4108E+07	7.2079E+21	1.7209E+07	1.4310E+04	5.9740E+00	3.2820E+04	3.2820E+04
I-132	3.0374E+03	1.4937E-02	4.0258E+07	5.3876E+21	3.9626E+06	1.0714E+04	8.5765E+00	2.4583E+04	2.4583E+04
I-133	8.7209E+05	1.3444E-01	9.2107E+07	1.2280E+22	1.7049E+07	2.4386E+04	1.2087E+01	5.5934E+04	5.5934E+04
I-134	1.2209E-02	6.0973E-03	1.7082E+07	2.3208E+21	2.3868E-01	4.6041E+03	1.2841E+01	1.0585E+04	1.0585E+04
I-135	1.4669E+05	3.1459E-02	6.3035E+07	8.4197E+21	2.8678E+06	1.6721E+04	1.1285E+01	3.8361E+04	3.8361E+04
Xe-133	1.1194E+08	1.0692E-02	2.7349E+09	3.6434E+23	0.0000E+00	7.2305E+05	1.1726E+01	1.6577E+06	1.6577E+06
Xe-135	1.4707E+07	2.0676E-02	6.9331E+08	9.2436E+22	0.0000E+00	1.8378E+05	4.1642E+00	4.2135E+05	4.2135E+05
Cs-134	6.4514E+01	8.0597E-02	7.2259E+06	9.6249E+20	4.0841E+06	1.9112E+03	1.4816E+00	4.3851E+03	4.3851E+03
Cs-136	1.9598E+01	4.6050E-03	2.2997E+06	3.0634E+20	1.2407E+06	6.0831E+02	4.7405E-01	1.3957E+03	1.3957E+03
Cs-137	3.8741E+01	3.3118E-02	4.3359E+06	5.7754E+20	2.4526E+06	1.1468E+03	8.8893E-01	2.6313E+03	2.6313E+03
Ba-139	2.2898E-04	5.9870E-05	1.2976E+06	1.7504E+20	1.3611E+01	3.4770E+02	0.0000E+00	7.9714E+02	7.9714E+02
Ba-140	3.6361E+01	3.5129E-03	3.8714E+06	5.1569E+20	2.1613E+06	1.0244E+03	0.0000E+00	2.3485E+03	2.3485E+03
La-140	1.2334E+01	1.9899E-04	1.3797E+05	1.7940E+19	7.3449E+05	3.6086E+01	0.0000E+00	8.2730E+01	8.2730E+01
La-141	5.2750E-03	3.4142E-06	2.3759E+04	3.1787E+18	3.1355E+02	6.3142E+00	0.0000E+00	1.4476E+01	1.4476E+01
La-142	7.2177E-06	5.3332E-06	1.2672E+04	1.7070E+18	4.2903E-01	3.3909E+00	0.0000E+00	7.7738E+00	7.7738E+00
Ce-141	8.9402E-01	1.9674E-04	9.2310E+04	1.2296E+19	5.3141E+04	2.4425E+01	0.0000E+00	5.5997E+01	5.5997E+01
Ce-143	5.0593E-01	6.7157E-05	8.0351E+04	1.0708E+19	3.0073E+04	2.1272E+01	0.0000E+00	4.8767E+01	4.8767E+01
Ce-144	7.4405E-01	6.7021E-03	7.5647E+04	1.0076E+19	4.4227E+04	2.0016E+01	0.0000E+00	4.5888E+01	4.5888E+01
Pr-143	3.4280E-01	6.4154E-05	3.3397E+04	4.4475E+18	2.0379E+04	8.8359E+00	0.0000E+00	2.0257E+01	2.0257E+01
Nd-147	3.4438E-01	6.0535E-05	3.6951E+04	4.9223E+18	2.0470E+04	9.7778E+00	0.0000E+00	2.2416E+01	2.2416E+01
Np-239	8.8971E+00	7.1984E-04	1.1724E+06	1.5622E+20	5.2886E+05	3.1031E+02	0.0000E+00	7.1142E+02	7.1142E+02
Pu-238	2.6088E-03	1.8082E-02	2.6463E+02	3.5249E+16	1.5507E+02	7.0021E-02	0.0000E+00	1.6053E-01	1.6053E-01
Pu-239	2.6370E-04	1.9494E-03	2.6680E+01	3.5538E+15	1.5675E+01	7.0594E-03	0.0000E+00	1.6184E-02	1.6184E-02
Pu-240	3.6070E-04	2.6737E-03	3.6593E+01	4.8742E+15	2.1441E+01	9.6824E-03	0.0000E+00	2.2198E-02	2.2198E-02
Pu-241	1.0881E-01	1.2976E-02	1.1040E+04	1.4705E+18	6.4677E+03	2.9211E+00	0.0000E+00	6.6968E+00	6.6968E+00
Am-241	5.6463E-05	5.9841E-04	5.6853E+00	7.5726E+14	3.3563E+03	1.5043E-03	0.0000E+00	3.4487E-03	3.4487E-03
Cm-242	1.4042E-02	8.8755E-03	1.4300E+03	1.9047E+17	8.3469E+02	3.7836E-01	0.0000E+00	8.6743E-01	8.6743E-01
Cm-244	9.0472E-04	5.3945E-03	9.1792E+01	1.2227E+16	5.3778E+01	2.4288E-02	0.0000E+00	5.5681E-02	5.5681E-02



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Total	1.2992E+08	1.0000E+00	0.0000E+00	0.0000E+00	6.0214E+07	1.0612E+06	7.7975E+01	2.4330E+06	2.4330E+06
Dose Effective (Ci/cc) I-131 (Thyroid)					2.7474E-04				
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid)					3.0038E-04				
Total I (Ci)					1.9013E+06				

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 24.0000	Atmosphere	Sump	
Noble gases (atoms)	1.8254E+25	0.0000E+00	
Elemental I (atoms)	3.5185E+22	0.0000E+00	
Organic I (atoms)	1.0882E+21	0.0000E+00	
Aerosol I (atoms)	1.1358E+19	0.0000E+00	
All Aerosols (kg)	5.2505E-04	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	
Aerosol I (atoms)	8.7176E+23	0.0000E+00	
All Aerosols (kg)	3.3175E+01	0.0000E+00	

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 24.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	7.6497E-09	1.5684E-06	7.6634E-04	1.0208E+11	4.1775E-01	6.8606E-03	1.4801E-03	0.0000E+00
Co-60	9.2423E-09	3.6325E-05	9.1818E-04	1.2230E+11	5.0051E-01	8.2199E-03	1.7732E-03	0.0000E+00
Kr-85	4.2582E-01	2.2310E-06	9.8619E+00	1.3136E+15	5.2729E+03	4.4095E+03	8.6216E+02	0.0000E+00
Kr-85m	1.9330E-01	5.9790E-04	4.2047E+01	5.6264E+15	2.2773E+04	1.8919E+04	3.8344E+03	0.0000E+00
Kr-87	3.1506E-05	1.1635E-03	1.4856E+01	2.0061E+15	8.3319E+03	6.7428E+03	1.5640E+03	0.0000E+00
Kr-88	6.0853E-02	1.2823E-02	6.6132E+01	8.8672E+15	3.6075E+04	2.9813E+04	6.2141E+03	0.0000E+00
Rb-86	3.1947E-07	4.2294E-05	3.5241E-02	4.6943E+12	1.9718E+01	3.1560E-01	7.7871E-02	0.0000E+00
Sr-89	9.7276E-06	7.2875E-03	9.7791E-01	1.3026E+14	5.3308E+02	8.7547E+00	1.8888E+00	0.0000E+00
Sr-90	1.1721E-06	2.7186E-02	1.1641E-01	1.5505E+13	6.3455E+01	1.0421E+00	2.2481E-01	0.0000E+00
Sr-91	2.1749E-06	4.0662E-04	1.0264E+00	1.3697E+14	5.6220E+02	9.2057E+00	2.0153E+00	0.0000E+00
Sr-92	2.9481E-08	1.9778E-04	7.2149E-01	9.6720E+13	4.0013E+02	6.5004E+00	1.4791E+00	0.0000E+00
Y-90	2.6529E-07	4.7155E-06	3.1077E-03	4.0563E+11	1.6579E+00	2.7550E-02	5.6033E-03	0.0000E+00
Y-91	1.5274E-07	1.1453E-04	1.3040E-02	1.7355E+12	7.1021E+00	1.1669E-01	2.5117E-02	0.0000E+00
Y-92	2.8342E-07	2.9934E-05	1.8130E-01	2.3317E+13	9.5827E+01	1.5990E+00	3.1839E-01	0.0000E+00
Y-93	3.0829E-08	5.2551E-06	1.3258E-02	1.7690E+12	7.2597E+00	1.1890E-01	2.606E-02	0.0000E+00
Zr-95	1.7792E-07	7.7073E-05	1.7841E-02	2.3764E+12	9.7254E+00	1.5972E-01	3.4458E-02	0.0000E+00
Zr-97	6.8117E-08	1.4005E-05	1.6221E-02	2.1629E+12	8.8661E+00	1.4537E-01	3.1618E-02	0.0000E+00
Nb-95	1.8100E-07	2.0063E-05	1.7982E-02	2.3952E+12	9.8023E+00	1.6099E-01	3.4728E-02	0.0000E+00
Mo-99	2.0104E-06	1.8121E-04	2.4968E-01	3.3266E+13	1.3619E+02	2.2358E+00	4.8332E-01	0.0000E+00
Tc-99m	1.9421E-06	3.8475E-06	2.2563E-01	2.9972E+13	1.2301E+02	2.0201E+00	4.3599E-01	0.0000E+00
Ru-103	2.1345E-06	3.5606E-04	2.1532E-01	2.8682E+13	1.1738E+02	1.9277E+00	4.1591E-01	0.0000E+00
Ru-105	3.6119E-08	1.5743E-05	1.0205E-01	1.3646E+13	5.6206E+01	9.1713E-01	2.0427E-01	0.0000E+00
Ru-106	8.7744E-07	7.4937E-03	8.7288E-02	1.1627E+13	4.7581E+01	7.8143E-01	1.6857E-01	0.0000E+00
Rh-105	1.0065E-06	2.4642E-05	1.3787E-01	1.8360E+13	7.5175E+01	1.2344E+00	2.6652E-01	0.0000E+00
Sb-127	2.5488E-06	3.4084E-04	2.9694E-01	3.9560E+13	1.6194E+02	2.6588E+00	5.7443E-01	0.0000E+00
Sb-129	1.9186E-07	1.4971E-04	5.9527E-01	7.9610E+13	3.2796E+02	5.3504E+00	1.1928E+00	0.0000E+00
Te-127	2.7171E-06	1.7444E-05	3.0242E-01	4.0217E+13	1.6490E+02	2.7077E+00	5.8463E-01	0.0000E+00
Te-127m	4.1083E-07	1.5755E-04	4.0752E-02	5.4282E+12	2.2214E+01	3.6483E-01	7.8700E-02	0.0000E+00
Te-129	1.0777E-06	1.3014E-05	6.8017E-01	8.9762E+13	3.7347E+02	6.1062E+00	1.3467E+00	0.0000E+00
Te-129m	1.2970E-06	5.6385E-04	1.3051E-01	1.7383E+13	7.1140E+01	1.1683E+00	2.5203E-01	0.0000E+00
Te-131m	2.2982E-06	4.8970E-04	3.7337E-01	4.9762E+13	2.0383E+02	3.3445E+00	7.2482E-01	0.0000E+00
Te-132	3.1448E-05	6.4730E-03	3.7716E+00	5.0249E+14	2.0571E+03	3.3772E+01	7.2983E+00	0.0000E+00
I-131	3.8013E+00	6.3243E-01	1.0630E+02	1.4161E+16	1.4310E+04	2.5766E+03	1.0598E+03	4.2960E+04
I-132	7.1518E-01	1.4345E-02	5.0968E+01	6.8432E+15	1.0714E+04	1.0928E+03	4.5711E+02	1.7571E+04
I-133	3.7666E+00	1.7549E-01	1.5850E+02	2.1137E+16	2.4386E+04	3.7420E+03	1.5418E+03	6.1415E+04
I-134	5.2729E-08	3.2273E-03	1.1920E+01	1.6194E+15	4.6041E+03	2.0062E+02	1.0757E+02	2.6183E+03
I-135	6.3356E-01	3.1557E-02	8.3359E+01	1.1139E+16	1.6721E+04	1.8384E+03	7.6382E+02	2.8920E+04
Xe-133	5.6032E+01	4.0311E-03	1.3593E+03	1.8109E+17	7.2305E+05	6.0796E+05	1.1893E+05	4.0470E+03
Xe-135	8.4604E+00	8.4238E-03	3.7237E+02	4.9691E+16	1.8378E+05	1.6706E+05	3.2842E+04	1.6317E+04
Cs-134	3.1988E-05	2.8907E-02	3.4165E+00	4.5508E+14	1.9112E+03	3.0595E+01	7.5442E+00	0.0000E+00
Cs-136	9.7176E-06	1.6513E-03	1.0872E+00	1.4482E+14	6.0831E+02	9.7359E+00	2.4029E+00	0.0000E+00
Cs-137	1.9209E-05	1.1878E-02	2.0501E+00	2.7307E+14	1.1468E+03	1.8359E+01	4.5269E+00	0.0000E+00
Ba-139	1.1354E-10	2.1547E-05	6.1567E-01	8.3046E+13	3.4770E+02	5.5816E+00	1.3443E+00	0.0000E+00
Ba-140	1.8029E-05	1.2933E-03	1.8790E+00	2.5029E+14	1.0244E+03	1.6822E+01	3.6306E+00	0.0000E+00
La-140	6.1158E-06	7.4268E-05	6.7884E-02	8.8298E+12	3.6086E+01	6.0082E-01	1.2100E-01	0.0000E+00
La-141	2.6155E-09	1.2479E-06	1.1448E-02	1.5317E+12	6.3142E+00	1.0294E-01	2.3026E-02	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

La-142	3.5788E-12	1.9246E-06	6.0284E-03	8.1208E+11	3.3909E+00	5.4580E-02	1.2980E-02	0.0000E+00
Ce-141	4.4329E-07	7.2437E-05	4.4806E-02	5.9682E+12	2.4425E+01	4.0113E-01	8.6541E-02	0.0000E+00
Ce-143	2.5086E-07	2.4706E-05	3.8969E-02	5.1935E+12	2.1272E+01	3.4905E-01	7.5615E-02	0.0000E+00
Ce-144	3.6893E-07	2.4677E-03	3.6719E-02	4.8909E+12	2.0016E+01	3.2872E-01	7.0913E-02	0.0000E+00
Pr-143	1.6997E-07	2.3624E-05	1.6212E-02	2.1590E+12	8.8359E+00	1.4513E-01	3.1293E-02	0.0000E+00
Nd-147	1.7076E-07	2.2287E-05	1.7934E-02	2.3890E+12	9.7778E+00	1.6057E-01	3.4655E-02	0.0000E+00
Np-239	4.4115E-06	2.6492E-04	5.6882E-01	7.5790E+13	3.1031E+02	5.0938E+00	1.1015E+00	0.0000E+00
Pu-238	1.2935E-09	6.6579E-03	1.2845E-04	1.7110E+10	7.0021E-02	1.1500E-03	2.4807E-04	0.0000E+00
Pu-239	1.3075E-10	7.1777E-04	1.2951E-05	1.7250E+09	7.0594E-03	1.1594E-04	2.5010E-05	0.0000E+00
Pu-240	1.7885E-10	9.8446E-04	1.7762E-05	2.3659E+09	9.6824E-03	1.5902E-04	3.4303E-05	0.0000E+00
Pu-241	5.3951E-08	4.7777E-03	5.3587E-03	7.1378E+11	2.9211E+00	4.7973E-02	1.0349E-02	0.0000E+00
Am-241	2.7997E-11	2.2034E-04	2.7597E-06	3.6758E+08	1.5043E-03	2.4705E-05	5.3291E-06	0.0000E+00
Cm-242	6.9626E-09	2.1567E-03	6.9410E-04	9.2454E+10	3.7836E-01	6.2139E-03	1.3405E-03	0.0000E+00
Cm-244	4.4860E-10	1.9862E-03	4.4556E-05	5.9348E+09	2.4288E-02	3.9888E-04	8.6047E-05	0.0000E+00
Total	7.4090E+01	1.0000E+00	0.0000E+00	0.0000E+00	1.0612E+06	8.4453E+05	1.6822E+05	1.7385E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 7.8590E-07
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 8.6286E-07
 Total I (Ci) 8.9167E+00

Reactor Building Compartment Group Inventory Distribution:

Time (h) = 24.0000	Atmosphere	Sump
Noble gases (atoms)	9.0600E+18	0.0000E+00
Elemental I (atoms)	1.5241E+17	0.0000E+00
Organic I (atoms)	4.7138E+15	0.0000E+00
Aerosol I (atoms)	5.6316E+12	0.0000E+00
All Aerosols (kg)	2.6034E-10	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 24.0000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	2.1491E-02	1.4549E-03	0.00000	0.00000	0.00000	0.00000
Co-60	2.5813E-02	1.7490E-03	0.00002	0.00000	0.00000	0.00001
Kr-85	7.0669E+03	5.7001E+02	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.6491E+04	1.6210E+03	0.00748	0.00151	0.00000	0.00070
Kr-87	8.5599E+03	4.2992E+02	0.02664	0.00565	0.00001	0.00117
Kr-88	3.9929E+04	2.1972E+03	0.20267	0.04133	0.00002	0.01559
Rb-86	1.0276E+00	6.8621E-02	0.00002	0.00000	0.00000	0.00001
Sr-89	2.7396E+01	1.8540E+00	0.00352	0.00072	0.00000	0.00122
Sr-90	3.2728E+00	2.2176E-01	0.01314	0.00267	0.00000	0.00456
Sr-91	2.0347E+01	1.1964E+00	0.00021	0.00004	0.00000	0.00006
Sr-92	1.0282E+01	5.2549E-01	0.00011	0.00002	0.00000	0.00002
Y-90	2.9051E-01	2.4441E-02	0.00000	0.00000	0.00000	0.00000
Y-91	3.8968E-01	2.6892E-02	0.00005	0.00001	0.00000	0.00002
Y-92	4.9658E+00	2.9656E-01	0.00001	0.00000	0.00000	0.00001
Y-93	2.6689E-01	1.5802E-02	0.00000	0.00000	0.00000	0.00000
Zr-95	5.0018E-01	3.3858E-02	0.00004	0.00001	0.00000	0.00001
Zr-97	3.6538E-01	2.2721E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	5.0553E-01	3.4253E-02	0.00001	0.00000	0.00000	0.00000
Mo-99	6.5860E+00	4.3607E-01	0.00009	0.00002	0.00000	0.00003
Tc-99m	6.1035E+00	4.0735E-01	0.00000	0.00000	0.00000	0.00000
Ru-103	6.0260E+00	4.0765E-01	0.00017	0.00004	0.00000	0.00006
Ru-105	1.6431E+00	8.7904E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	2.4529E+00	1.6618E-01	0.00362	0.00074	0.00000	0.00126
Rh-105	3.5865E+00	2.3558E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	7.9727E+00	5.3135E-01	0.00017	0.00003	0.00000	0.00006
Sb-129	9.5137E+00	5.0736E-01	0.00008	0.00002	0.00000	0.00002
Te-127	8.2363E+00	5.5164E-01	0.00001	0.00000	0.00000	0.00000
Te-127m	1.1463E+00	7.7681E-02	0.00008	0.00002	0.00000	0.00003
Te-129	1.2074E+01	6.8114E-01	0.00001	0.00000	0.00000	0.00000
Te-129m	3.6579E+00	2.4755E-01	0.00027	0.00006	0.00000	0.00009
Te-131m	9.1832E+00	5.9194E-01	0.00024	0.00005	0.00000	0.00008
Te-132	1.0045E+02	6.6746E+00	0.00315	0.00064	0.00000	0.00106
I-131	4.0563E+03	3.0971E+02	0.22793	0.08836	0.00088	0.02014
I-132	1.6512E+03	1.0420E+02	0.00911	0.00349	0.00006	0.00056
I-133	5.8451E+03	4.2092E+02	0.07622	0.02949	0.00033	0.00641
I-134	3.1848E+02	1.5576E+01	0.00330	0.00136	0.00009	0.00012
I-135	2.8267E+03	1.7744E+02	0.01879	0.00725	0.00011	0.00140
Xe-133	9.7264E+05	7.7920E+04	0.02267	0.00449	0.00000	0.00301
Xe-135	2.6865E+05	1.9807E+04	0.06211	0.01232	0.00000	0.00898
Cs-134	1.0055E+02	6.7383E+00	0.01400	0.00305	0.00031	0.00522



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Cs-136	3.1572E+01	2.1052E+00	0.00080	0.00017	0.00002	0.00030
Cs-137	6.0349E+01	4.0446E+00	0.00575	0.00125	0.00013	0.00215
Ba-139	7.8331E+00	3.9218E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	5.2084E+01	3.5114E+00	0.00063	0.00013	0.00000	0.00022
La-140	6.7751E+00	5.7148E-01	0.00003	0.00001	0.00000	0.00003
La-141	1.7842E-01	9.4158E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7807E-02	3.8999E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	1.2534E+00	8.4778E-02	0.00004	0.00001	0.00000	0.00001
Ce-143	9.6925E-01	6.2751E-02	0.00001	0.00000	0.00000	0.00000
Ce-144	1.0317E+00	6.9893E-02	0.00119	0.00024	0.00000	0.00041
Pr-143	4.6241E-01	3.1480E-02	0.00001	0.00000	0.00000	0.00000
Nd-147	4.9600E-01	3.3413E-02	0.00001	0.00000	0.00000	0.00000
Np-239	1.4852E+01	9.7963E-01	0.00013	0.00003	0.00000	0.00004
Pu-238	3.6117E-03	2.4473E-04	0.00322	0.00065	0.00000	0.00112
Pu-239	3.6442E-04	2.4700E-05	0.00035	0.00007	0.00000	0.00012
Pu-240	4.9940E-04	3.3839E-05	0.00048	0.00010	0.00000	0.00016
Pu-241	1.5066E-01	1.0209E-02	0.00231	0.00047	0.00000	0.00080
Am-241	7.7764E-05	5.2734E-06	0.00011	0.00002	0.00000	0.00004
Cm-242	1.9493E-02	1.3203E-03	0.00104	0.00021	0.00000	0.00036
Cm-244	1.2527E-03	8.4881E-05	0.00096	0.00020	0.00000	0.00033

Environment Compartment Group Inventory Distribution:

Time (h) = 24.0000	Total Release	
	Release	Rate/s
Noble gases (atoms)	1.5166E+23	1.7553E+18
Elemental I (atoms)	1.4502E+20	1.6784E+15
Organic I (atoms)	1.3134E+19	1.5202E+14
Aerosol I (atoms)	1.9994E+19	2.3141E+14
All Aerosols (kg)	8.1386E-04	9.4197E-09

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 24.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	9.1722E+02	6.5087E-06	2.1010E+04	2.7986E+18	0.0000E+00
Co-60	1.1082E+03	1.5133E-04	2.5272E+04	3.3662E+18	0.0000E+00
Rb-86	4.0800E+04	1.7352E-04	9.5524E+05	1.2725E+20	0.0000E+00
Sr-89	1.1664E+06	3.0193E-02	2.6767E+07	3.5655E+21	0.0000E+00
Sr-90	1.4053E+05	1.1327E-01	3.2043E+06	4.2682E+20	0.0000E+00
Sr-91	2.6078E+05	9.1436E-04	1.5249E+07	2.0362E+21	0.0000E+00
Sr-92	3.5349E+03	1.9390E-04	4.6731E+06	6.2675E+20	0.0000E+00
Y-90	3.1868E+04	9.0779E-05	3.9525E+05	5.2313E+19	0.0000E+00
Y-91	1.8328E+04	5.2349E-04	3.9377E+05	5.2422E+19	0.0000E+00
Y-92	3.4119E+04	1.1570E-04	4.6298E+06	6.1405E+20	0.0000E+00
Y-93	3.6965E+03	1.2188E-05	2.0315E+05	2.7123E+19	0.0000E+00
Zr-95	2.1334E+04	3.1970E-04	4.8892E+05	6.5125E+19	0.0000E+00
Zr-97	8.1675E+03	4.0208E-05	3.0768E+05	4.1043E+19	0.0000E+00
Nb-95	2.1702E+04	8.3582E-05	4.9493E+05	6.5922E+19	0.0000E+00
Mo-99	2.4106E+05	6.8191E-04	6.2074E+06	8.2716E+20	0.0000E+00
Tc-99m	2.3286E+05	1.5075E-05	5.8407E+06	7.7500E+20	0.0000E+00
Ru-103	2.5593E+05	1.4728E-03	5.8844E+06	7.8382E+20	0.0000E+00
Ru-105	4.3308E+03	2.2015E-05	9.4280E+05	1.2616E+20	0.0000E+00
Ru-106	1.0521E+05	3.1199E-02	2.4010E+06	3.1981E+20	0.0000E+00
Rh-105	1.2068E+05	9.0600E-05	3.3489E+06	4.4626E+20	0.0000E+00
Sb-127	3.0561E+05	1.3199E-03	7.5970E+06	1.0122E+21	0.0000E+00
Sb-129	2.3004E+04	2.0532E-04	5.3934E+06	7.2181E+20	0.0000E+00
Te-127	3.2579E+05	6.9108E-05	7.9155E+06	1.0518E+21	0.0000E+00
Te-127m	4.9260E+04	6.5687E-04	1.1225E+06	1.4952E+20	0.0000E+00
Te-129	1.2922E+05	2.3141E-05	7.9905E+06	1.0505E+21	0.0000E+00
Te-129m	1.5552E+05	2.3379E-03	3.5750E+06	4.7619E+20	0.0000E+00
Te-131m	2.7556E+05	1.6404E-03	8.2633E+06	1.1016E+21	0.0000E+00
Te-132	3.7707E+06	2.4741E-02	9.5242E+07	1.2691E+22	0.0000E+00
I-131	1.8169E+07	3.9144E-01	4.3467E+08	5.7906E+22	4.2960E+04
I-132	3.9665E+06	7.5416E-03	1.7703E+08	2.3520E+22	1.7571E+04
I-133	1.8001E+07	1.0395E-01	6.2031E+08	8.2726E+22	6.1415E+04
I-134	2.5200E-01	1.0624E-03	2.5923E+07	3.5220E+21	2.6183E+03
I-135	3.0279E+06	1.6688E-02	2.9123E+08	3.8922E+22	2.8920E+04
Xe-133	3.0880E+06	1.8465E-05	4.1135E+07	5.4483E+21	4.0470E+03
Xe-135	6.3834E+06	5.6550E-04	1.6515E+08	2.1904E+22	1.6317E+04
Cs-134	4.0852E+06	1.2038E-01	9.4002E+07	1.2521E+22	0.0000E+00
Cs-136	1.2410E+06	6.7311E-03	2.9278E+07	3.9001E+21	0.0000E+00
Cs-137	2.4532E+06	4.9484E-02	5.6427E+07	7.5160E+21	0.0000E+00



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Ba-139	1.3614E+01	1.3686E-05	2.5835E+06	3.4851E+20	0.0000E+00
Ba-140	2.1617E+06	5.2697E-03	5.0580E+07	6.7378E+21	0.0000E+00
La-140	7.3463E+05	1.5372E-03	9.2829E+06	1.2284E+21	0.0000E+00
La-141	3.1361E+02	1.5991E-06	9.6920E+04	1.2976E+19	0.0000E+00
La-142	4.2911E-01	1.3035E-06	2.6975E+04	3.6342E+18	0.0000E+00
Ce-141	5.3151E+04	2.9945E-04	1.2237E+06	1.6300E+20	0.0000E+00
Ce-143	3.0079E+04	8.4346E-05	8.7894E+05	1.1717E+20	0.0000E+00
Ce-144	4.4235E+04	1.0272E-02	1.0098E+06	1.3450E+20	0.0000E+00
Pr-143	2.0383E+04	1.0064E-04	4.5629E+05	6.0764E+19	0.0000E+00
Nd-147	2.0474E+04	9.0483E-05	4.8105E+05	6.4082E+19	0.0000E+00
Np-239	5.2896E+05	9.8045E-04	1.3908E+07	1.8534E+21	0.0000E+00
Pu-238	1.5510E+02	2.7742E-02	3.5361E+03	4.7101E+17	0.0000E+00
Pu-239	1.5678E+01	2.9947E-03	3.5697E+02	4.7548E+16	0.0000E+00
Pu-240	2.1445E+01	4.1019E-03	4.8895E+02	6.5129E+16	0.0000E+00
Pu-241	6.4689E+03	1.9906E-02	1.4750E+05	1.9648E+19	0.0000E+00
Am-241	3.3569E+00	9.2130E-04	7.6233E+01	1.0154E+16	0.0000E+00
Cm-242	8.3484E+02	8.9705E-03	1.9073E+04	2.5406E+18	0.0000E+00
Cm-244	5.3788E+01	8.2756E-03	1.2265E+03	1.6336E+17	0.0000E+00
Total	7.1765E+07	1.0000E+00	0.0000E+00	0.0000E+00	1.7385E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 7.7907E-03
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 8.5594E-03
 Total I (Ci) 4.3165E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 24.0000	Atmosphere	Sump
Noble gases (atoms)	8.5848E+22	0.0000E+00
Elemental I (atoms)	7.2874E+23	0.0000E+00
Organic I (atoms)	2.2538E+22	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	3.2987E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 24.0000

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	1.6340E-06	3.02E+09	3.3535E-08	1.482E-07	2.861E-08	0.000E+00	1.491E-06
Co-60	1.9742E-06	3.64E+09	4.0298E-08	1.775E-07	3.426E-08	0.000E+00	1.803E-06
Kr-85	0.0000E+00	0.00E+00	1.8534E-01	8.348E-03	1.611E-03	1.843E-04	1.752E-01
Kr-85m	0.0000E+00	0.00E+00	6.3141E-01	1.222E-01	2.358E-02	3.411E-03	4.823E-01
Kr-87	0.0000E+00	0.00E+00	2.4718E-01	1.280E-01	2.471E-02	6.420E-03	8.804E-02
Kr-88	0.0000E+00	0.00E+00	9.6656E-01	2.861E-01	5.522E-02	9.136E-03	6.162E-01
Rb-86	1.0399E-04	2.34E+11	7.5552E-06	6.788E-06	1.310E-06	3.464E-05	6.882E-05
Sr-89	2.0778E-03	3.85E+12	4.2742E-05	1.891E-04	3.651E-05	0.000E+00	1.895E-03
Sr-90	2.5035E-04	4.62E+11	5.1094E-06	2.250E-05	4.344E-06	0.000E+00	2.286E-04
Sr-91	4.6456E-04	1.76E+12	2.9155E-05	2.108E-04	4.069E-05	0.000E+00	7.717E-04
Sr-92	6.2972E-06	3.13E+11	1.2389E-05	1.651E-04	3.186E-05	0.000E+00	2.914E-04
Y-90	5.6949E-05	6.92E+10	5.1112E-07	4.147E-07	8.004E-08	0.000E+00	5.697E-05
Y-91	3.2692E-05	5.80E+10	6.1566E-07	2.493E-06	4.811E-07	0.000E+00	3.033E-05
Y-92	6.1187E-05	5.48E+11	8.2979E-06	2.733E-05	5.276E-06	0.000E+00	5.405E-04
Y-93	6.5850E-06	2.38E+10	3.8440E-07	2.714E-06	5.239E-07	0.000E+00	9.851E-06
Zr-95	3.8004E-05	7.03E+10	7.8047E-07	3.450E-06	6.660E-07	0.000E+00	3.467E-05
Zr-97	1.4550E-05	3.93E+10	5.4388E-07	3.249E-06	6.272E-07	0.000E+00	1.246E-05
Nb-95	3.8661E-05	7.13E+10	7.8921E-07	3.476E-06	6.710E-07	0.000E+00	3.530E-05
Mo-99	4.2943E-04	8.68E+11	1.0161E-05	4.873E-05	9.406E-06	0.000E+00	3.815E-04
Tc-99m	4.1483E-04	8.21E+11	9.4694E-06	4.376E-05	8.447E-06	0.000E+00	3.721E-04
Ru-103	4.5593E-04	8.46E+11	9.3999E-06	4.165E-05	8.040E-06	0.000E+00	4.156E-04
Ru-105	7.7151E-06	8.33E+10	2.1501E-06	2.216E-05	4.277E-06	0.000E+00	6.050E-05
Ru-106	1.8742E-04	3.46E+11	3.8291E-06	1.688E-05	3.257E-06	0.000E+00	1.711E-04
Rh-105	2.1499E-04	4.63E+11	5.5270E-06	2.682E-05	5.178E-06	0.000E+00	1.885E-04
Sb-127	5.4442E-04	1.07E+12	1.2343E-05	5.780E-05	1.116E-05	0.000E+00	4.878E-04
Sb-129	4.0981E-05	4.70E+11	1.2397E-05	1.296E-04	2.501E-05	0.000E+00	3.458E-04
Te-127	5.8037E-04	1.12E+12	1.2786E-05	5.871E-05	1.133E-05	0.000E+00	5.231E-04
Te-127m	8.7754E-05	1.62E+11	1.7896E-06	7.877E-06	1.521E-06	0.000E+00	8.015E-05
Te-129	2.3019E-04	8.25E+11	1.6490E-05	1.445E-04	2.789E-05	0.000E+00	3.492E-04
Te-129m	2.7704E-04	5.14E+11	5.7080E-06	2.523E-05	4.870E-06	0.000E+00	2.526E-04
Te-131m	4.9090E-04	1.11E+12	1.3963E-05	7.368E-05	1.422E-05	0.000E+00	4.170E-04
Te-132	6.7173E-03	1.34E+13	1.5526E-04	7.350E-04	1.419E-04	0.000E+00	5.996E-03
I-131	6.0793E-02	1.29E+14	5.4631E-03	7.907E-03	2.601E-03	1.349E-02	4.227E-02
I-132	7.2256E-03	2.94E+13	5.1142E-03	7.990E-03	2.628E-03	1.920E-02	2.157E-02
I-133	6.0266E-02	1.74E+14	9.4950E-03	1.494E-02	4.912E-03	2.726E-02	2.361E-02
I-134	8.4368E-10	5.47E+12	5.8454E-03	2.228E-03	7.325E-04	2.834E-02	2.592E-02



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I-135	1.0137E-02	7.16E+13	7.1470E-03	1.185E-02	3.897E-03	2.540E-02	2.832E-02
Xe-133	0.0000E+00	0.00E+00	2.5050E+01	1.197E+00	2.311E-01	2.649E-02	2.359E+01
Xe-135	0.0000E+00	0.00E+00	5.3318E+00	4.574E-01	8.829E-02	9.403E-03	4.777E+00
Cs-134	1.0413E-02	2.31E+13	7.3193E-04	6.588E-04	1.272E-04	3.345E-03	7.014E-03
Cs-136	3.1633E-03	7.16E+12	2.3314E-04	2.093E-04	4.040E-05	1.070E-03	2.077E-03
Cs-137	6.2531E-03	1.38E+13	4.3919E-04	3.953E-04	7.631E-05	2.007E-03	4.214E-03
Ba-139	2.4252E-08	1.10E+11	8.4770E-06	1.529E-04	2.952E-05	0.000E+00	2.459E-04
Ba-140	3.8510E-03	7.24E+12	8.1106E-05	3.640E-04	7.026E-05	0.000E+00	3.498E-03
La-140	1.3126E-03	1.62E+12	1.1979E-05	8.438E-06	1.629E-06	0.000E+00	1.315E-03
La-141	5.5868E-07	8.05E+09	2.2905E-07	2.515E-06	4.855E-07	0.000E+00	6.189E-06
La-142	7.6444E-10	1.24E+09	8.5461E-08	1.478E-06	2.853E-07	0.000E+00	2.377E-06
Ce-141	9.4681E-05	1.76E+11	1.9551E-06	8.667E-06	1.673E-06	0.000E+00	8.630E-05
Ce-143	5.3583E-05	1.19E+11	1.4773E-06	7.676E-06	1.482E-06	0.000E+00	4.590E-05
Ce-144	7.8803E-05	1.45E+11	1.6105E-06	7.099E-06	1.370E-06	0.000E+00	7.194E-05
Pr-143	3.6320E-05	6.61E+10	7.2388E-07	3.127E-06	6.036E-07	0.000E+00	3.331E-05
Nd-147	3.6473E-05	6.88E+10	7.7208E-07	3.475E-06	6.708E-07	0.000E+00	3.310E-05
Np-239	9.4230E-04	1.94E+12	2.2868E-05	1.112E-04	2.146E-05	0.000E+00	8.325E-04
Pu-238	2.7630E-07	5.09E+08	5.6384E-09	2.483E-08	4.793E-09	0.000E+00	2.523E-07
Pu-239	2.7929E-08	5.14E+07	5.6900E-10	2.503E-09	4.832E-10	0.000E+00	2.551E-08
Pu-240	3.8203E-08	7.04E+07	7.7965E-10	3.434E-09	6.628E-10	0.000E+00	3.489E-08
Pu-241	1.1524E-05	2.12E+10	2.3520E-07	1.036E-06	2.000E-07	0.000E+00	1.052E-05
Am-241	5.9803E-09	1.10E+07	1.2145E-10	5.333E-10	1.029E-10	0.000E+00	5.465E-09
Cm-242	1.4872E-06	2.75E+09	3.0426E-08	1.342E-07	2.590E-08	0.000E+00	1.358E-06
Cm-244	9.5820E-08	1.77E+08	1.9556E-09	8.613E-09	1.663E-09	0.000E+00	8.750E-08

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 24.0000	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	3.9610E+18
Elemental I (atoms)	6.4194E+14	8.2937E+13
Organic I (atoms)	2.3557E+14	2.9227E+13
Aerosol I (atoms)	1.9053E+15	1.0909E+14
All Aerosols (kg)	7.8761E-08	4.5195E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:08

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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)	5.6395E-01	1.7413E+01	1.2094E+00

Low Population Zone Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	8.8370E-02	1.4238E+01	5.3407E-01
Accumulated dose (rem)	1.3456E+00	5.6992E+01	3.3223E+00

Control Room Doses:

Time (h) = 96.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	2.8969E-02	9.4952E+00	4.1391E-01	1.9376E+00
Accumulated dose (rem)	1.0469E-01	3.9831E+01	1.8918E+00	5.5283E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 96.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1	Pathway 7	Pathway 8	Pathway 9
						Outflow	Outflow	Outflow	Outflow
Co-58	1.0605E-05	2.8538E-06	1.5790E+03	2.1032E+17	8.9052E+02	4.1777E-01	0.0000E+00	9.5777E-01	9.5777E-01
Co-60	1.3181E-05	6.6094E-05	1.8918E+03	2.5199E+17	1.1068E+03	5.0053E-01	0.0000E+00	1.1475E+00	1.1475E+00
Kr-85	8.1447E+05	1.6019E-05	8.0184E+07	1.0680E+22	0.0000E+00	1.3243E+04	8.1591E-02	3.0361E+04	3.0361E+04
Kr-85m	5.3719E+00	1.1055E-03	8.8034E+07	1.1792E+22	0.0000E+00	2.3119E+04	1.5084E+00	5.3006E+04	5.3006E+04
Kr-87	5.4496E-16	2.1486E-03	3.1064E+07	4.1948E+21	0.0000E+00	8.3319E+03	2.8333E+00	1.9108E+04	1.9108E+04
Kr-88	2.7190E-03	2.3265E-02	1.3586E+08	1.8220E+22	0.0000E+00	3.6146E+04	4.0384E+00	8.2877E+04	8.2877E+04
Rb-86	4.0801E-04	7.9012E-05	7.4551E+04	9.9306E+18	3.6488E+04	1.9719E+01	1.5341E-02	4.5242E+01	4.5242E+01
Sr-89	1.3328E-02	1.3260E-02	2.0149E+06	2.6839E+20	1.1191E+06	5.3311E+02	0.0000E+00	1.2222E+03	1.2222E+03



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

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Sr-90	1.6730E-03	4.9465E-02	2.3984E+05	3.1947E+19	1.4048E+05	6.3458E+01	0.0000E+00	1.4548E+02	1.4548E+02
Sr-91	1.6240E-05	7.4198E-04	2.1209E+06	2.8303E+20	1.3637E+03	5.6220E+02	0.0000E+00	1.2889E+03	1.2889E+03
Sr-92	4.2300E-13	3.6376E-04	1.5026E+06	2.0144E+20	3.5519E-05	4.0013E+02	0.0000E+00	9.1734E+02	9.1734E+02
Y-90	1.0806E-03	8.4891E-06	6.3352E+03	8.2669E+17	9.0762E+04	1.6588E+00	0.0000E+00	3.8029E+00	3.8029E+00
Y-91	2.1898E-04	2.0830E-04	2.6855E+04	3.5742E+18	1.8401E+04	7.1025E+00	0.0000E+00	1.6283E+01	1.6283E+01
Y-92	4.0920E-10	5.3630E-05	3.6783E+05	4.7254E+19	3.4462E-02	9.5827E+01	0.0000E+00	2.1969E+02	2.1969E+02
Y-93	3.1451E-07	9.5876E-06	2.7391E+04	3.6547E+18	2.6409E+01	7.2597E+00	0.0000E+00	1.6644E+01	1.6644E+01
Zr-95	2.4590E-04	1.4024E-04	3.6759E+04	4.8963E+18	2.0648E+04	9.7258E+00	0.0000E+00	2.2297E+01	2.2297E+01
Zr-97	5.0745E-06	2.5523E-05	3.3475E+04	4.4635E+18	4.2611E+02	8.8662E+00	0.0000E+00	2.0327E+01	2.0327E+01
Nb-95	2.5778E-04	3.6505E-05	3.7050E+04	4.9350E+18	2.1645E+02	9.8028E+00	0.0000E+00	2.2474E+01	2.2474E+01
Mo-99	1.3475E-03	3.2984E-04	5.1463E+05	6.8567E+19	1.1315E+05	1.3620E+02	0.0000E+00	3.1225E+02	3.1225E+02
Tc-99m	1.3186E-03	7.0012E-06	4.6492E+05	6.1757E+19	1.1072E+05	1.2302E+02	0.0000E+00	2.8203E+02	2.8203E+02
Ru-103	2.8903E-03	6.4788E-04	4.4366E+05	5.9096E+19	2.4269E+05	1.1739E+02	0.0000E+00	2.6912E+02	2.6912E+02
Ru-105	6.7734E-10	2.8827E-05	2.1160E+05	2.8296E+19	5.6876E-02	5.6206E+01	0.0000E+00	1.2886E+02	1.2886E+02
Ru-106	1.2457E-03	1.3635E-02	1.7984E+05	2.3955E+19	1.0460E+05	4.7584E+01	0.0000E+00	1.0909E+02	1.0909E+02
Rh-105	3.5215E-04	4.4842E-05	2.8410E+05	3.7833E+19	2.9570E+04	7.5178E+01	0.0000E+00	1.7235E+02	1.7235E+02
Sb-127	2.1203E-03	6.2034E-04	6.1198E+05	8.1531E+19	1.7804E+05	1.6195E+02	0.0000E+00	3.7129E+02	3.7129E+02
Sb-129	2.6330E-09	2.7420E-04	1.2346E+06	1.6510E+20	2.2109E-01	3.2796E+02	0.0000E+00	7.5188E+02	7.5188E+02
Te-127	2.5251E-03	3.1744E-05	6.2320E+05	8.2874E+19	2.1203E+05	1.6491E+02	0.0000E+00	3.7806E+02	3.7806E+02
Te-127m	5.8501E-04	2.8666E-04	8.3964E+04	1.1184E+19	4.9123E+04	2.2215E+01	0.0000E+00	5.0931E+01	5.0931E+01
Te-129	1.1951E-03	2.3784E-05	1.4076E+06	1.8576E+20	1.0035E+05	3.7348E+02	0.0000E+00	8.5623E+02	8.5623E+02
Te-129m	1.7409E-03	1.0259E-03	2.6889E+05	3.5815E+19	1.4619E+05	7.1143E+01	0.0000E+00	1.6310E+02	1.6310E+02
Te-131m	6.2166E-04	8.9180E-04	7.6995E+05	1.0262E+20	5.2201E+04	2.0384E+02	0.0000E+00	4.6731E+02	4.6731E+02
Te-132	2.3717E-02	1.1782E-02	7.7734E+06	1.0357E+21	1.9915E+06	2.0572E+03	0.0000E+00	4.7163E+03	4.7163E+03
I-131	6.4365E+05	5.6969E-01	1.0843E+08	1.4451E+22	1.3311E+07	2.1511E+04	5.9740E+00	4.9330E+04	4.9330E+04
I-132	3.7155E-02	1.0009E-02	4.0268E+07	5.3890E+21	2.1085E+06	1.0716E+04	8.5765E+00	2.4586E+04	2.4586E+04
I-133	7.5040E+04	1.1272E-01	1.1528E+08	1.5396E+22	1.5477E+06	2.7509E+04	1.2087E+01	6.3094E+04	6.3094E+04
I-134	2.1880E-27	4.0844E-03	1.7082E+07	2.3208E+21	4.5127E-26	4.6041E+03	1.2841E+01	1.0585E+04	1.0585E+04
I-135	7.3142E+01	2.1525E-02	6.4384E+07	8.6046E+21	1.5086E+03	1.6910E+04	1.1285E+01	3.8794E+04	3.8794E+04
Xe-133	7.3336E+07	2.4420E-02	9.3243E+09	1.2432E+24	0.0000E+00	1.5974E+06	1.1726E+01	3.6622E+06	3.6622E+06
Xe-135	8.1444E+04	1.8053E-02	9.0365E+08	1.2095E+23	0.0000E+00	2.1266E+05	4.1642E+00	4.8755E+05	4.8755E+05
Cs-134	4.5544E-02	5.3995E-02	7.2265E+06	9.6257E+20	4.0729E+06	1.9113E+03	1.4816E+00	4.3852E+03	4.3852E+03
Cs-136	1.1837E-02	3.0850E-03	2.2999E+06	3.0637E+20	1.0586E+06	6.0833E+02	4.7405E-01	1.3957E+03	1.3957E+03
Cs-137	2.7420E-02	2.2187E-02	4.3363E+06	5.7759E+20	2.4521E+06	1.1469E+03	8.8893E-01	2.6314E+03	2.6314E+03
Ba-139	3.0540E-23	4.0106E-05	1.2976E+06	1.7504E+20	2.5644E-15	3.4770E+02	0.0000E+00	7.9714E+02	7.9714E+02
Ba-140	2.1863E-02	2.3534E-03	3.8717E+06	5.1574E+20	1.8359E+06	1.0244E+03	0.0000E+00	2.3486E+03	2.3486E+03
La-140	1.9150E-02	1.3345E-04	1.3813E+05	1.7961E+19	1.6084E+06	3.6107E+01	0.0000E+00	8.2777E+01	8.2777E+01
La-141	1.1406E-11	2.2871E-06	2.3759E+04	3.1787E+18	9.5778E-04	6.3142E+00	0.0000E+00	1.4476E+01	1.4476E+01
La-142	4.4613E-23	3.5726E-06	1.2672E+04	1.7070E+18	3.7461E-15	3.3909E+00	0.0000E+00	7.7738E+00	7.7738E+00
Ce-141	5.9368E-04	1.3180E-04	9.2318E+04	1.2297E+19	4.9850E+04	2.4426E+01	0.0000E+00	5.5999E+01	5.5999E+01
Ce-143	7.8935E-05	4.4989E-05	8.0355E+04	1.0709E+19	6.6282E+03	2.1272E+01	0.0000E+00	4.8768E+01	4.8768E+01
Ce-144	5.2288E-04	4.4901E-03	7.5654E+04	1.0077E+19	4.3906E+04	2.0017E+01	0.0000E+00	4.5890E+01	4.5890E+01
Pr-143	2.3393E-04	4.2980E-05	3.3400E+04	4.4480E+18	1.9646E+04	8.8363E+00	0.0000E+00	2.0258E+01	2.0258E+01
Nd-147	2.0173E-04	4.0555E-05	3.6955E+04	4.9227E+18	1.6939E+04	9.7782E+00	0.0000E+00	2.2417E+01	2.2417E+01
Np-239	2.6046E-03	4.8224E-04	1.1725E+06	1.5623E+20	2.1871E+05	3.1032E+02	0.0000E+00	7.1144E+02	7.1144E+02
Pu-238	1.8473E-06	1.2114E-02	2.6466E+02	3.5253E+16	1.5511E+02	7.0024E-02	0.0000E+00	1.6054E-01	1.6054E-01
Pu-239	1.8767E-07	1.3060E-03	2.6683E+01	3.5541E+15	1.5758E+01	7.0597E-03	0.0000E+00	1.6185E-02	1.6185E-02
Pu-240	2.5535E-07	1.7912E-03	3.6597E+01	4.8747E+15	2.1441E+01	9.6828E-03	0.0000E+00	2.2199E-02	2.2199E-02
Pu-241	7.6996E-05	8.6931E-03	1.1041E+04	1.4706E+18	6.4653E+03	2.9212E+00	0.0000E+00	6.6971E+00	6.6971E+00
Am-241	4.0985E-08	4.0090E-04	5.6858E+00	7.5734E+14	3.4415E+00	1.5044E-03	0.0000E+00	3.4488E-03	3.4488E-03
Cm-242	9.8144E-06	3.9242E-03	1.4301E+03	1.9049E+17	8.2411E+02	3.7838E-01	0.0000E+00	8.6747E-01	8.6747E-01
Cm-244	6.4026E-07	3.6140E-03	9.1801E+01	1.2228E+16	5.3762E+01	2.4289E-02	0.0000E+00	5.5684E-02	5.5684E-02
Total	7.4950E+07	1.0000E+00	0.0000E+00	0.0000E+00	3.3141E+07	1.9833E+06	7.7975E+01	4.5470E+06	4.5470E+06

Dose Effective (Ci/cc) I-131 (Thyroid) 1.7521E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.7723E-04
 Total I (Ci) 7.1877E+05

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 96.0000	Atmosphere	Sump
Noble gases (atoms)	1.6482E+25	0.0000E+00
Elemental I (atoms)	2.3442E+25	0.0000E+00
Organic I (atoms)	7.2501E+20	0.0000E+00
Aerosol I (atoms)	5.6498E+15	0.0000E+00
All Aerosols (kg)	3.7083E-07	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
Aerosol I (atoms)	8.7177E+23	0.0000E+00



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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

All Aerosols (kg) 3.3176E+01 0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 96.0000

Nuclide	Compartment Atmosphere	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	2.6278E-12	6.3498E-07	7.6637E-04	1.0208E+11	4.1777E-01	6.8610E-03	1.4802E-03	0.0000E+00
Co-60	3.2660E-12	1.4707E-05	9.1823E-04	1.2231E+11	5.0053E-01	8.2204E-03	1.7733E-03	0.0000E+00
Kr-85	2.0177E-01	2.2698E-06	2.4784E+01	3.3012E+15	1.3243E+04	1.1111E+04	2.1558E+03	0.0000E+00
Kr-85m	1.3308E-06	2.4548E-04	4.2643E+01	5.7092E+15	2.3119E+04	1.9219E+04	3.8923E+03	0.0000E+00
Kr-87	1.3501E-22	4.7104E-04	1.4856E+01	2.0061E+15	8.3319E+03	6.7428E+03	1.5640E+03	0.0000E+00
Kr-88	6.7360E-10	5.2005E-03	6.6249E+01	8.8838E+15	3.6146E+04	2.9875E+04	6.2262E+03	0.0000E+00
Rb-86	1.0110E-10	1.7123E-05	3.5243E-02	4.6945E+12	1.9719E+01	3.1561E-01	7.7873E-02	0.0000E+00
Sr-89	3.3024E-09	2.9504E-03	9.7795E-01	1.3027E+14	5.3311E+02	8.7552E+00	1.8889E+00	0.0000E+00
Sr-90	4.1454E-10	1.1006E-02	1.1641E-01	1.5506E+13	6.3458E+01	1.0422E+00	2.2482E-01	0.0000E+00
Sr-91	4.0240E-12	1.6461E-04	1.0264E+00	1.3697E+14	5.6220E+02	9.2058E+00	2.0153E+00	0.0000E+00
Sr-92	1.0481E-19	8.0069E-05	7.2149E-01	9.6720E+13	4.0013E+02	6.5004E+00	1.4791E+00	0.0000E+00
Y-90	2.6775E-10	1.9101E-06	3.1094E-03	4.0585E+11	1.6588E+00	2.7565E-02	5.6063E-03	0.0000E+00
Y-91	5.4259E-11	4.6369E-05	1.3041E-02	1.7356E+12	7.1025E+00	1.1670E-01	2.5119E-02	0.0000E+00
Y-92	1.0139E-16	1.2118E-05	1.8130E-01	2.3317E+13	9.5827E+01	1.5990E+00	3.1839E-01	0.0000E+00
Y-93	7.7930E-14	2.1275E-06	1.3258E-02	1.7690E+12	7.2597E+00	1.1890E-01	2.6006E-02	0.0000E+00
Zr-95	6.0929E-11	3.1203E-05	1.7842E-02	2.3765E+12	9.7258E+00	1.5973E-01	3.4459E-02	0.0000E+00
Zr-97	1.2574E-12	5.6700E-06	1.6222E-02	2.1630E+12	8.8662E+00	1.4537E-01	3.1619E-02	0.0000E+00
Nb-95	6.3873E-11	8.1227E-06	1.7983E-02	2.3953E+12	9.8028E+00	1.6099E-01	3.4730E-02	0.0000E+00
Mo-99	3.3389E-10	7.3363E-05	2.4969E-01	3.3267E+13	1.3620E+02	2.2359E+00	4.8334E-01	0.0000E+00
Tc-99m	3.2672E-10	1.5577E-06	2.2564E-01	2.9973E+13	1.2302E+02	2.0202E+00	4.3600E-01	0.0000E+00
Ru-103	7.1616E-10	1.4415E-04	2.1533E-01	2.8683E+13	1.1739E+02	1.9278E+00	4.1592E-01	0.0000E+00
Ru-105	1.6784E-16	6.3733E-06	1.0205E-01	1.3646E+13	5.6206E+01	9.1713E-01	2.0427E-01	0.0000E+00
Ru-106	3.0866E-10	3.0339E-03	8.7292E-02	1.1627E+13	4.7584E+01	7.8147E-01	1.6858E-01	0.0000E+00
Rh-105	8.7257E-11	9.9761E-06	1.3787E-01	1.8360E+13	7.5178E+01	1.2344E+00	2.6653E-01	0.0000E+00
Sb-127	5.2538E-10	1.3799E-04	2.9695E-01	3.9562E+13	1.6195E+02	2.6590E+00	5.7445E-01	0.0000E+00
Sb-129	6.5241E-16	6.0610E-05	5.9527E-01	7.9610E+13	3.2796E+02	5.3504E+00	1.1928E+00	0.0000E+00
Te-127	6.2568E-10	7.0622E-06	3.0243E-01	4.0218E+13	1.6491E+02	2.7078E+00	5.8465E-01	0.0000E+00
Te-127m	1.4496E-10	6.3785E-05	4.0754E-02	5.4284E+12	2.2215E+01	3.6485E-01	7.8704E-02	0.0000E+00
Te-129	2.9612E-10	5.2686E-06	6.8017E-01	8.9763E+13	3.7348E+02	6.1062E+00	1.3467E+00	0.0000E+00
Te-129m	4.3137E-10	2.2828E-04	1.3051E-01	1.7384E+13	7.1143E+01	1.1684E+00	2.5204E-01	0.0000E+00
Te-131m	1.5404E-10	1.9825E-04	3.7338E-01	4.9763E+13	2.0384E+02	3.3446E+00	7.2484E-01	0.0000E+00
Te-132	5.8767E-09	2.6206E-03	3.7717E+00	5.0251E+14	2.0572E+03	3.3774E+01	7.2985E+00	0.0000E+00
I-131	2.7438E+00	8.0097E-01	3.3254E+02	4.4326E+16	2.1511E+04	8.6660E+03	3.5674E+03	1.5682E+05
I-132	3.8234E-01	9.6049E-03	8.4298E+01	1.1671E+16	1.0716E+04	2.0711E+03	8.5998E+02	3.8570E+04
I-133	3.1914E-01	1.1393E-01	2.5419E+02	3.3999E+16	2.7509E+04	6.3605E+03	6.6201E+03	1.1033E+05
I-134	9.3053E-33	1.3065E-03	1.1920E+01	1.6194E+15	4.6041E+03	2.0062E+02	1.0757E+02	2.6183E+03
I-135	3.1106E-04	1.3622E-02	8.8883E+01	1.1896E+16	1.6910E+04	1.9957E+03	8.2859E+02	3.1854E+04
Xe-133	1.8920E+01	3.6568E-03	3.0458E+03	4.0605E+17	1.5974E+06	1.3679E+06	2.6562E+05	3.3069E+04
Xe-135	2.9595E-02	4.0649E-03	4.4385E+02	5.9396E+16	2.1266E+05	2.0064E+05	3.9325E+04	2.7131E+04
Cs-134	1.1285E-08	1.1703E-02	3.4167E+00	4.5510E+14	1.9113E+03	3.0596E+01	7.5445E+00	0.0000E+00
Cs-136	2.9331E-09	6.6853E-04	1.0872E+00	1.4482E+14	6.0833E+02	9.7363E+00	2.4030E+00	0.0000E+00
Cs-137	6.7943E-09	4.8089E-03	2.0502E+00	2.7309E+14	1.1469E+03	1.8359E+01	4.5270E+00	0.0000E+00
Ba-139	7.5674E-30	8.7230E-06	6.1567E-01	8.3046E+13	3.4770E+02	5.5816E+00	1.3443E+00	0.0000E+00
Ba-140	5.4174E-09	5.2362E-04	1.8791E+00	2.5031E+14	1.0244E+03	1.6823E+01	3.6307E+00	0.0000E+00
La-140	4.7450E-09	3.0083E-05	6.7922E-02	8.8348E+12	3.6107E+01	6.0117E-01	1.2106E-01	0.0000E+00
La-141	2.8263E-18	5.0520E-07	1.1448E-02	1.5317E+12	6.3142E+00	1.0294E-01	2.3026E-02	0.0000E+00
La-142	1.1054E-29	7.7916E-07	6.0284E-03	8.1208E+11	3.3909E+00	5.4580E-02	1.2980E-02	0.0000E+00
Ce-141	1.4710E-10	2.9327E-05	4.4808E-02	5.9685E+12	2.4426E+01	4.0115E-01	8.6545E-02	0.0000E+00
Ce-143	1.9559E-11	1.0002E-05	3.8970E-02	5.1936E+12	2.1272E+01	3.4906E-01	7.5617E-02	0.0000E+00
Ce-144	1.2956E-10	9.9907E-04	3.6720E-02	4.8912E+12	2.0017E+01	3.2874E-01	7.0916E-02	0.0000E+00
Pr-143	5.7965E-11	9.5642E-06	1.6213E-02	2.1591E+12	8.8363E+00	1.4513E-01	3.1295E-02	0.0000E+00
Nd-147	4.9984E-11	9.0228E-06	1.7935E-02	2.3891E+12	9.7782E+00	1.6057E-01	3.4657E-02	0.0000E+00
Np-239	6.4539E-10	1.0725E-04	5.6884E-01	7.5792E+13	3.1032E+02	5.0940E+00	1.1016E+00	0.0000E+00
Pu-238	4.5772E-13	2.6955E-03	1.2846E-04	1.7111E+10	7.0024E-02	1.1500E-03	2.4808E-04	0.0000E+00
Pu-239	4.6501E-14	2.9060E-04	1.2951E-05	1.7251E+09	7.0597E-03	1.1594E-04	2.5011E-05	0.0000E+00
Pu-240	6.3270E-14	3.9857E-04	1.7763E-05	2.3661E+09	9.6828E-03	1.5902E-04	3.4304E-05	0.0000E+00
Pu-241	1.9078E-11	1.9343E-03	5.3590E-03	7.1382E+11	2.9212E+00	4.7976E-02	1.0349E-02	0.0000E+00
Am-241	1.0155E-14	8.9206E-05	2.7598E-06	3.6760E+08	1.5044E-03	2.4707E-05	5.3294E-06	0.0000E+00
Cm-242	2.4318E-12	8.7316E-04	6.9413E-04	9.2459E+10	3.7838E-01	6.2142E-03	1.3406E-03	0.0000E+00
Cm-244	1.5865E-13	8.0414E-04	4.4558E-05	5.9351E+09	2.4289E-02	3.9890E-04	8.6051E-05	0.0000E+00
Total	2.2597E+01	1.0000E+00	0.0000E+00	0.0000E+00	1.9833E+06	1.6549E+06	3.2681E+05	4.0039E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 4.9427E-07
Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 5.0199E-07
Total I (Ci) 3.4456E+00

Reactor Building Compartment Group Inventory Distribution:



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

Appendix I - Page: I80 of I93

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Time (h) = 96.0000	Atmosphere	Sump
Noble gases (atoms)	4.1014E+18	0.0000E+00
Elemental I (atoms)	1.0009E+17	0.0000E+00
Organic I (atoms)	3.0956E+15	0.0000E+00
Aerosol I (atoms)	1.3999E+09	0.0000E+00
All Aerosols (kg)	9.1885E-14	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 96.0000

Nuclide	Compartment Atmosphere	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	3.0652E-02	6.4842E-03	0.00000	0.00000	0.00000	0.00000
Co-60	3.7034E-02	7.9090E-03	0.00002	0.00000	0.00000	0.00001
Kr-85	2.4078E+04	9.9104E+03	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.7051E+04	1.9252E+03	0.00748	0.00151	0.00000	0.00070
Kr-87	8.5600E+03	4.2993E+02	0.02664	0.00565	0.00001	0.00117
Kr-88	4.0036E+04	2.2551E+03	0.20267	0.04133	0.00002	0.01559
Rb-86	1.4331E+00	2.9124E-01	0.00002	0.00000	0.00000	0.00001
Sr-89	3.8980E+01	8.2132E+00	0.00352	0.00072	0.00000	0.00122
Sr-90	4.6964E+00	1.0033E+00	0.01314	0.00267	0.00000	0.00456
Sr-91	2.0876E+01	1.4856E+00	0.00021	0.00004	0.00000	0.00006
Sr-92	1.0284E+01	5.2658E-01	0.00011	0.00002	0.00000	0.00002
Y-90	9.4079E-01	3.8158E-01	0.00000	0.00000	0.00000	0.00000
Y-91	5.7827E-01	1.3043E-01	0.00005	0.00001	0.00000	0.00002
Y-92	4.9939E+00	3.1177E-01	0.00001	0.00000	0.00000	0.00001
Y-93	2.7484E-01	2.0148E-02	0.00000	0.00000	0.00000	0.00000
Zr-95	7.1294E-01	1.5066E-01	0.00004	0.00001	0.00000	0.00001
Zr-97	3.9305E-01	3.7884E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	7.2516E-01	1.5482E-01	0.00001	0.00000	0.00000	0.00000
Mo-99	8.3208E+00	1.3881E+00	0.00009	0.00002	0.00000	0.00003
Tc-99m	7.7972E+00	1.3369E+00	0.00000	0.00000	0.00000	0.00000
Ru-103	8.5536E+00	1.7952E+00	0.00017	0.00004	0.00000	0.00006
Ru-105	1.6472E+00	9.0148E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	3.5159E+00	7.4970E-01	0.00362	0.00074	0.00000	0.00126
Rh-105	4.2592E+00	6.0464E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	1.0386E+01	1.8561E+00	0.00017	0.00003	0.00000	0.00006
Sb-129	9.5351E+00	5.1895E-01	0.00008	0.00002	0.00000	0.00002
Te-127	1.0938E+01	2.0348E+00	0.00001	0.00000	0.00000	0.00000
Te-127m	1.6450E+00	3.5149E-01	0.00008	0.00002	0.00000	0.00003
Te-129	1.3148E+01	1.2707E+00	0.00001	0.00000	0.00000	0.00000
Te-129m	5.1875E+00	1.0872E+00	0.00027	0.00006	0.00000	0.00009
Te-131m	1.0579E+01	1.3576E+00	0.00024	0.00005	0.00000	0.00008
Te-132	1.2898E+02	2.2336E+01	0.00315	0.00064	0.00000	0.00106
I-131	1.3238E+04	5.3502E+03	0.22793	0.08836	0.00088	0.02014
I-132	2.9603E+03	8.2271E+02	0.00911	0.00349	0.00006	0.00056
I-133	9.7076E+03	2.5387E+03	0.07622	0.02949	0.00033	0.00641
I-134	3.1848E+02	1.5576E+01	0.00330	0.00136	0.00009	0.00012
I-135	3.0482E+03	2.9826E+02	0.01879	0.00725	0.00011	0.00140
Xe-133	2.8379E+06	1.1020E+06	0.02267	0.00449	0.00000	0.00301
Xe-135	3.3420E+05	5.5669E+04	0.06211	0.01232	0.00000	0.00898
Cs-134	1.4332E+02	3.0219E+01	0.01400	0.00305	0.00031	0.00522
Cs-136	4.3634E+01	8.7270E+00	0.00080	0.00017	0.00002	0.00030
Cs-137	8.6067E+01	1.8163E+01	0.00575	0.00125	0.00013	0.00215
Ba-139	7.8331E+00	3.9218E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	7.2345E+01	1.4633E+01	0.00063	0.00013	0.00000	0.00022
La-140	1.9735E+01	7.6889E+00	0.00003	0.00001	0.00000	0.00003
La-141	1.7868E-01	9.5590E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7807E-02	3.8999E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	1.7756E+00	3.7142E-01	0.00004	0.00001	0.00000	0.00001
Ce-143	1.1301E+00	1.5100E-01	0.00001	0.00000	0.00000	0.00000
Ce-144	1.4783E+00	3.1504E-01	0.00119	0.00024	0.00000	0.00041
Pr-143	6.6819E-01	1.4444E-01	0.00001	0.00000	0.00000	0.00000
Nd-147	6.8556E-01	1.3747E-01	0.00001	0.00000	0.00000	0.00000
Np-239	1.8463E+01	2.9611E+00	0.00013	0.00003	0.00000	0.00004
Pu-238	5.1831E-03	1.1074E-03	0.00322	0.00065	0.00000	0.00112
Pu-239	5.2372E-04	1.1215E-04	0.00035	0.00007	0.00000	0.00012
Pu-240	7.1665E-04	1.5310E-04	0.00048	0.00010	0.00000	0.00016
Pu-241	2.1618E-01	4.6178E-02	0.00231	0.00047	0.00000	0.00080
Am-241	1.1219E-04	2.4172E-05	0.00011	0.00002	0.00000	0.00004
Cm-242	2.7899E-02	5.9347E-03	0.00104	0.00021	0.00000	0.00036
Cm-244	1.7975E-03	3.8398E-04	0.00096	0.00020	0.00000	0.00033



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

Appendix I - Page: 181 of 193

Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 96.0000		
Noble gases (atoms)	5.0408E+23	1.4586E+18
Elemental I (atoms)	4.6299E+20	1.3397E+15
Organic I (atoms)	4.5708E+19	1.3226E+14
Aerosol I (atoms)	2.6194E+19	7.5793E+13
All Aerosols (kg)	1.1603E-03	3.3574E-09

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 96.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	Atmosphere	7.3998E-06	8.5851E+04	1.1436E+19	0.0000E+00
Co-60	Atmosphere	1.7450E-04	1.0473E+05	1.3950E+19	0.0000E+00
Rb-86	Atmosphere	1.8823E-04	3.7241E+06	4.9621E+20	0.0000E+00
Sr-89	Atmosphere	3.4126E-02	1.0874E+08	1.4485E+22	0.0000E+00
Sr-90	Atmosphere	1.3067E-01	1.3285E+07	1.7696E+21	0.0000E+00
Sr-91	Atmosphere	3.1247E-04	1.8730E+07	2.5092E+21	0.0000E+00
Sr-92	Atmosphere	5.4099E-05	4.6860E+06	6.2859E+20	0.0000E+00
Y-90	Atmosphere	3.2465E-04	5.0803E+06	6.7289E+20	0.0000E+00
Y-91	Atmosphere	6.3920E-04	1.7280E+06	2.3013E+20	0.0000E+00
Y-92	Atmosphere	3.3438E-05	4.8089E+06	6.3909E+20	0.0000E+00
Y-93	Atmosphere	4.2659E-06	2.5556E+05	3.4237E+19	0.0000E+00
Zr-95	Atmosphere	3.6291E-04	1.9947E+06	2.6572E+20	0.0000E+00
Zr-97	Atmosphere	1.7960E-05	4.9393E+05	6.6132E+19	0.0000E+00
Nb-95	Atmosphere	9.6334E-05	2.0502E+06	2.7307E+20	0.0000E+00
Mo-99	Atmosphere	5.5971E-04	1.8312E+07	2.4441E+21	0.0000E+00
Tc-99m	Atmosphere	1.2683E-05	1.7660E+07	2.3387E+21	0.0000E+00
Ru-103	Atmosphere	1.6550E-03	2.3765E+07	3.1660E+21	0.0000E+00
Ru-105	Atmosphere	6.2979E-06	9.6936E+05	1.2986E+20	0.0000E+00
Ru-106	Atmosphere	3.5894E-02	9.9274E+06	1.3224E+21	0.0000E+00
Rh-105	Atmosphere	6.0118E-05	7.9866E+06	1.0673E+21	0.0000E+00
Sb-127	Atmosphere	1.1847E-03	2.4508E+07	3.2694E+21	0.0000E+00
Sb-129	Atmosphere	5.8580E-05	5.5306E+06	7.4090E+20	0.0000E+00
Te-127	Atmosphere	6.5318E-05	2.6888E+07	3.5673E+21	0.0000E+00
Te-127m	Atmosphere	7.5783E-04	4.6545E+06	6.1997E+20	0.0000E+00
Te-129	Atmosphere	1.2550E-05	1.5574E+07	2.0085E+21	0.0000E+00
Te-129m	Atmosphere	2.6190E-03	1.4393E+07	1.9176E+21	0.0000E+00
Te-131m	Atmosphere	9.8563E-04	1.7844E+07	2.3859E+21	0.0000E+00
Te-132	Atmosphere	2.1308E-02	2.9480E+08	3.9336E+22	0.0000E+00
I-131	Atmosphere	3.9675E-01	1.5834E+09	2.1107E+23	1.5682E+05
I-132	Atmosphere	4.6025E-03	3.8830E+08	5.0984E+22	3.8570E+04
I-133	Atmosphere	5.1564E-02	1.1059E+09	1.4800E+23	1.1033E+05
I-134	Atmosphere	2.9560E-04	2.5923E+07	3.5220E+21	2.6183E+03
I-135	Atmosphere	5.0898E-03	3.1924E+08	4.2762E+22	3.1854E+04
Xe-133	Atmosphere	4.1849E-05	3.3507E+08	4.4532E+22	3.3069E+04
Xe-135	Atmosphere	2.5820E-04	2.7101E+08	3.6212E+22	2.7131E+04
Cs-134	Atmosphere	1.3778E-01	3.8668E+08	5.1506E+22	0.0000E+00
Cs-136	Atmosphere	7.1366E-03	1.1156E+08	1.4867E+22	0.0000E+00
Cs-137	Atmosphere	5.6709E-02	2.3241E+08	3.0957E+22	0.0000E+00
Ba-139	Atmosphere	3.8079E-06	2.5835E+06	3.4852E+20	0.0000E+00
Ba-140	Atmosphere	5.6121E-03	1.9360E+08	2.5799E+22	0.0000E+00
La-140	Atmosphere	4.7091E-03	1.0220E+08	1.3544E+22	0.0000E+00
La-141	Atmosphere	4.5270E-07	9.8613E+04	1.3212E+19	0.0000E+00
La-142	Atmosphere	3.6270E-07	2.6976E+04	3.6343E+18	0.0000E+00
Ce-141	Atmosphere	3.3477E-04	4.9168E+06	6.5504E+20	0.0000E+00
Ce-143	Atmosphere	5.3025E-05	1.9859E+06	2.6547E+20	0.0000E+00
Ce-144	Atmosphere	1.1807E-02	4.1717E+06	5.5568E+20	0.0000E+00
Pr-143	Atmosphere	1.1734E-04	1.9121E+06	2.5468E+20	0.0000E+00
Nd-147	Atmosphere	9.5165E-05	1.8184E+06	2.4234E+20	0.0000E+00
Np-239	Atmosphere	7.6575E-04	3.9041E+07	5.2124E+21	0.0000E+00
Pu-238	Atmosphere	3.2011E-02	1.4665E+04	1.9533E+18	0.0000E+00
Pu-239	Atmosphere	3.4666E-03	1.4852E+03	1.9782E+17	0.0000E+00
Pu-240	Atmosphere	4.7324E-03	2.0275E+03	2.7006E+17	0.0000E+00
Pu-241	Atmosphere	2.2961E-02	6.1151E+05	8.1453E+19	0.0000E+00
Am-241	Atmosphere	1.0765E-03	3.2014E+02	4.2638E+16	0.0000E+00
Cm-242	Atmosphere	1.0283E-02	7.8584E+04	1.0468E+19	0.0000E+00
Cm-244	Atmosphere	9.5462E-03	5.0847E+03	6.7729E+17	0.0000E+00
Total	Atmosphere	1.0000E+00	0.0000E+00	0.0000E+00	4.0039E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 5.2121E-03



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

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Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 5.2951E-03
 Total I (Ci) 1.7670E+07

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 96.0000	Atmosphere	Sump
Noble gases (atoms)	9.8314E+22	0.0000E+00
Elemental I (atoms)	5.0901E+23	0.0000E+00
Organic I (atoms)	1.5743E+22	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	3.2723E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 96.0000

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	2.1033E-06	2.11E+10	4.4242E-08	1.482E-07	2.861E-08	0.000E+00	1.971E-06
Co-60	2.6141E-06	2.58E+10	5.3409E-08	1.775E-07	3.426E-08	0.000E+00	2.456E-06
Kr-85	0.0000E+00	0.00E+00	7.1563E-01	8.363E-03	1.614E-03	1.843E-04	7.055E-01
Kr-85m	0.0000E+00	0.00E+00	6.4684E-01	1.222E-01	2.358E-02	3.411E-03	4.977E-01
Kr-87	0.0000E+00	0.00E+00	2.4718E-01	1.280E-01	2.471E-02	6.420E-03	8.804E-02
Kr-88	0.0000E+00	0.00E+00	9.6959E-01	2.861E-01	5.522E-02	9.136E-03	6.192E-01
Rb-86	1.1494E-04	1.29E+12	8.0295E-06	6.788E-06	1.310E-06	3.464E-05	8.023E-05
Sr-89	2.6432E-03	2.67E+13	5.6281E-05	1.891E-04	3.651E-05	0.000E+00	2.474E-03
Sr-90	3.3180E-04	3.27E+12	6.7727E-06	2.250E-05	4.344E-06	0.000E+00	3.117E-04
Sr-91	3.2208E-06	2.66E+12	2.9799E-05	2.108E-04	4.069E-05	0.000E+00	1.234E-03
Sr-92	8.3890E-14	3.16E+11	1.2392E-05	1.651E-04	3.186E-05	0.000E+00	2.977E-04
Y-90	2.1447E-04	1.40E+12	1.2656E-06	4.147E-07	8.004E-08	0.000E+00	2.152E-04
Y-91	4.3509E-05	4.30E+11	8.3601E-07	2.493E-06	4.811E-07	0.000E+00	4.137E-05
Y-92	8.1769E-11	5.94E+11	8.3340E-06	2.733E-05	5.276E-06	0.000E+00	6.017E-04
Y-93	6.2375E-08	3.74E+10	3.9404E-07	2.714E-06	5.239E-07	0.000E+00	1.638E-05
Zr-95	4.8767E-05	4.90E+11	1.0291E-06	3.450E-06	6.660E-07	0.000E+00	4.568E-05
Zr-97	1.0064E-06	8.85E+10	5.7695E-07	3.249E-06	6.272E-07	0.000E+00	2.604E-05
Nb-95	5.1123E-05	5.05E+11	1.0458E-06	3.476E-06	6.710E-07	0.000E+00	4.802E-05
Mo-99	2.6724E-04	4.19E+12	1.2200E-05	4.873E-05	9.406E-06	0.000E+00	5.457E-04
Tc-99m	2.6151E-04	4.04E+12	1.1459E-05	4.376E-05	8.447E-06	0.000E+00	5.274E-04
Ru-103	5.7321E-04	5.83E+12	1.2354E-05	4.165E-05	8.040E-06	0.000E+00	5.359E-04
Ru-105	1.3433E-10	9.01E+10	2.1554E-06	2.216E-05	4.277E-06	0.000E+00	6.822E-05
Ru-106	2.4705E-04	2.44E+12	5.0711E-06	1.688E-05	3.257E-06	0.000E+00	2.320E-04
Rh-105	6.9839E-05	1.72E+12	6.3214E-06	2.682E-05	5.178E-06	0.000E+00	3.345E-04
Sb-127	4.2051E-04	5.74E+12	1.5174E-05	5.780E-05	1.116E-05	0.000E+00	6.146E-04
Sb-129	5.2219E-10	5.05E+11	1.2424E-05	1.296E-04	2.501E-05	0.000E+00	3.868E-04
Te-127	5.0079E-04	6.33E+12	1.5954E-05	5.871E-05	1.133E-05	0.000E+00	6.059E-04
Te-127m	1.1602E-04	1.15E+12	2.3724E-06	7.877E-06	1.521E-06	0.000E+00	1.090E-04
Te-129	2.3701E-04	2.82E+12	1.7748E-05	1.445E-04	2.789E-05	0.000E+00	4.054E-04
Te-129m	3.4527E-04	3.53E+12	7.4961E-06	2.523E-05	4.870E-06	0.000E+00	3.227E-04
Te-131m	1.2329E-04	3.70E+12	1.5615E-05	7.368E-05	1.422E-05	0.000E+00	7.862E-04
Te-132	4.7037E-03	6.83E+13	1.8877E-04	7.350E-04	1.419E-04	0.000E+00	8.043E-03
I-131	7.5604E-02	7.81E+14	8.5198E-03	7.913E-03	2.603E-03	1.349E-02	6.013E-02
I-132	5.0095E-03	8.65E+13	5.3576E-03	7.992E-03	2.628E-03	1.920E-02	2.402E-02
I-133	8.8048E-03	4.31E+14	1.0660E-02	1.496E-02	4.921E-03	2.726E-02	7.621E-02
I-134	2.5673E-34	5.47E+12	5.8454E-03	2.228E-03	7.325E-04	2.834E-02	2.592E-02
I-135	8.5821E-06	8.53E+13	7.2062E-03	1.185E-02	3.899E-03	2.540E-02	3.850E-02
Xe-133	0.0000E+00	0.00E+00	8.0871E+01	1.199E+00	2.314E-01	2.649E-02	7.941E+01
Xe-135	0.0000E+00	0.00E+00	6.5056E+00	4.574E-01	8.829E-02	9.403E-03	5.951E+00
Cs-134	1.2830E-02	1.35E+14	7.8191E-04	6.588E-04	1.272E-04	3.345E-03	9.480E-03
Cs-136	3.3346E-03	3.86E+13	2.4726E-04	2.093E-04	4.040E-05	1.070E-03	2.262E-03
Cs-137	7.7242E-03	8.12E+13	4.6924E-04	3.953E-04	7.631E-05	2.007E-03	5.715E-03
Ba-139	6.0568E-24	1.10E+11	8.4771E-06	1.529E-04	2.952E-05	0.000E+00	2.459E-04
Ba-140	4.3361E-03	4.70E+13	1.0481E-04	3.640E-04	7.026E-05	0.000E+00	4.007E-03
La-140	3.8002E-03	2.78E+13	2.7041E-05	8.438E-06	1.629E-06	0.000E+00	3.817E-03
La-141	2.2621E-12	8.49E+09	2.2938E-07	2.515E-06	4.855E-07	0.000E+00	6.748E-06
La-142	8.8479E-24	1.24E+09	8.5462E-08	1.478E-06	2.853E-07	0.000E+00	2.378E-06
Ce-141	1.1773E-04	1.20E+12	2.5655E-06	8.667E-06	1.673E-06	0.000E+00	1.100E-04
Ce-143	1.5655E-05	4.19E+11	1.6675E-06	7.676E-06	1.482E-06	0.000E+00	8.402E-05
Ce-144	1.0370E-04	1.03E+12	2.1323E-06	7.099E-06	1.370E-06	0.000E+00	9.736E-05
Pr-143	4.6410E-05	4.72E+11	9.6437E-07	3.127E-06	6.036E-07	0.000E+00	4.364E-05
Nd-147	4.0007E-05	4.40E+11	9.9388E-07	3.475E-06	6.708E-07	0.000E+00	3.685E-05
Np-239	5.1656E-04	8.82E+12	2.7115E-05	1.112E-04	2.146E-05	0.000E+00	1.263E-03
Pu-238	3.6636E-07	3.61E+09	7.4745E-09	2.483E-08	4.793E-09	0.000E+00	3.442E-07
Pu-239	3.7219E-08	3.66E+08	7.5512E-10	2.503E-09	4.832E-10	0.000E+00	3.499E-08
Pu-240	5.0641E-08	4.99E+08	1.0335E-09	3.434E-09	6.628E-10	0.000E+00	4.758E-08
Pu-241	1.5270E-05	1.51E+11	3.1176E-07	1.036E-06	2.000E-07	0.000E+00	1.435E-05



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Am-241	8.1284E-09	7.90E+07	1.6167E-10	5.333E-10	1.029E-10	0.000E+00	7.654E-09
Cm-242	1.9464E-06	1.93E+10	4.0249E-08	1.342E-07	2.590E-08	0.000E+00	1.827E-06
Cm-244	1.2698E-07	1.25E+09	2.5922E-09	8.613E-09	1.663E-09	0.000E+00	1.193E-07

Filtered Environment to Control Room Transport Group Inventory:

Time (h) = 96.0000	Pathway	
	Filtered	Transported
Noble gases (atoms)	0.0000E+00	1.5072E+19
Elemental I (atoms)	1.0537E+15	1.3383E+14
Organic I (atoms)	7.2252E+14	8.9411E+13
Aerosol I (atoms)	2.2660E+15	1.1645E+14
All Aerosols (kg)	9.8821E-08	4.9289E-09

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:19

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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)	5.6395E-01	1.7413E+01	1.2094E+00

Low Population Zone Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE
Delta dose (rem)	6.2409E-02	1.2107E+01	4.3996E-01
Accumulated dose (rem)	1.4080E+00	6.9099E+01	3.7622E+00

Control Room Doses:

Time (h) = 720.0000	Whole Body	Thyroid	TEDE	Skin
Delta dose (rem)	5.8124E-02	2.5335E+01	9.6599E-01	4.3939E+00
Accumulated dose (rem)	1.6282E-01	6.5167E+01	2.8578E+00	9.9223E+00

Drywell Free Volume Compartment Nuclide Inventory (Ci) at Time (h) = 720.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Compartment Dep Surfaces	Pathway 1 Outflow	Pathway 7 Outflow	Pathway 8 Outflow	Pathway 9 Outflow
Co-58	4.1188E-33	1.6214E-06	1.5790E+03	2.1032E+17	6.9040E+02	4.1777E-01	0.0000E+00	9.5777E-01	9.5777E-01
Co-60	6.5415E-33	3.7552E-05	1.8918E+03	2.5199E+17	1.0965E+03	5.0053E-01	0.0000E+00	1.1475E+00	1.1475E+00
Kr-85	5.1126E+05	5.5211E-05	4.8641E+08	6.4790E+22	0.0000E+00	6.6995E+04	8.1591E-02	1.5359E+05	1.5359E+05
Kr-85m	3.9876E-42	6.2809E-04	8.8034E+07	1.1792E+22	0.0000E+00	2.3119E+04	1.5084E+00	5.3006E+04	5.3006E+04
Kr-87	6.6424-164	1.2207E-03	3.1064E+07	4.1948E+21	0.0000E+00	8.3319E+03	2.8333E+00	1.9108E+04	1.9108E+04
Kr-88	1.2370E-69	1.3218E-02	1.3586E+08	1.8220E+22	0.0000E+00	3.6146E+04	4.0384E+00	8.2877E+04	8.2877E+04
Rb-86	7.7807E-32	4.4892E-05	7.4551E+04	9.9306E+18	1.3890E+04	1.9719E+01	1.5341E-02	4.5242E+01	4.5242E+01
Sr-89	4.6727E-30	7.5339E-03	2.0149E+06	2.6839E+20	7.8324E+05	5.3311E+02	0.0000E+00	1.2222E+03	1.2222E+03
Sr-90	8.3667E-31	2.8104E-02	2.3984E+05	3.1947E+19	1.4024E+05	6.3458E+01	0.0000E+00	1.4548E+02	1.4548E+02
Sr-91	1.3723E-52	4.2157E-04	2.1209E+06	2.8303E+20	2.3003E-17	5.6220E+02	0.0000E+00	1.2889E+03	1.2889E+03
Sr-92	1.0268-109	2.0668E-04	1.5026E+06	2.0144E+20	1.7211E-74	4.0013E+02	0.0000E+00	9.1734E+02	9.1734E+02
Y-90	8.3736E-31	4.8232E-06	6.3352E+03	8.2670E+17	1.4036E+05	1.6588E+00	0.0000E+00	3.8029E+00	3.8029E+00
Y-91	8.0633E-32	1.1835E-04	2.6855E+04	3.5742E+18	1.3526E+04	7.1025E+00	0.0000E+00	1.6283E+01	1.6283E+01
Y-92	1.7795E-90	3.0471E-05	3.6783E+05	4.7254E+19	2.9917E-55	9.5827E+01	0.0000E+00	2.1969E+02	2.1969E+02
Y-93	3.9732E-53	5.4473E-06	2.7391E+04	3.6547E+18	6.6599E-18	7.2597E+00	0.0000E+00	1.6644E+01	1.6644E+01
Zr-95	9.2942E-32	7.9678E-05	3.6759E+04	4.8963E+18	1.5579E+04	9.7258E+00	0.0000E+00	2.2297E+01	2.2297E+01
Zr-97	1.9509E-44	1.4502E-05	3.3475E+04	4.4635E+18	3.2701E-09	8.8662E+00	0.0000E+00	2.0327E+01	2.0327E+01
Nb-95	1.1946E-31	2.0741E-05	3.7050E+04	4.9350E+18	2.0024E+04	9.8028E+00	0.0000E+00	2.2474E+01	2.2474E+01
Mo-99	9.6210E-34	1.8741E-04	5.1463E+05	6.8567E+19	1.6127E+02	1.3620E+02	0.0000E+00	3.1225E+02	3.1225E+02
Tc-99m	9.4146E-34	3.9778E-06	4.6492E+05	6.1757E+19	1.5781E+02	1.2302E+02	0.0000E+00	2.8203E+02	2.8203E+02
Ru-103	9.1511E-31	3.6810E-04	4.4366E+05	5.9096E+19	1.5339E+05	1.1739E+02	0.0000E+00	2.6912E+02	2.6912E+02
Ru-105	1.6737E-79	1.6379E-05	2.1160E+05	2.8296E+19	2.8055E-44	5.6206E+01	0.0000E+00	1.2886E+02	1.2886E+02
Ru-106	5.9420E-31	7.7469E-03	1.7984E+05	2.3955E+19	9.9602E+04	4.7584E+01	0.0000E+00	1.0909E+02	1.0909E+02
Rh-105	8.5945E-37	2.5478E-05	2.8410E+05	3.7833E+19	1.4406E-01	7.5178E+01	0.0000E+00	1.7235E+02	1.7235E+02
Sb-127	9.8461E-33	3.5246E-04	6.1198E+05	8.1531E+19	1.6504E+03	1.6195E+02	0.0000E+00	3.7129E+02	3.7129E+02
Sb-129	4.3464E-80	1.5579E-04	1.2346E+06	1.6510E+20	7.2855E-45	3.2796E+02	0.0000E+00	7.5188E+02	7.5188E+02
Te-127	2.6081E-31	1.8036E-05	6.2320E+05	8.2874E+19	4.3718E+04	1.6491E+02	0.0000E+00	3.7806E+02	3.7806E+02
Te-127m	2.5427E-31	1.6287E-04	8.3964E+04	1.1184E+19	4.2621E+04	2.2215E+01	0.0000E+00	5.0931E+01	5.0931E+01
Te-129	3.5015E-31	1.3513E-05	1.4076E+06	1.8576E+20	5.8692E+04	3.7348E+02	0.0000E+00	8.5623E+02	8.5623E+02



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Te-129m	5.1007E-31	5.8290E-04	2.6889E+05	3.5815E+19	8.5499E+04	7.1143E+01	0.0000E+00	1.6310E+02	1.6310E+02
Te-131m	1.7058E-37	5.0669E-04	7.6995E+05	1.0262E+20	2.8592E-02	2.0384E+02	0.0000E+00	4.6731E+02	4.6731E+02
Te-132	4.7073E-32	6.6939E-03	7.7734E+06	1.0357E+21	7.8905E+03	2.0572E+03	0.0000E+00	4.7163E+03	4.7163E+03
I-131	4.3146E+04	7.3710E-01	2.4691E+08	3.2915E+22	1.4157E+06	3.9872E+04	5.9740E+00	9.1424E+04	9.1424E+04
I-132	7.3742E-32	5.6865E-03	4.0268E+07	5.3890E+21	8.3539E+03	1.0716E+04	8.5765E+00	2.4586E+04	2.4586E+04
I-133	4.4072E-05	6.5253E-02	1.1747E+08	1.5689E+22	1.4414E-03	2.7803E+04	1.2087E+01	6.3768E+04	6.3768E+04
I-134	7.4226E-242	2.3206E-03	1.7082E+07	2.3208E+21	2.4276E-240	4.6041E+03	1.2841E+01	1.0585E+04	1.0585E+04
I-135	1.7619E-27	1.2230E-02	6.4385E+07	8.6047E+21	5.7624E-26	1.6910E+04	1.1285E+01	3.8794E+04	3.8794E+04
Xe-133	1.4953E+06	3.1023E-02	2.0849E+10	2.7807E+24	0.0000E+00	3.1270E+06	1.1726E+01	7.1689E+06	7.1689E+06
Xe-135	1.1619E-16	1.0269E-02	9.0470E+08	1.2110E+23	0.0000E+00	2.1281E+05	4.1642E+00	4.8789E+05	4.8789E+05
Cs-134	2.2275E-29	3.0678E-02	7.2265E+06	9.6257E+20	3.9766E+06	1.9113E+03	1.4816E+00	4.3852E+03	4.3852E+03
Cs-136	1.4983E-30	1.7528E-03	2.2999E+06	3.0637E+20	2.6747E+05	6.0833E+02	4.7405E-01	1.3957E+03	1.3957E+03
Cs-137	1.3713E-29	1.2606E-02	4.3363E+06	5.7759E+20	2.4481E+06	1.1469E+03	8.8893E-01	2.6314E+03	2.6314E+03
Ba-139	7.9828E-187	2.2787E-05	1.2976E+06	1.7504E+20	1.3381E-151	3.4770E+02	0.0000E+00	7.9714E+02	7.9714E+02
Ba-140	2.6617E-30	1.3371E-03	3.8717E+06	5.1574E+20	4.4616E+05	1.0244E+03	0.0000E+00	2.3486E+03	2.3486E+03
La-140	3.0703E-30	7.5822E-05	1.3813E+05	1.7961E+19	5.1464E+05	3.6107E+01	0.0000E+00	8.2777E+01	8.2777E+01
La-141	9.1160E-87	1.2995E-06	2.3759E+04	3.1787E+18	1.5280E-51	6.3142E+00	0.0000E+00	1.4476E+01	1.4476E+01
La-142	3.2013E-172	2.0299E-06	1.2672E+04	1.7070E+18	5.3661E-137	3.3909E+00	0.0000E+00	7.7738E+00	7.7738E+00
Ce-141	1.7081E-31	7.4886E-05	9.2318E+04	1.2297E+19	2.8632E+04	2.4426E+01	0.0000E+00	5.5999E+01	5.5999E+01
Ce-143	8.0326E-38	2.5561E-05	8.0355E+04	1.0709E+19	1.3465E-02	2.1272E+01	0.0000E+00	4.8768E+01	4.8768E+01
Ce-144	2.4584E-31	2.5511E-03	7.5654E+04	1.0077E+19	4.1209E+04	2.0017E+01	0.0000E+00	4.5890E+01	4.5890E+01
Pr-143	3.2205E-32	2.4420E-05	3.3400E+04	4.4480E+18	5.3989E+03	8.8363E+00	0.0000E+00	2.0258E+01	2.0258E+01
Nd-147	1.9576E-32	2.3042E-05	3.6955E+04	4.9227E+18	3.2814E+03	9.7782E+00	0.0000E+00	2.2417E+01	2.2417E+01
Np-239	6.1953E-34	2.7399E-04	1.1725E+06	1.5623E+20	1.0385E+02	3.1032E+02	0.0000E+00	7.1144E+02	7.1144E+02
Pu-238	9.2748E-34	6.8828E-03	2.6466E+02	3.5253E+16	1.5547E+02	7.0024E-02	0.0000E+00	1.6054E-01	1.6054E-01
Pu-239	9.4360E-35	7.4202E-04	2.6683E+01	3.5541E+15	1.5817E+01	7.0597E-03	0.0000E+00	1.6185E-02	1.6185E-02
Pu-240	1.2792E-34	1.0177E-03	3.6597E+01	4.8747E+15	2.1441E+01	9.6828E-03	0.0000E+00	2.2199E-02	2.2199E-02
Pu-241	3.8439E-32	4.9391E-03	1.1041E+04	1.4706E+18	6.4432E+03	2.9212E+00	0.0000E+00	6.6971E+00	6.6971E+00
Am-241	2.4924E-35	2.2778E-04	5.6858E+00	7.5734E+14	4.1779E+00	1.5044E-03	0.0000E+00	3.4488E-03	3.4488E-03
Cm-242	4.4013E-33	2.2296E-03	1.4301E+03	1.9049E+17	7.3775E+02	3.7838E-01	0.0000E+00	8.6747E-01	8.6747E-01
Cm-244	3.1986E-34	2.0533E-03	9.1801E+01	1.2228E+16	5.3616E+01	2.4289E-02	0.0000E+00	5.5684E-02	5.5684E-02
Total	2.0497E+06	1.0000E+00	0.0000E+00	0.0000E+00	1.0785E+07	3.5854E+06	7.7975E+01	8.2200E+06	8.2200E+06

Dose Effective (Ci/cc) I-131 (Thyroid) 1.1521E-05
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 1.1521E-05
 Total I (Ci) 4.3146E+04

Drywell Free Volume Compartment Group Inventory Distribution:

Time (h) = 720.0000	Atmosphere	Sump
Noble gases (atoms)	9.2686E+24	0.0000E+00
Elemental I (atoms)	1.5519E+21	0.0000E+00
Organic I (atoms)	4.7996E+19	0.0000E+00
Aerosol I (atoms)	2.9711E-13	0.0000E+00
All Aerosols (kg)	1.8417E-34	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
Aerosol I (atoms)	8.7177E+23	0.0000E+00
All Aerosols (kg)	3.3176E+01	0.0000E+00

Reactor Building Compartment Nuclide Inventory (Ci) at Time (h) = 720.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 1	Pathway 2	Pathway 3	Pathway 12
					Inflow	Outflow	Outflow	Inflow
Co-58	1.0206E-39	2.4313E-07	7.6637E-04	1.0208E+11	4.1777E-01	6.8610E-03	1.4802E-03	0.0000E+00
Co-60	1.6209E-39	5.6310E-06	9.1823E-04	1.2231E+11	5.0053E-01	8.2204E-03	1.7733E-03	0.0000E+00
Kr-85	1.2666E-01	4.3981E-06	1.2542E+02	1.6706E+16	6.6995E+04	5.6166E+04	1.0853E+04	0.0000E+00
Kr-85m	9.8788E-49	9.3993E-05	4.2643E+01	5.7092E+15	2.3119E+04	1.9219E+04	3.8923E+03	0.0000E+00
Kr-87	1.6456E-170	1.8036E-04	1.4856E+01	2.0061E+15	8.3319E+03	6.7428E+03	1.5640E+03	0.0000E+00
Kr-88	3.0645E-76	1.9912E-03	6.6249E+01	8.8838E+15	3.6146E+04	2.9875E+04	6.2262E+03	0.0000E+00
Rb-86	1.9279E-38	6.5563E-06	3.5243E-02	4.6945E+12	1.9719E+01	3.1561E-01	7.7873E-02	0.0000E+00
Sr-89	1.1578E-36	1.1297E-03	9.7795E-01	1.3027E+14	5.3311E+02	8.7552E+00	1.8889E+00	0.0000E+00
Sr-90	2.0731E-37	4.2143E-03	1.1641E-01	1.5506E+13	6.3458E+01	1.0422E+00	2.2482E-01	0.0000E+00
Sr-91	3.4004E-59	6.3030E-05	1.0264E+00	1.3697E+14	5.6220E+02	9.2058E+00	2.0153E+00	0.0000E+00
Sr-92	2.5442E-116	3.0658E-05	7.2149E-01	9.6720E+13	4.0013E+02	6.5004E+00	1.4791E+00	0.0000E+00
Y-90	2.0748E-37	7.3136E-07	3.1094E-03	4.0585E+11	1.6588E+00	2.7565E-02	5.6063E-03	0.0000E+00
Y-91	1.9979E-38	1.7755E-05	1.3041E-02	1.7228E+12	7.1025E+00	1.1670E-01	2.5119E-02	0.0000E+00
Y-92	4.4093E-97	4.6400E-06	1.8130E-01	2.3317E+13	9.5827E+01	1.5990E+00	3.1839E-01	0.0000E+00
Y-93	9.8448E-60	8.1459E-07	1.3258E-02	1.7690E+12	7.2597E+00	1.1890E-01	2.6006E-02	0.0000E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

Zr-95	2.3030E-38	1.1948E-05	1.7842E-02	2.3765E+12	9.7258E+00	1.5973E-01	3.4459E-02	0.0000E+00
Zr-97	4.8340E-51	2.1710E-06	1.6222E-02	2.1630E+12	8.8662E+00	1.4537E-01	3.1619E-02	0.0000E+00
Nb-95	2.9600E-38	3.1101E-06	1.7983E-02	2.3953E+12	9.8028E+00	1.6099E-01	3.4730E-02	0.0000E+00
Mo-99	2.3839E-40	2.8090E-05	2.4969E-01	3.3267E+13	1.3620E+02	2.2359E+00	4.8334E-01	0.0000E+00
Tc-99m	2.3328E-40	5.9643E-07	2.2564E-01	2.9973E+13	1.2302E+02	2.0202E+00	4.3600E-01	0.0000E+00
Ru-103	2.2675E-37	5.5196E-05	2.1533E-01	2.8683E+13	1.1739E+02	1.9278E+00	4.1592E-01	0.0000E+00
Ru-105	4.1472E-86	2.4403E-06	1.0205E-01	1.3646E+13	5.6206E+01	9.1713E-01	2.0427E-01	0.0000E+00
Ru-106	1.4723E-37	1.1617E-03	8.7292E-02	1.1627E+13	4.7584E+01	7.8147E-01	1.6858E-01	0.0000E+00
Rh-105	2.1296E-43	3.8198E-06	1.3787E-01	1.8360E+13	7.5178E+01	1.2344E+00	2.6653E-01	0.0000E+00
Sb-127	2.4397E-39	5.2836E-05	2.9695E-01	3.9562E+13	1.6195E+02	2.6590E+00	5.7445E-01	0.0000E+00
Sb-129	1.0770E-86	2.3207E-05	5.9527E-01	7.9610E+13	3.2796E+02	5.3504E+00	1.1928E+00	0.0000E+00
Te-127	6.4625E-38	2.7041E-06	3.0243E-01	4.0218E+13	1.6491E+02	2.7078E+00	5.8465E-01	0.0000E+00
Te-127m	6.3004E-38	2.4423E-05	4.0754E-02	5.4284E+12	2.2215E+01	3.6485E-01	7.8704E-02	0.0000E+00
Te-129	8.6760E-38	2.0173E-06	6.8017E-01	8.9763E+13	3.7348E+02	6.1062E+00	1.3467E+00	0.0000E+00
Te-129m	1.2639E-37	8.7407E-05	1.3051E-01	1.7384E+13	7.1143E+01	1.1684E+00	2.5204E-01	0.0000E+00
Te-131m	4.2266E-44	7.5910E-05	3.7338E-01	4.9763E+13	2.0384E+02	3.3446E+00	7.2484E-01	0.0000E+00
Te-132	1.1664E-38	1.0034E-03	3.7717E+00	5.0251E+14	2.0572E+03	3.3774E+01	7.2985E+00	0.0000E+00
I-131	2.6910E-01	9.1919E-01	9.9669E+02	1.3288E+17	3.9872E+04	2.6538E+04	1.0927E+04	4.9382E+05
I-132	1.4242E-03	5.2759E-03	1.2093E+02	1.6978E+16	1.0716E+04	3.1463E+03	1.3027E+03	6.1656E+04
I-133	2.7407E-10	4.5245E-02	2.6364E+02	3.5269E+16	2.7803E+04	6.6190E+03	2.7265E+03	1.1518E+05
I-134	4.6159E-247	5.0026E-04	1.1920E+01	1.1920E+15	4.6041E+03	2.0062E+02	1.0757E+02	2.6183E+03
I-135	1.0956E-32	5.2160E-03	8.8886E+01	1.1896E+16	1.6910E+04	1.9958E+03	8.2862E+02	3.1856E+04
Xe-133	3.9496E-01	2.7762E-03	6.0392E+03	8.0536E+17	3.1270E+06	2.7120E+06	5.2507E+05	1.0707E+05
Xe-135	4.9307E-23	1.5578E-03	4.4424E+02	5.9448E+16	2.1281E+05	2.0082E+05	3.9359E+04	2.7200E+04
Cs-134	5.5195E-36	4.4810E-03	3.4167E+00	4.5510E+14	1.9113E+03	3.0596E+01	7.5445E+00	0.0000E+00
Cs-136	3.7124E-37	2.5598E-04	1.0872E+00	1.4482E+14	6.0833E+02	9.7363E+00	2.4030E+00	0.0000E+00
Cs-137	3.3980E-36	1.8413E-03	2.0502E+00	2.7309E+14	1.1469E+03	1.8359E+01	4.5270E+00	0.0000E+00
Ba-139	1.9780E-193	3.3400E-06	6.1567E-01	8.3046E+13	3.4770E+02	5.5816E+00	1.3443E+00	0.0000E+00
Ba-140	6.5953E-37	2.0049E-04	1.8791E+00	2.5031E+14	1.0244E+03	1.6823E+01	3.6307E+00	0.0000E+00
La-140	7.6076E-37	1.1519E-05	6.7922E-02	8.8348E+12	3.6107E+01	6.0117E-01	1.2106E-01	0.0000E+00
La-141	2.2588E-93	1.9344E-07	1.1448E-02	1.5317E+12	6.3142E+00	1.0294E-01	2.3026E-02	0.0000E+00
La-142	7.9323E-179	2.9833E-07	6.0284E-03	8.1208E+11	3.3909E+00	5.4580E-02	1.2980E-02	0.0000E+00
Ce-141	4.2325E-38	1.1229E-05	4.4808E-02	5.9685E+12	2.4426E+01	4.0115E-01	8.6545E-02	0.0000E+00
Ce-143	1.9904E-44	3.8298E-06	3.8970E-02	5.1936E+12	2.1272E+01	3.4906E-01	7.5617E-02	0.0000E+00
Ce-144	6.0916E-38	3.8254E-04	3.6720E-02	4.8912E+12	2.0017E+01	3.2874E-01	7.0916E-02	0.0000E+00
Pr-143	7.9798E-39	3.6621E-06	1.6213E-02	2.1591E+12	8.8363E+00	1.4513E-01	3.1295E-02	0.0000E+00
Nd-147	4.8507E-39	3.4548E-06	1.7935E-02	2.3891E+12	9.7782E+00	1.6057E-01	3.4657E-02	0.0000E+00
Np-239	1.5351E-40	4.1066E-05	5.6884E-01	7.5792E+13	3.1032E+02	5.0940E+00	1.1016E+00	0.0000E+00
Pu-238	2.2981E-40	1.0321E-03	1.2846E-04	1.7111E+10	7.0024E-02	1.1500E-03	2.4808E-04	0.0000E+00
Pu-239	2.3381E-41	1.1127E-04	1.2951E-05	1.7251E+09	7.0597E-03	1.1594E-04	2.5011E-05	0.0000E+00
Pu-240	3.1695E-41	1.5261E-04	1.7763E-05	2.3661E+09	9.6828E-03	1.5902E-04	3.4304E-05	0.0000E+00
Pu-241	9.5245E-39	7.4063E-04	5.3590E-03	7.1382E+11	2.9212E+00	4.7976E-02	1.0349E-02	0.0000E+00
Am-241	6.1758E-42	3.4156E-05	2.7598E-06	3.6760E+08	1.5044E-03	2.4707E-05	5.3294E-06	0.0000E+00
Cm-242	1.0906E-39	3.3433E-04	6.9413E-04	9.2459E+10	3.7838E-01	6.2142E-03	1.3406E-03	0.0000E+00
Cm-244	7.9256E-41	3.0790E-04	4.4558E-05	5.9351E+09	2.4289E-02	3.9890E-04	8.6051E-05	0.0000E+00
Total	7.9214E-01	1.0000E+00	0.0000E+00	0.0000E+00	3.5854E+06	3.0635E+06	6.0290E+05	8.3940E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 4.7517E-08
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 4.7524E-08
 Total I (Ci) 2.7052E-01

Reactor Building Compartment Group Inventory Distribution:

Time (h) = 720.0000	Atmosphere	Sump
Noble gases (atoms)	2.2968E+18	0.0000E+00
Elemental I (atoms)	9.6795E+15	0.0000E+00
Organic I (atoms)	2.9936E+14	0.0000E+00
Aerosol I (atoms)	7.3620E-20	0.0000E+00
All Aerosols (kg)	4.5634E-41	0.0000E+00

Environment Integral Nuclide Release (Ci): at Time (h) = 720.0000

Nuclide	Compartment	Exposure (Ci-hr)	Dose Fract Pathway 2	Dose Fract Pathway 3	Dose Fract Pathway 7	Dose Fract Pathway 11
Co-58	5.6946E-02	2.0937E-02	0.00000	0.00000	0.00000	0.00000
Co-60	7.2437E-02	2.7370E-02	0.00002	0.00000	0.00000	0.00001
Kr-85	2.7358E+05	1.4711E+05	0.00001	0.00000	0.00000	0.00000
Kr-85m	2.7051E+04	1.9252E+03	0.00748	0.00151	0.00000	0.00070
Kr-87	8.5600E+03	4.2993E+02	0.02664	0.00565	0.00001	0.00117
Kr-88	4.0036E+04	2.2551E+03	0.20267	0.04133	0.00002	0.01559
Rb-86	2.3359E+00	7.8741E-01	0.00002	0.00000	0.00000	0.00001
Sr-89	7.0974E+01	2.5799E+01	0.00352	0.00072	0.00000	0.00122
Sr-90	9.2015E+00	3.4797E+00	0.01314	0.00267	0.00000	0.00456



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Calc. No.: ALION-CAL-NPPD-3236-002

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Sr-91	2.0878E+01	1.4868E+00	0.00021	0.00004	0.00000	0.00006
Sr-92	1.0284E+01	5.2658E-01	0.00011	0.00002	0.00000	0.00002
Y-90	5.0181E+00	2.6232E+00	0.00000	0.00000	0.00000	0.00000
Y-91	1.1130E+00	4.2435E-01	0.00005	0.00001	0.00000	0.00002
Y-92	4.9939E+00	3.1177E-01	0.00001	0.00000	0.00000	0.00001
Y-93	2.7488E-01	2.0173E-02	0.00000	0.00000	0.00000	0.00000
Zr-95	1.3174E+00	4.8289E-01	0.00004	0.00001	0.00000	0.00001
Zr-97	3.9423E-01	3.8528E-02	0.00001	0.00000	0.00000	0.00000
Nb-95	1.4067E+00	5.2946E-01	0.00001	0.00000	0.00000	0.00000
Mo-99	9.3276E+00	1.9408E+00	0.00009	0.00002	0.00000	0.00003
Tc-99m	8.7824E+00	1.8777E+00	0.00000	0.00000	0.00000	0.00000
Ru-103	1.5277E+01	5.4906E+00	0.00017	0.00004	0.00000	0.00006
Ru-105	1.6472E+00	9.0148E-02	0.00001	0.00000	0.00000	0.00000
Ru-106	6.8178E+00	2.5647E+00	0.00362	0.00074	0.00000	0.00126
Rh-105	4.4179E+00	6.9164E-01	0.00001	0.00000	0.00000	0.00000
Sb-127	1.2406E+01	2.9652E+00	0.00017	0.00003	0.00000	0.00006
Sb-129	9.5351E+00	5.1895E-01	0.00008	0.00002	0.00000	0.00002
Te-127	1.4292E+01	3.8775E+00	0.00001	0.00000	0.00000	0.00000
Te-127m	3.1600E+00	1.1842E+00	0.00008	0.00002	0.00000	0.00003
Te-129	1.5867E+01	2.7649E+00	0.00001	0.00000	0.00000	0.00000
Te-129m	9.1429E+00	3.2613E+00	0.00027	0.00006	0.00000	0.00009
Te-131m	1.0822E+01	1.4907E+00	0.00024	0.00005	0.00000	0.00008
Te-132	1.4907E+02	3.3366E+01	0.00315	0.00064	0.00000	0.00106
I-131	4.1752E+04	2.1024E+04	0.22793	0.08836	0.00088	0.02014
I-132	4.3857E+03	1.6056E+03	0.00911	0.00349	0.00006	0.00056
I-133	1.0101E+04	2.7543E+03	0.07622	0.02949	0.00033	0.00641
I-134	3.1848E+02	1.5576E+01	0.00330	0.00136	0.00009	0.00012
I-135	3.0483E+03	2.9833E+02	0.01879	0.00725	0.00011	0.00140
Xe-133	8.6871E+06	4.3172E+06	0.02267	0.00449	0.00000	0.00301
Xe-135	3.3462E+05	5.5895E+04	0.06211	0.01232	0.00000	0.00898
Cs-134	2.7751E+02	1.0398E+02	0.01400	0.00305	0.00031	0.00522
Cs-136	6.7126E+01	2.1637E+01	0.00080	0.00017	0.00002	0.00030
Cs-137	1.6746E+02	6.2903E+01	0.00575	0.00125	0.00013	0.00215
Ba-139	7.8331E+00	3.9218E-01	0.00001	0.00000	0.00000	0.00000
Ba-140	1.1132E+02	3.6053E+01	0.00063	0.00013	0.00000	0.00022
La-140	6.1645E+01	3.0724E+01	0.00003	0.00001	0.00000	0.00003
La-141	1.7868E-01	9.5590E-03	0.00000	0.00000	0.00000	0.00000
La-142	7.7807E-02	3.8999E-03	0.00000	0.00000	0.00000	0.00000
Ce-141	3.1171E+00	1.1087E+00	0.00004	0.00001	0.00000	0.00001
Ce-143	1.1636E+00	1.6937E-01	0.00001	0.00000	0.00000	0.00000
Ce-144	2.8576E+00	1.0733E+00	0.00119	0.00024	0.00000	0.00041
Pr-143	1.1070E+00	3.8561E-01	0.00001	0.00000	0.00000	0.00000
Nd-147	1.0256E+00	3.2430E-01	0.00001	0.00000	0.00000	0.00000
Np-239	2.0189E+01	3.9087E+00	0.00013	0.00003	0.00000	0.00004
Pu-238	1.0164E-02	3.8455E-03	0.00322	0.00065	0.00000	0.00112
Pu-239	1.0308E-03	3.9088E-04	0.00035	0.00007	0.00000	0.00012
Pu-240	1.4046E-03	5.3129E-04	0.00048	0.00010	0.00000	0.00016
Pu-241	4.2340E-01	1.6008E-01	0.00231	0.00047	0.00000	0.00080
Am-241	2.3055E-04	8.9236E-05	0.00011	0.00002	0.00000	0.00004
Cm-242	5.3389E-02	1.9947E-02	0.00104	0.00021	0.00000	0.00036
Cm-244	3.5210E-03	1.3314E-03	0.00096	0.00020	0.00000	0.00033

Environment Compartment Group Inventory Distribution:

	Total Release	Release Rate/s
Time (h) = 720.0000		
Noble gases (atoms)	5.1512E+24	1.9873E+18
Elemental I (atoms)	1.3859E+21	5.3469E+14
Organic I (atoms)	1.7337E+20	6.6886E+13
Aerosol I (atoms)	3.5127E+19	1.3552E+13
All Aerosols (kg)	2.2525E-03	8.6901E-10

Suppression Pool Compartment Nuclide Inventory (Ci) at Time (h) = 720.0000

Nuclide	Compartment	Dose Fract	Exposure (Ci-hr)	Decays (Bq-s)	Pathway 12 Outflow
Co-58	6.4457E+02	9.5594E-06	5.5887E+05	7.4450E+19	0.0000E+00
Co-60	1.0237E+03	2.5352E-04	7.6676E+05	1.0213E+20	0.0000E+00
Rb-86	1.2969E+04	1.7902E-04	1.7848E+07	2.3784E+21	0.0000E+00
Sr-89	7.3126E+05	4.2057E-02	6.7528E+08	8.9961E+22	0.0000E+00
Sr-90	1.3094E+05	1.9056E-01	9.7633E+07	1.3005E+22	0.0000E+00
Sr-91	2.1477E-17	6.2069E-05	1.8748E+07	2.5116E+21	0.0000E+00
Sr-92	1.6069E-74	1.0736E-05	4.6860E+06	6.2859E+20	0.0000E+00



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Y-90	1.3104E+05	1.0782E-03	8.5018E+07	1.1308E+22	0.0000E+00
Y-91	1.2628E+04	8.2658E-04	1.1260E+07	1.5000E+21	0.0000E+00
Y-92	2.7931E-55	6.6356E-06	4.8089E+06	6.3909E+20	0.0000E+00
Y-93	6.2179E-18	8.4780E-07	2.5593E+05	3.4287E+19	0.0000E+00
Zr-95	1.4545E+04	4.6295E-04	1.2822E+07	1.7081E+21	0.0000E+00
Zr-97	3.0531E-09	3.6375E-06	5.0410E+05	6.7503E+19	0.0000E+00
Nb-95	1.8695E+04	1.3671E-04	1.4661E+07	1.9528E+21	0.0000E+00
Mo-99	1.5057E+02	1.7509E-04	2.8866E+07	3.8540E+21	0.0000E+00
Tc-99m	1.4733E+02	3.9888E-06	2.7989E+07	3.7053E+21	0.0000E+00
Ru-103	1.4321E+05	1.9484E-03	1.4098E+08	1.8782E+22	0.0000E+00
Ru-105	2.6193E-44	1.2498E-06	9.6936E+05	1.2986E+20	0.0000E+00
Ru-106	9.2991E+04	5.1146E-02	7.1284E+07	9.4952E+21	0.0000E+00
Rh-105	1.3450E-01	1.4144E-05	9.4690E+06	1.2658E+21	0.0000E+00
Sb-127	1.5409E+03	4.5586E-04	4.7520E+07	6.3409E+21	0.0000E+00
Sb-129	6.8020E-45	1.1625E-05	5.5306E+06	7.4090E+20	0.0000E+00
Te-127	4.0816E+04	3.6379E-05	7.5466E+07	1.0002E+22	0.0000E+00
Te-127m	3.9792E+04	1.0463E-03	3.2383E+07	4.3136E+21	0.0000E+00
Te-129	5.4797E+04	9.9811E-06	6.2417E+07	7.9202E+21	0.0000E+00
Te-129m	7.9825E+04	2.9809E-03	8.2554E+07	1.0999E+22	0.0000E+00
Te-131m	2.6695E-02	2.1993E-04	2.0064E+07	2.6834E+21	0.0000E+00
Te-132	7.3668E+03	7.3739E-03	5.1410E+08	6.8618E+22	0.0000E+00
I-131	1.3950E+06	2.4780E-01	4.9836E+09	6.6442E+23	4.9382E+05
I-132	7.7995E+03	1.4596E-03	6.2055E+08	8.1178E+22	6.1656E+04
I-133	1.4206E-03	1.0678E-02	1.1540E+09	1.5446E+23	1.1518E+05
I-134	2.3926-240	5.8660E-05	2.5923E+07	3.5220E+21	2.6183E+03
I-135	5.6792E-26	1.0101E-03	3.1926E+08	4.2764E+22	3.1856E+04
Xe-133	1.3233E+05	2.6794E-05	1.0811E+09	1.4404E+23	1.0707E+05
Xe-135	1.1079E-16	5.1364E-05	2.7168E+08	3.6302E+22	2.7200E+04
Cs-134	3.7130E+06	1.9839E-01	2.8056E+09	3.7371E+23	0.0000E+00
Cs-136	2.4974E+05	5.8309E-03	4.5933E+08	6.1218E+22	0.0000E+00
Cs-137	2.2858E+06	8.2554E-02	1.7049E+09	2.2709E+23	0.0000E+00
Ba-139	1.2493-151	7.5567E-07	2.5835E+06	3.4852E+20	0.0000E+00
Ba-140	4.1655E+05	4.5316E-03	7.8774E+08	1.0499E+23	0.0000E+00
La-140	4.8048E+05	6.9351E-03	7.5848E+08	1.0087E+23	0.0000E+00
La-141	1.4266E-51	8.9837E-08	9.8613E+04	1.3212E+19	0.0000E+00
La-142	5.0100-137	7.1976E-08	2.6976E+04	3.6343E+18	0.0000E+00
Ce-141	2.6731E+04	3.7793E-04	2.7971E+07	3.7266E+21	0.0000E+00
Ce-143	1.2571E-02	1.2166E-05	2.2960E+06	3.0701E+20	0.0000E+00
Ce-144	3.8474E+04	1.6707E-02	2.9744E+07	3.9621E+21	0.0000E+00
Pr-143	5.0406E+03	1.0593E-04	8.6982E+06	1.1591E+21	0.0000E+00
Nd-147	3.0636E+03	7.1199E-05	6.8555E+06	9.1377E+20	0.0000E+00
Np-239	9.6955E+01	2.2008E-04	5.6542E+07	7.5514E+21	0.0000E+00
Pu-238	1.4515E+02	4.6776E-02	1.0798E+05	1.4383E+19	0.0000E+00
Pu-239	1.4767E+01	5.0884E-03	1.0985E+04	1.4632E+18	0.0000E+00
Pu-240	2.0018E+01	6.9074E-03	1.4912E+04	1.9863E+18	0.0000E+00
Pu-241	6.0155E+03	3.3457E-02	4.4901E+06	5.9808E+20	0.0000E+00
Am-241	3.9006E+00	1.7400E-03	2.6075E+03	3.4728E+17	0.0000E+00
Cm-242	6.8878E+02	1.4221E-02	5.4763E+05	7.2947E+19	0.0000E+00
Cm-244	5.0057E+01	1.3915E-02	3.7348E+04	4.9748E+18	0.0000E+00
Total	1.0275E+07	1.0000E+00	0.0000E+00	0.0000E+00	8.3940E+05

Dose Effective (Ci/cc) I-131 (Thyroid) 5.1082E-04
 Dose Effective (Ci/cc) I-131 (ICRP2 Thyroid) 5.1090E-04
 Total I (Ci) 1.4028E+06

Suppression Pool Compartment Group Inventory Distribution:

Time (h) = 720.0000	Atmosphere	Sump
Noble gases (atoms)	3.2011E+21	0.0000E+00
Elemental I (atoms)	5.0179E+22	0.0000E+00
Organic I (atoms)	1.5519E+21	0.0000E+00
Aerosol I (atoms)	0.0000E+00	0.0000E+00
All Aerosols (kg)	3.0594E+01	0.0000E+00

Filtered Environment to Control Room Pathway Nuclide Inventory (Ci) at Time (h) = 720.0000

Nuclide	Filter	Decays	Transported	Activity			
				Pathway 2	Pathway 3	Pathway 7	Pathway 11
Co-58	2.6670E-06	2.39E+11	6.9353E-08	1.482E-07	2.861E-08	0.000E+00	2.718E-06
Co-60	4.2358E-06	3.33E+11	8.7212E-08	1.775E-07	3.426E-08	0.000E+00	4.111E-06
Kr-85	0.0000E+00	0.00E+00	1.0072E+01	8.461E-03	1.633E-03	1.843E-04	1.006E+01
Kr-85m	0.0000E+00	0.00E+00	6.4684E-01	1.222E-01	2.358E-02	3.411E-03	4.977E-01
Kr-87	0.0000E+00	0.00E+00	2.4718E-01	1.280E-01	2.471E-02	6.420E-03	8.804E-02



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Kr-88	0.0000E+00	0.00E+00	9.6959E-01	2.861E-01	5.522E-02	9.136E-03	6.192E-01
Rb-86	6.5335E-05	9.20E+12	8.8922E-06	6.788E-06	1.310E-06	3.464E-05	1.323E-04
Sr-89	3.0257E-03	2.86E+14	8.6839E-05	1.891E-04	3.651E-05	0.000E+00	3.347E-03
Sr-90	5.4177E-04	4.25E+13	1.1074E-05	2.250E-05	4.344E-06	0.000E+00	5.260E-04
Sr-91	8.8864E-26	2.67E+12	2.9801E-05	2.108E-04	4.069E-05	0.000E+00	1.237E-03
Sr-92	6.6487E-83	3.16E+11	1.2392E-05	1.651E-04	3.186E-05	0.000E+00	2.977E-04
Y-90	5.4222E-04	3.89E+13	5.1562E-06	4.147E-07	8.004E-08	0.000E+00	5.469E-04
Y-91	5.2304E-05	4.81E+12	1.3467E-06	2.493E-06	4.811E-07	0.000E+00	5.610E-05
Y-92	1.1605E-63	5.94E+11	8.3340E-06	2.733E-05	5.276E-06	0.000E+00	6.017E-04
Y-93	2.5728E-26	3.75E+10	3.9408E-07	2.714E-06	5.239E-07	0.000E+00	1.645E-05
Zr-95	6.0183E-05	5.47E+12	1.6064E-06	3.450E-06	6.660E-07	0.000E+00	6.252E-05
Zr-97	1.2633E-17	9.20E+10	5.7810E-07	3.249E-06	6.272E-07	0.000E+00	2.705E-05
Nb-95	7.7354E-05	6.35E+12	1.6966E-06	3.476E-06	6.710E-07	0.000E+00	7.491E-05
Mo-99	6.2300E-07	8.17E+12	1.3167E-05	4.873E-05	9.406E-06	0.000E+00	8.133E-04
Tc-99m	6.0963E-07	7.90E+12	1.2406E-05	4.376E-05	8.447E-06	0.000E+00	7.892E-04
Ru-103	5.9256E-04	5.93E+13	1.8776E-05	4.165E-05	8.040E-06	0.000E+00	7.252E-04
Ru-105	1.0838E-52	9.01E+10	2.1554E-06	2.216E-05	4.277E-06	0.000E+00	6.822E-05
Ru-106	3.8477E-04	3.09E+13	8.2239E-06	1.688E-05	3.257E-06	0.000E+00	3.729E-04
Rh-105	5.5653E-10	2.25E+12	6.4745E-06	2.682E-05	5.178E-06	0.000E+00	4.044E-04
Sb-127	6.3757E-06	1.48E+13	1.7111E-05	5.780E-05	1.116E-05	0.000E+00	1.031E-03
Sb-129	2.8145E-53	5.05E+11	1.2424E-05	1.296E-04	2.501E-05	0.000E+00	3.868E-04
Te-127	1.6889E-04	2.72E+13	1.9164E-05	5.871E-05	1.133E-05	0.000E+00	9.410E-04
Te-127m	1.6465E-04	1.40E+13	3.8190E-06	7.877E-06	1.521E-06	0.000E+00	1.606E-04
Te-129	2.2673E-04	2.30E+13	2.0345E-05	1.445E-04	2.789E-05	0.000E+00	4.866E-04
Te-129m	3.3029E-04	3.45E+13	1.1275E-05	2.523E-05	4.870E-06	0.000E+00	4.400E-04
Te-131m	1.1045E-10	4.48E+12	1.5849E-05	7.368E-05	1.422E-05	0.000E+00	9.097E-04
Te-132	3.0482E-05	1.53E+14	2.0804E-04	7.350E-04	1.419E-04	0.000E+00	1.274E-02
I-131	4.8982E-02	7.08E+15	2.5047E-02	7.929E-03	2.610E-03	1.349E-02	1.289E-01
I-132	3.2289E-05	1.74E+14	5.5475E-03	8.000E-03	2.631E-03	1.920E-02	2.918E-02
I-133	5.0010E-11	4.72E+14	1.0826E-02	1.496E-02	4.922E-03	2.726E-02	8.517E-02
I-134	8.4227-248	5.47E+12	5.8454E-03	2.228E-03	7.325E-04	2.834E-02	2.592E-02
I-135	1.9993E-33	8.54E+13	7.2063E-03	1.185E-02	3.899E-03	2.540E-02	3.851E-02
Xe-133	0.0000E+00	0.00E+00	2.8453E+02	1.202E+00	2.320E-01	2.649E-02	2.831E+02
Xe-135	0.0000E+00	0.00E+00	6.5155E+00	4.574E-01	8.829E-02	9.403E-03	5.960E+00
Cs-134	1.8705E-02	1.53E+15	9.1003E-04	6.588E-04	1.272E-04	3.345E-03	1.548E-02
Cs-136	1.2581E-03	2.31E+14	2.6971E-04	2.093E-04	4.040E-05	1.070E-03	4.361E-03
Cs-137	1.1515E-02	9.33E+14	5.4695E-04	3.953E-04	7.631E-05	2.007E-03	9.583E-03
Ba-139	5.1692-160	1.10E+11	8.4771E-06	1.529E-04	2.952E-05	0.000E+00	2.459E-04
Ba-140	1.7236E-03	3.08E+14	1.4207E-04	3.640E-04	7.026E-05	0.000E+00	6.668E-03
La-140	1.9881E-03	3.18E+14	6.7083E-05	8.438E-06	1.629E-06	0.000E+00	7.186E-03
La-141	5.9030E-60	8.49E+09	2.2938E-07	2.515E-06	4.855E-07	0.000E+00	6.748E-06
La-142	2.0730-145	1.24E+09	8.5462E-08	1.478E-06	2.853E-07	0.000E+00	2.378E-06
Ce-141	1.1060E-04	1.17E+13	3.8470E-06	8.667E-06	1.673E-06	0.000E+00	1.504E-04
Ce-143	5.2014E-11	5.28E+11	1.6998E-06	7.676E-06	1.482E-06	0.000E+00	9.971E-05
Ce-144	1.5919E-04	1.29E+13	3.4494E-06	7.099E-06	1.370E-06	0.000E+00	1.542E-04
Pr-143	2.0860E-05	3.46E+12	1.3838E-06	3.127E-06	6.036E-07	0.000E+00	7.183E-05
Nd-147	1.2676E-05	2.63E+12	1.3190E-06	3.475E-06	6.708E-07	0.000E+00	6.451E-05
Np-239	4.0117E-07	1.53E+13	2.8775E-05	1.112E-04	2.146E-05	0.000E+00	1.780E-03
Pu-238	6.0058E-07	4.70E+10	1.2231E-08	2.483E-08	4.793E-09	0.000E+00	5.832E-07
Pu-239	6.1101E-08	4.78E+09	1.2393E-09	2.503E-09	4.832E-10	0.000E+00	5.935E-08
Pu-240	8.2830E-08	6.49E+09	1.6904E-09	3.434E-09	6.628E-10	0.000E+00	8.042E-08
Pu-241	2.4890E-05	1.95E+12	5.0961E-07	1.036E-06	2.000E-07	0.000E+00	2.416E-05
Am-241	1.6140E-08	1.15E+09	2.7466E-10	5.333E-10	1.029E-10	0.000E+00	1.578E-08
Cm-242	2.8500E-06	2.36E+11	6.4589E-08	1.342E-07	2.590E-08	0.000E+00	2.754E-06
Cm-244	2.0712E-07	1.62E+10	4.2378E-09	8.613E-09	1.663E-09	0.000E+00	2.011E-07

Filtered Environment to Control Room Transport Group Inventory:

	Pathway	
	Filtered	Transported
Time (h) = 720.0000		
Noble gases (atoms)	0.0000E+00	1.8896E+20
Elemental I (atoms)	3.2893E+15	4.1014E+14
Organic I (atoms)	3.3799E+15	4.1786E+14
Aerosol I (atoms)	2.6852E+15	1.2501E+14
All Aerosols (kg)	1.4997E-07	5.9727E-09

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ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:19

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0.017	1.6950E-03	1.1009E+00	8.8960E-07
0.017	1.6973E-03	1.1142E+00	9.0228E-07
0.083	6.2937E-03	2.7400E+01	3.0139E-05
0.300	5.6307E-03	3.4230E+02	3.9931E-04
0.500	5.0865E-03	9.1910E+02	1.0828E-03
0.700	4.6042E-03	1.8575E+03	2.1947E-03
0.900	4.1828E-03	3.2520E+03	3.8522E-03
1.000	3.9947E-03	4.1147E+03	4.8790E-03
1.200	3.6632E-03	6.1602E+03	7.3166E-03
1.300	3.5196E-03	7.3389E+03	8.7224E-03
1.500	5.2883E-03	9.9976E+03	1.1896E-02
1.700	7.2389E-03	1.3045E+04	1.5536E-02
1.800	8.2770E-03	1.4709E+04	1.7526E-02
2.000	7.6600E-03	1.8310E+04	2.1834E-02
2.200	7.0374E-03	2.1802E+04	2.6040E-02
2.400	6.4964E-03	2.4777E+04	2.9647E-02
2.600	6.0263E-03	2.7316E+04	3.2747E-02
2.800	5.6176E-03	2.9486E+04	3.5418E-02
3.000	5.2622E-03	3.1344E+04	3.7726E-02
3.200	4.9532E-03	3.2939E+04	3.9727E-02
3.400	4.6846E-03	3.4310E+04	4.1469E-02
3.600	4.4512E-03	3.5492E+04	4.2990E-02
3.800	4.2484E-03	3.6514E+04	4.4326E-02
4.000	4.0724E-03	3.7402E+04	4.5505E-02
4.200	3.9198E-03	3.8175E+04	4.6550E-02
4.400	3.7877E-03	3.8851E+04	4.7482E-02
4.600	3.6735E-03	3.9445E+04	4.8319E-02
4.800	3.5749E-03	3.9970E+04	4.9074E-02
5.000	3.4902E-03	4.0437E+04	4.9761E-02
5.200	3.4176E-03	4.0861E+04	5.0399E-02
5.400	3.3557E-03	4.1256E+04	5.1003E-02
5.600	3.3033E-03	4.1626E+04	5.1575E-02
5.800	3.2593E-03	4.1971E+04	5.2120E-02
6.000	3.2227E-03	4.2296E+04	5.2640E-02
6.200	3.1928E-03	4.2601E+04	5.3138E-02
6.400	3.1687E-03	4.2890E+04	5.3615E-02
6.600	3.1497E-03	4.3163E+04	5.4073E-02
6.800	3.1353E-03	4.3422E+04	5.4515E-02
7.000	3.1250E-03	4.3668E+04	5.4942E-02
7.200	3.1182E-03	4.3903E+04	5.5356E-02
7.400	3.1146E-03	4.4128E+04	5.5757E-02
7.600	3.1137E-03	4.4343E+04	5.6146E-02
7.800	3.1153E-03	4.4550E+04	5.6526E-02
8.000	3.1191E-03	4.4750E+04	5.6897E-02
8.200	2.9686E-03	4.4943E+04	5.7259E-02
8.333	2.8772E-03	4.5068E+04	5.7496E-02
8.550	2.7425E-03	4.5266E+04	5.7875E-02
8.750	2.6319E-03	4.5444E+04	5.8219E-02
8.950	2.5333E-03	4.5618E+04	5.8558E-02
9.150	2.4453E-03	4.5788E+04	5.8892E-02
9.350	2.3669E-03	4.5955E+04	5.9221E-02
9.550	2.2973E-03	4.6118E+04	5.9545E-02
9.750	2.2355E-03	4.6278E+04	5.9866E-02
9.950	2.1807E-03	4.6435E+04	6.0183E-02
10.000	2.1681E-03	4.6474E+04	6.0262E-02
10.200	2.1211E-03	4.6628E+04	6.0574E-02
12.000	1.8933E-03	4.7921E+04	6.3262E-02
19.444	2.0237E-03	5.2425E+04	7.3048E-02
24.000	2.1997E-03	5.4809E+04	7.8341E-02
96.000	6.0726E-04	5.8720E+04	3.0443E-02
720.000	9.0821E-05	8.6967E+03	5.3736E-03

Suppression Pool
I-131 (Curies)

0.000	3.6699E+03
0.017	1.0965E+05
0.017	1.1031E+05
0.083	5.5010E+05
0.300	1.9797E+06
0.500	3.2972E+06
0.700	5.4917E+06
0.900	7.6832E+06
1.000	8.7778E+06



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1.200	1.0965E+07
1.300	1.2057E+07
1.500	1.4240E+07
1.700	1.6419E+07
1.800	1.7508E+07
2.000	1.9683E+07
2.200	1.9669E+07
2.400	1.9655E+07
2.600	1.9640E+07
2.800	1.9626E+07
3.000	1.9612E+07
3.200	1.9598E+07
3.400	1.9583E+07
3.600	1.9569E+07
3.800	1.9555E+07
4.000	1.9541E+07
4.200	1.9527E+07
4.400	1.9513E+07
4.600	1.9498E+07
4.800	1.9484E+07
5.000	1.9470E+07
5.200	1.9456E+07
5.400	1.9442E+07
5.600	1.9428E+07
5.800	1.9414E+07
6.000	1.9400E+07
6.200	1.9385E+07
6.400	1.9371E+07
6.600	1.9357E+07
6.800	1.9343E+07
7.000	1.9329E+07
7.200	1.9315E+07
7.400	1.9301E+07
7.600	1.9287E+07
7.800	1.9273E+07
8.000	1.9259E+07
8.200	1.9245E+07
8.333	1.9236E+07
8.550	1.9221E+07
8.750	1.9207E+07
8.950	1.9193E+07
9.150	1.9179E+07
9.350	1.9165E+07
9.550	1.9151E+07
9.750	1.9137E+07
9.950	1.9123E+07
10.000	1.9120E+07
10.200	1.9106E+07
12.000	1.8981E+07
19.444	1.8474E+07
24.000	1.8169E+07
96.000	1.3952E+07
720.000	1.3950E+06

 Cumulative Dose Summary

Time (hr)	Exclusion Area Bounda		Low Population Zone		Control Room	
	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
0.017	2.0583E-03	9.8647E-05	5.1456E-03	2.4662E-04	4.9048E-03	2.0872E-04
0.017	2.0893E-03	1.0006E-04	5.2232E-03	2.5015E-04	4.9862E-03	2.1218E-04
0.083	5.2978E-02	2.5154E-03	1.3245E-01	6.2884E-03	1.1938E-01	5.0775E-03
0.300	8.8458E-02	4.3344E-03	2.2115E-01	1.0836E-02	7.3751E-01	3.1354E-02
0.500	1.5596E-01	7.7449E-03	3.8990E-01	1.9362E-02	1.2489E+00	5.3085E-02
0.700	2.6793E-01	1.4294E-02	6.6981E-01	3.5735E-02	1.7100E+00	7.2676E-02
0.900	4.3602E-01	2.5381E-02	1.0901E+00	6.3453E-02	2.1271E+00	9.0399E-02
1.000	5.4090E-01	3.2546E-02	1.3523E+00	8.1364E-02	2.3210E+00	9.8646E-02
1.200	7.4846E-01	4.8418E-02	1.8711E+00	1.2105E-01	2.6831E+00	1.1408E-01
1.300	8.6954E-01	5.7755E-02	2.1739E+00	1.4439E-01	2.8528E+00	1.2134E-01
1.500	2.9374E+00	2.1752E-01	4.5864E+00	3.3078E-01	3.2676E+00	1.3921E-01



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1.700	5.3373E+00	4.0241E-01	7.3863E+00	5.4649E-01	3.8580E+00	1.6482E-01
1.800	6.6604E+00	5.0388E-01	8.9299E+00	6.6487E-01	4.2240E+00	1.8075E-01
2.000	7.0458E+00	5.3325E-01	9.8932E+00	7.3830E-01	4.9744E+00	2.1350E-01
2.200	7.4430E+00	5.6328E-01	1.0886E+01	8.1336E-01	5.6652E+00	2.4378E-01
2.400	7.8218E+00	5.9167E-01	1.1833E+01	8.8433E-01	6.3003E+00	2.7171E-01
2.600	8.1850E+00	6.1863E-01	1.2741E+01	9.5172E-01	6.8871E+00	2.9766E-01
2.800	8.5350E+00	6.4432E-01	1.3616E+01	1.0160E+00	7.4319E+00	3.2191E-01
3.000	8.8736E+00	6.6890E-01	1.4463E+01	1.0774E+00	7.9403E+00	3.4473E-01
3.200	9.2026E+00	6.9248E-01	1.5285E+01	1.1364E+00	8.4171E+00	3.6632E-01
3.400	9.5235E+00	7.1519E-01	1.6087E+01	1.1931E+00	8.8665E+00	3.8687E-01
3.600	9.8373E+00	7.3711E-01	1.6872E+01	1.2479E+00	9.2921E+00	4.0654E-01
3.800	1.0145E+01	7.5832E-01	1.7642E+01	1.3010E+00	9.6969E+00	4.2546E-01
4.000	1.0448E+01	7.7889E-01	1.8398E+01	1.3524E+00	1.0084E+01	4.4375E-01
4.200	1.0746E+01	7.9888E-01	1.9144E+01	1.4024E+00	1.0455E+01	4.6149E-01
4.400	1.1040E+01	8.1835E-01	1.9880E+01	1.4510E+00	1.0813E+01	4.7878E-01
4.600	1.1331E+01	8.3734E-01	2.0607E+01	1.4985E+00	1.1159E+01	4.9568E-01
4.800	1.1620E+01	8.5589E-01	2.1328E+01	1.5449E+00	1.1495E+01	5.1225E-01
5.000	1.1905E+01	8.7404E-01	2.2042E+01	1.5903E+00	1.1822E+01	5.2855E-01
5.200	1.2189E+01	8.9184E-01	2.2752E+01	1.6347E+00	1.2141E+01	5.4462E-01
5.400	1.2471E+01	9.0931E-01	2.3457E+01	1.6784E+00	1.2454E+01	5.6049E-01
5.600	1.2752E+01	9.2650E-01	2.4160E+01	1.7214E+00	1.2761E+01	5.7621E-01
5.800	1.3032E+01	9.4339E-01	2.4859E+01	1.7636E+00	1.3064E+01	5.9178E-01
6.000	1.3311E+01	9.6003E-01	2.5555E+01	1.8052E+00	1.3362E+01	6.0726E-01
6.200	1.3588E+01	9.7640E-01	2.6249E+01	1.8462E+00	1.3657E+01	6.2264E-01
6.400	1.3864E+01	9.9254E-01	2.6940E+01	1.8865E+00	1.3949E+01	6.3795E-01
6.600	1.4140E+01	1.0085E+00	2.7628E+01	1.9263E+00	1.4239E+01	6.5322E-01
6.800	1.4414E+01	1.0241E+00	2.8314E+01	1.9655E+00	1.4527E+01	6.6844E-01
7.000	1.4688E+01	1.0396E+00	2.8998E+01	2.0042E+00	1.4813E+01	6.8363E-01
7.200	1.4960E+01	1.0549E+00	2.9680E+01	2.0425E+00	1.5098E+01	6.9880E-01
7.400	1.5232E+01	1.0700E+00	3.0360E+01	2.0802E+00	1.5383E+01	7.1397E-01
7.600	1.5503E+01	1.0849E+00	3.1037E+01	2.1175E+00	1.5666E+01	7.2912E-01
7.800	1.5774E+01	1.0997E+00	3.1713E+01	2.1544E+00	1.5949E+01	7.4429E-01
8.000	1.6044E+01	1.1143E+00	3.2388E+01	2.1908E+00	1.6232E+01	7.5946E-01
8.200	1.6182E+01	1.1243E+00	3.2526E+01	2.2009E+00	1.6508E+01	7.7425E-01
8.333	1.6274E+01	1.1310E+00	3.2618E+01	2.2075E+00	1.6685E+01	7.8371E-01
8.550	1.6423E+01	1.1416E+00	3.2767E+01	2.2182E+00	1.6960E+01	7.9846E-01
8.750	1.6561E+01	1.1513E+00	3.2905E+01	2.2279E+00	1.7202E+01	8.1145E-01
8.950	1.6698E+01	1.1609E+00	3.3042E+01	2.2375E+00	1.7435E+01	8.2392E-01
9.150	1.6835E+01	1.1704E+00	3.3179E+01	2.2469E+00	1.7659E+01	8.3591E-01
9.350	1.6971E+01	1.1797E+00	3.3316E+01	2.2563E+00	1.7875E+01	8.4748E-01
9.550	1.7108E+01	1.1890E+00	3.3452E+01	2.2655E+00	1.8084E+01	8.5867E-01
9.750	1.7244E+01	1.1981E+00	3.3588E+01	2.2747E+00	1.8286E+01	8.6952E-01
9.950	1.7380E+01	1.2072E+00	3.3724E+01	2.2837E+00	1.8484E+01	8.8006E-01
10.000	1.7413E+01	1.2094E+00	3.3758E+01	2.2860E+00	1.8532E+01	8.8266E-01
10.200	1.7413E+01	1.2094E+00	3.3893E+01	2.2949E+00	1.8724E+01	8.9286E-01
12.000	1.7413E+01	1.2094E+00	3.5101E+01	2.3714E+00	2.0303E+01	9.7668E-01
19.444	1.7413E+01	1.2094E+00	3.9922E+01	2.6426E+00	2.6379E+01	1.2861E+00
24.000	1.7413E+01	1.2094E+00	4.2754E+01	2.7882E+00	3.0336E+01	1.4779E+00
96.000	1.7413E+01	1.2094E+00	5.6992E+01	3.3223E+00	3.9831E+01	1.8918E+00
720.000	1.7413E+01	1.2094E+00	6.9099E+01	3.7622E+00	6.5167E+01	2.8578E+00



Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station

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Calc. No.: ALION-CAL-NPPD-3236-002

Rev. Number: 1

ALION RADTRAD Version 3.10 (Spring 2008) run on 6/25/2008 at 14:51:19

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LOCA_leak-msiv-esf (err only 1 path offsite X/Q)

Worst Two-Hour Doses

Exclusion Area Boundary

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
1.3	3.0795E-01	8.4935E+00	6.4608E-01


Final Doses

Low Population Zone

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
720.0	1.4080E+00	6.9099E+01	3.7622E+00

Control Room

Time (hr)	Whole Body (rem)	Thyroid (rem)	TEDE (rem)
720.0	1.6282E-01	6.5167E+01	2.8578E+00

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
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	Rev. Number: <u>1</u>

APPENDIX J

RADTRAD Compartment Inventory Tables

(Shielding Input)

Drywell

Curie loading at time

Time(hr) -->	0.0006	0.5	1	2	8	24	96	720
Nuclides								
Co-58			286.65	770.78	12.603	0.015428	1.06E-05	4.12E-33
Co-60			343.21	923.24	15.131	0.01864	1.32E-05	6.54E-33
Kr-85	49.382	44427	325770	887850	880050	859420	814470	511260
Kr-85m	918.74	765100	5192500	12123000	4748800	390130	5.3719	3.99E-42
Kr-87	1753.5	1201600	6708800	10601000	399180	63.587	5.45E-16	
Kr-88	2468.7	1966200	12761000	27246000	6244100	122820	0.002719	1.24E-69
Rb-86	9.4296	7435.6	16768	33007	536.02	0.64431	0.000408	7.78E-32
Sr-89			365890	983690	16068	19.619	0.013328	4.67E-30
Sr-90			43512	117050	1918.5	2.3638	0.001673	8.37E-31
Sr-91			432400	1081300	11440	4.3863	1.62E-05	1.37E-52
Sr-92			392690	817940	2889.6	0.059457	4.23E-13	
Y-90			574.92	2114.9	153.22	0.53504	0.001081	8.37E-31
Y-91			4779	12953	229.52	0.30804	0.000219	8.06E-32
Y-92			25714	131610	4772.3	0.5716	4.09E-10	1.78E-90
Y-93			5547.5	13933	151.3	0.062175	3.15E-07	3.97E-53
Zr-95			6673.8	17945	293.34	0.35883	0.000246	9.29E-32
Zr-97			6494.9	16769	214.91	0.13738	5.07E-06	1.95E-44
Nb-95			6721.7	18081	296.35	0.36503	0.000258	1.19E-31
Mo-99			95023	252940	3892.8	4.0546	0.001348	9.62E-34
Tc-99m			84719	227510	3631.5	3.9167	0.001319	9.41E-34
Ru-103			80588	216620	3535.1	4.3048	0.00289	9.15E-31
Ru-105			48614	111870	718.67	0.072845	6.77E-10	1.67E-79
Ru-106			32631	87772	1438	1.7696	0.001246	5.94E-31
Rh-105			51965	139420	2162.7	2.0299	0.000352	8.59E-37
Sb-127			112430	300190	4703.9	5.1404	0.00212	9.85E-33
Sb-129			285310	653720	4091.7	0.38694	2.63E-09	4.35E-80
Te-127			113920	305120	4859.2	5.4798	0.002525	2.61E-31
Te-127m			15230	40974	671.91	0.82856	0.000585	2.54E-31
Te-129			303700	735740	5767.4	2.1735	0.001195	3.5E-31
Te-129m			48780	131240	2147.9	2.6158	0.001741	5.1E-31
Te-131m			145150	381530	5444.2	4.635	0.000622	1.71E-37
Te-132			1431400	3816500	59317	63.424	0.023717	4.71E-32
I-131	3669.4	2911000	7592000	15731000	1190100	879460	643650	43146
I-132	5300.8	3893200	9785300	18530000	352070	3037.4	0.037155	7.37E-32
I-133	7433	5809300	14925000	30012000	1899100	872090	75040	4.41E-05
I-134	8144.6	4360700	7671800	7233800	4865.9	0.012209	2.19E-27	
I-135	6960.6	5249100	13012000	24359000	1003400	146690	73.142	1.76E-27
Xe-133	7096.9	6385000	46773000	127200000	123050000	111940000	73336000	1495300
Xe-135	2509.7	2367600	17591000	48674000	37379000	14707000	81444	1.16E-16
Cs-134	910.59	718570	1621600	3197000	52391	64.514	0.045544	2.23E-29
Cs-136	291.39	229690	517800	1018600	16477	19.598	0.011837	1.5E-30
Cs-137	546.35	431150	973020	1918300	31443	38.741	0.02742	1.37E-29
Ba-139			444640	723370	580.17	0.000229	3.05E-23	
Ba-140			705090	1892400	30600	36.361	0.021863	2.66E-30
La-140			10519	42842	3657.1	12.334	0.01915	3.07E-30
La-141			5609.8	12650	71.965	0.005275	1.14E-11	9.12E-87
La-142			4115.4	7061.7	7.7972	7.218E-06	4.46E-23	
Ce-141			16764	45078	735.62	0.89402	0.000594	1.71E-31
Ce-143			15096	39765	574.62	0.50593	7.89E-05	8.03E-38
Ce-144			13727	36923	604.84	0.74405	0.000523	2.46E-31
Pr-143			6037	16263	270.95	0.3428	0.000234	3.22E-32
Nd-147			6734.1	18067	291.51	0.34438	0.000202	1.96E-32
Np-239			217130	576970	8786.2	8.8971	0.002605	6.2E-34
Pu-238			48.013	129.16	2.1171	0.0026088	1.85E-06	9.27E-34
Pu-239			4.8395	13.02	0.2136	0.0002637	1.88E-07	9.44E-35
Pu-240			6.6393	17.86	0.29274	0.0003607	2.55E-07	1.28E-34
Pu-241			2003	5388.2	88.315	0.10881	7.7E-05	3.84E-32
Am-241			1.031	2.774	0.045566	5.646E-05	4.1E-08	2.49E-35
Cm-242			259.52	698	11.429	0.014042	9.81E-06	4.4E-33
Cm-244			16.654	44.801	0.73431	0.0009047	6.4E-07	3.2E-34
Total	48063.08	36340073	1.51E+08	342798466	177438634	129921025	74950683	2049706

Reactor Building

No holdup in this compartment by design

Curie loading at time

Time(hr) -->	0.0006	0.5	1	2	8	24	96	720
Nuclides								
Co-58		8.45E-05	0.000382	6.25E-06	7.65E-09	2.63E-12	1.02E-39	
Co-60		0.000101	0.000457	7.5E-06	9.24E-09	3.27E-12	1.62E-39	
Kr-85	0.013102	0.096099	0.43939	0.43604	0.42582	0.20177	0.12666	
Kr-85m	0.22562	1.5317	5.9994	2.3529	0.1933	1.33E-06	9.88E-49	
Kr-87	0.35434	1.979	5.2463	0.19778	3.15E-05	1.35E-22		
Kr-88	0.57982	3.7643	13.484	3.0938	0.060853	6.74E-10	3.06E-76	
Rb-86	0.002193	0.00495	0.016341	0.000266	3.19E-07	1.01E-10	1.93E-38	
Sr-89		0.10792	0.48688	0.00797	9.73E-06	3.3E-09	1.16E-36	
Sr-90		0.012833	0.057932	0.000952	1.17E-06	4.15E-10	2.07E-37	
Sr-91		0.12753	0.5352	0.005674	2.17E-06	4.02E-12	3.4E-59	
Sr-92		0.11582	0.40484	0.001433	2.95E-08	1.05E-19		
Y-90		0.00017	0.001047	7.6E-05	2.65E-07	2.68E-10	2.07E-37	
Y-91		0.00141	0.006411	0.000114	1.53E-07	5.43E-11	2E-38	
Y-92		0.007596	0.065223	0.002367	2.83E-07	1.01E-16	4.41E-97	
Y-93		0.001636	0.006896	7.5E-05	3.08E-08	7.79E-14	9.84E-60	
Zr-95		0.001968	0.008882	0.000145	1.78E-07	6.09E-11	2.3E-38	
Zr-97		0.001916	0.0083	0.000107	6.81E-08	1.26E-12	4.83E-51	
Nb-95		0.001983	0.008949	0.000147	1.81E-07	6.39E-11	2.96E-38	
Mo-99		0.028026	0.12519	0.001931	2.01E-06	3.34E-10	2.38E-40	
Tc-99m		0.024987	0.11261	0.001801	1.94E-06	3.27E-10	2.33E-40	
Ru-103		0.023768	0.10722	0.001753	2.13E-06	7.16E-10	2.27E-37	
Ru-105		0.014338	0.055371	0.000356	3.61E-08	1.68E-16	4.15E-86	
Ru-106		0.009624	0.043443	0.000713	8.77E-07	3.09E-10	1.47E-37	
Rh-105		0.015326	0.069008	0.001073	1.01E-06	8.73E-11	2.13E-43	
Sb-127		0.033161	0.14858	0.002333	2.55E-06	5.25E-10	2.44E-39	
Sb-129		0.084149	0.32356	0.002029	1.92E-07	6.52E-16	1.08E-86	
Te-127		0.0336	0.15102	0.00241	2.72E-06	6.26E-10	6.46E-38	
Te-127m		0.004492	0.02028	0.000333	4.11E-07	1.45E-10	6.3E-38	
Te-129		0.089574	0.36415	0.002861	1.08E-06	2.96E-10	8.68E-38	
Te-129m		0.014387	0.064957	0.001065	1.3E-06	4.31E-10	1.26E-37	
Te-131m		0.04281	0.18884	0.0027	2.3E-06	1.54E-10	4.23E-44	
Te-132		0.42218	1.889	0.029419	3.14E-05	5.88E-09	1.17E-38	
I-131	0.000101	1.2222	3.2095	11.43	4.1573	3.8013	2.7438	0.2691
I-132	0.000146	1.6329	4.1217	13.351	1.5424	0.71518	0.38234	0.001424
I-133	0.000204	2.4391	6.3096	21.806	6.6333	3.7666	0.31914	2.74E-10
I-134	0.000224	1.8309	3.2432	5.2559	0.016996	5.27E-08	9.31E-33	
I-135	0.000191	2.2039	5.5009	17.698	3.5049	0.63356	0.000311	1.1E-32
Xe-133		1.8839	13.802	62.985	61.195	56.032	18.92	0.39496
Xe-135		0.70916	5.2373	24.428	19.997	8.4604	0.029595	4.93E-23
Cs-134		0.21196	0.47872	1.5827	0.025984	3.2E-05	1.13E-08	5.52E-36
Cs-136		0.067755	0.15286	0.50428	0.008172	9.72E-06	2.93E-09	3.71E-37
Cs-137		0.12718	0.28724	0.9497	0.015595	1.92E-05	6.79E-09	3.4E-36
Ba-139			0.13114	0.35803	0.000288	1.14E-10	7.57E-30	
Ba-140			0.20796	0.93665	0.015177	1.8E-05	5.42E-09	6.6E-37
La-140			0.003104	0.021221	0.001814	6.12E-06	4.75E-09	7.61E-37
La-141			0.001655	0.006261	3.57E-05	2.62E-09	2.83E-18	2.26E-93
La-142			0.001214	0.003495	3.87E-06	3.58E-12	1.11E-29	
Ce-141			0.004944	0.022311	0.000365	4.43E-07	1.47E-10	4.23E-38
Ce-143			0.004453	0.019682	0.000285	2.51E-07	1.96E-11	1.99E-44
Ce-144			0.004049	0.018275	0.0003	3.69E-07	1.3E-10	6.09E-38
Pr-143			0.001781	0.008049	0.000134	1.7E-07	5.8E-11	7.98E-39
Nd-147			0.001986	0.008942	0.000145	1.71E-07	5E-11	4.85E-39
Np-239			0.06404	0.28557	0.004358	4.41E-06	6.45E-10	1.54E-40
Pu-238			1.42E-05	6.39E-05	1.05E-06	1.29E-09	4.58E-13	2.3E-40
Pu-239			1.43E-06	6.44E-06	1.06E-07	1.31E-10	4.65E-14	2.34E-41
Pu-240			1.96E-06	8.84E-06	1.45E-07	1.79E-10	6.33E-14	3.17E-41
Pu-241			0.000591	0.002667	4.38E-05	5.4E-08	1.91E-11	9.52E-39
Am-241				1.37E-06	2.26E-08	2.8E-11	1.02E-14	6.18E-42
Cm-242			7.65E-05	0.000345	5.67E-06	6.96E-09	2.43E-12	1.09E-39
Cm-244			4.91E-06	2.22E-05	3.64E-07	4.49E-10	1.59E-13	7.93E-41

Environment

Integral Curie loading at time

Time(hr) -->	0.0006	0.5	1	2	8	24	96	720
Nuclides								
Co-58			0.000391	0.003354	0.011695	0.021491	0.030652	0.056946
Co-60			0.000468	0.004017	0.014015	0.025813	0.037034	0.072437
Kr-85	3.63E-06	2.9409	27.533	190.71	1758.2	7066.9	24078	273580
Kr-85m	6.75E-05	51.786	453.79	2825	16549	26491	27051	27051
Kr-87	0.000129	86.157	640.72	3087.4	8319.8	8559.9	8560	8560
Kr-88	0.000181	134.82	1137.5	6666.6	31304	39929	40036	40036
Rb-86		0.025417	0.058512	0.19941	0.57288	1.0276	1.4331	2.3359
Sr-89			0.4994	4.2807	14.922	27.396	38.98	70.974
Sr-90			0.059384	0.50922	1.7768	3.2728	4.6964	9.2015
Sr-91			0.59636	4.8749	15.017	20.347	20.876	20.878
Sr-92			0.55622	4.0441	9.7188	10.282	10.284	10.284
Y-90			0.000749	0.008138	0.059174	0.29051	0.94079	5.0181
Y-91			0.006516	0.056176	0.2009	0.38968	0.57827	1.113
Y-92			0.029844	0.46958	3.2878	4.9658	4.9939	4.9939
Y-93			0.007646	0.062681	0.19443	0.26689	0.27484	0.27488
Zr-95			0.009109	0.078085	0.27225	0.50018	0.71294	1.3174
Zr-97			0.008917	0.074425	0.24162	0.36538	0.39305	0.39423
Nb-95			0.009174	0.078664	0.27448	0.50553	0.72516	1.4067
Mo-99			0.12988	1.106	3.7868	6.586	8.3208	9.3276
Tc-99m			0.11564	0.99067	3.4366	6.1035	7.7972	8.7824
Ru-103			0.11	0.94276	3.2852	6.026	8.5536	15.277
Ru-105			0.067863	0.52569	1.4317	1.6431	1.6472	1.6472
Ru-106			0.044535	0.38187	1.3323	2.4529	3.5159	6.8178
Rh-105			0.07093	0.60742	2.0951	3.5865	4.2592	4.4179
Sb-127			0.15361	1.3107	4.5119	7.9727	10.386	12.406
Sb-129			0.39853	3.0786	8.3351	9.5137	9.5351	9.5351
Te-127			0.15558	1.3302	4.603	8.2363	10.938	14.292
Te-127m			0.020786	0.17825	0.62208	1.1463	1.645	3.16
Te-129			0.42006	3.3728	9.698	12.074	13.148	15.867
Te-129m			0.066571	0.57092	1.9919	3.6579	5.1875	9.1429
Te-131m			0.19875	1.6786	5.6202	9.1832	10.579	10.822
Te-132			1.956	16.675	57.26	100.45	128.98	149.07
I-131	0.00027	18.326	63.657	239.01	1348	4056.3	13238	41752
I-132	0.00039	25.292	84.039	294.82	1039.9	1651.2	2960.3	4385.7
I-133	0.000546	36.833	126.45	465.18	2409.3	5845.1	9707.6	10101
I-134	0.000599	33.345	86.764	201.12	317.61	318.48	318.48	318.48
I-135	0.000512	33.852	113.05	396.3	1698.3	2826.7	3048.2	3048.3
Xe-133	0.000522	423.27	3959.9	27401	250500	972640	2837900	8687100
Xe-135	0.000184	161.49	1534	10860	96960	268650	334200	334620
Cs-134	6.69E-05	2.4551	5.6549	19.294	55.583	100.55	143.32	277.51
Cs-136	2.14E-05	0.78532	1.8075	6.157	17.667	31.572	43.634	67.126
Cs-137	4.02E-05	1.4731	3.393	11.577	33.354	60.349	86.067	167.46
Ba-139			0.65341	4.0806	7.7735	7.8331	7.8331	7.8331
Ba-140			0.96261	8.242	28.641	52.084	72.345	111.32
La-140			0.013446	0.15922	1.332	6.7751	19.735	61.645
La-141			0.007854	0.060057	0.15916	0.17842	0.17868	0.17868
La-142			0.006	0.038692	0.076915	0.077807	0.077807	0.077807
Ce-141			0.02288	0.19615	0.68363	1.2534	1.7756	3.1171
Ce-143			0.020665	0.17477	0.58733	0.96925	1.1301	1.1636
Ce-144			0.018735	0.16064	0.56044	1.0317	1.4783	2.8576
Pr-143			0.008238	0.070708	0.24792	0.46241	0.66819	1.107
Nd-147			0.009194	0.078702	0.27331	0.496	0.68556	1.0256
Np-239			0.29686	2.5251	8.618	14.852	18.463	20.189
Pu-238	6.55E-05	0.000562	0.001961	0.003612	0.005183	0.010164		
Pu-239	6.6E-06	5.66E-05	0.000198	0.000364	0.000524	0.001031		
Pu-240	9.06E-06	7.77E-05	0.000271	0.000499	0.000717	0.001405		
Pu-241	0.002734	0.023441	0.081796	0.15066	0.21618	0.4234		
Am-241	1.41E-06	1.21E-05	4.21E-05	7.78E-05	0.000112	0.000231		
Cm-242	0.000354	0.003037	0.010594	0.019493	0.027899	0.053389		
Cm-244	2.27E-05	0.000195	0.00068	0.001253	0.001798	0.003521		

Suppression Pool


Curie loading at time

Time(hr) -->	0.0006	0.5	1	2	8	24	96	720
Nuclides								
Co-58			309.31	927.51	924.69	917.22	884.35	644.57
Co-60			370.35	1111	1110.2	1108.2	1099.1	1023.7
Kr-85								
Kr-85m								
Kr-87								
Kr-88								
Rb-86	9.4311	8481.2	19774	42305	41889	40800	36238	12969
Sr-89			394820	1183700	1179000	1166400	1111400	731260
Sr-90			46952	140850	140760	140530	139510	130940
Sr-91			466580	1301200	839380	260780	1354.2	2.15E-17
Sr-92			423730	984260	212010	3534.9	3.53E-05	1.61E-74
Y-90			623.75	2620.3	11313	31868	90133	131040
Y-91			5157.5	15602	16854	18328	18273	12628
Y-92			28310	168470	353260	34119	0.034223	2.79E-55
Y-93			5986.1	16766	11101	3696.5	26.226	6.22E-18
Zr-95			7201.4	21593	21522	21334	20505	14545
Zr-97			7008.4	20179	15768	8167.5	423.15	3.05E-09
Nb-95			7253.1	21758	21743	21702	21495	18695
Mo-99			102540	304380	285620	241060	112370	150.57
Tc-99m			91417	273780	266450	232860	109950	147.33
Ru-103			86959	260670	259370	255930	241010	143210
Ru-105			52457	134620	52729	4330.8	0.056482	2.62E-44
Ru-106			35211	105620	105510	105210	103870	92991
Rh-105			56073	167770	158680	120680	29365	0.1345
Sb-127			121320	361230	345130	305610	176810	1540.9
Sb-129			307870	786650	300210	23004	0.21956	6.8E-45
Te-127			122930	367160	356520	325790	210560	40816
Te-127m			16435	49306	49299	49260	48783	39792
Te-129			327710	885340	423160	129220	99655	54782
Te-129m			52636	157930	157590	155520	145170	79825
Te-131m			156620	459110	399440	275560	51839	0.026695
Te-132			1544600	4592600	4352100	3770700	1977700	7366.8
I-131	3669.9	3297200	8777800	19683000	19259000	18169000	13952000	1395000
I-132	5301.6	4396500	11207000	22665000	7450400	3966500	2093900	7798.9
I-133	7434.1	6580100	17257000	37553000	30729000	18001000	1622500	0.001421
I-134	8145.7	4939300	8870200	9051400	78736	0.252	4.73E-26	0
I-135	6961.6	5945600	15045000	30479000	16237000	3027900	1581.5	5.68E-26
Xe-133	0.02206	9578.9	42879	192120	1257700	3088000	4060600	132330
Xe-135	0.25069	105220	454550	1896500	8101300	6383400	50853	1.11E-16
Cs-134	910.72	819620	1912400	4097600	4094200	4085200	4045000	3713000
Cs-136	291.43	261990	610630	1305600	1287600	1241000	1051400	249740
Cs-137	546.43	491780	1147500	2458700	2457200	2453200	2435400	2285800
Ba-139			479790	870460	42568	13.614	2.55E-15	0
Ba-140			760830	2277200	2245100	2161700	1823100	416550
La-140			11438	53482	270060	734630	1597200	480480
La-141			6053.3	15223	5280.2	313.61	0.000951	1.43E-51
La-142			4440.8	8497.6	572.09	0.42911	3.72E-15	0
Ce-141			18089	54243	53972	53151	49504	26731
Ce-143			16290	47851	42160	30079	6582.2	0.012571
Ce-144			14813	44431	44378	44235	43601	38474
Pr-143			6514.4	19572	19883	20383	19510	5040.6
Nd-147			7266.5	21741	21388	20474	16821	3063.6
Np-239			234300	694290	644650	528960	217190	96.955
Pu-238			51.809	155.42	155.33	155.1	154.04	145.15
Pu-239			5.2221	15.668	15.672	15.678	15.649	14.767
Pu-240			7.1642	21.492	21.479	21.445	21.293	20.018
Pu-241			2161.4	6483.8	6479.7	6468.9	6420.5	6015.5
Am-241			1.1125	3.3381	3.3433	3.3569	3.4176	3.9006
Cm-242			280.04	839.94	838.54	834.84	818.4	688.78
Cm-244			17.971	53.91	53.877	53.788	53.39	50.057

Control Room Filter

Curie loading at time

Time(hr) -->	0.0006	0.5	1	2	8	24	96	720
Nuclides								
Co-58			1.91E-09	2.17E-07	8.03E-07	1.63E-06	2.1E-06	2.67E-06
Co-60			2.28E-09	2.6E-07	9.65E-07	1.97E-06	2.61E-06	4.24E-06
Kr-85								
Kr-85m								
Kr-87								
Kr-88								
Rb-86	2.87E-05	2.9E-05	3.96E-05	6.72E-05	0.000104	0.000115	6.53E-05	
Sr-89		2.43E-06	0.000277	0.001024	0.002078	0.002643	0.003026	
Sr-90		2.89E-07	3.3E-05	0.000122	0.00025	0.000332	0.000542	
Sr-91		2.88E-06	0.000305	0.000729	0.000465	3.22E-06	8.89E-26	
Sr-92		2.61E-06	0.000231	0.000184	6.3E-06	8.39E-14	6.65E-83	
Y-90		4.21E-09	6.89E-07	9.97E-06	5.69E-05	0.000214	0.000542	
Y-91		3.19E-08	3.67E-06	1.47E-05	3.27E-05	4.35E-05	5.23E-05	
Y-92		2.35E-07	4.95E-05	0.000313	6.12E-05	8.18E-11	1.16E-63	
Y-93		3.69E-08	3.93E-06	9.64E-06	6.59E-06	6.24E-08	2.57E-26	
Zr-95		4.44E-08	5.06E-06	1.87E-05	3.8E-05	4.88E-05	6.02E-05	
Zr-97		4.32E-08	4.73E-06	1.37E-05	1.46E-05	1.01E-06	1.26E-17	
Nb-95		4.47E-08	5.1E-06	1.89E-05	3.87E-05	5.11E-05	7.74E-05	
Mo-99		6.32E-07	7.13E-05	0.000248	0.000429	0.000267	6.23E-07	
Tc-99m		5.63E-07	6.41E-05	0.000231	0.000415	0.000262	6.1E-07	
Ru-103		5.36E-07	6.11E-05	0.000225	0.000456	0.000573	0.000593	
Ru-105		3.23E-07	3.15E-05	4.58E-05	7.72E-06	1.34E-10	1.08E-52	
Ru-106		2.17E-07	2.47E-05	9.17E-05	0.000187	0.000247	0.000385	
Rh-105		3.46E-07	3.93E-05	0.000138	0.000215	6.98E-05	5.57E-10	
Sb-127		7.48E-07	8.46E-05	0.0003	0.000544	0.000421	6.38E-06	
Sb-129		1.9E-06	0.000184	0.000261	4.1E-05	5.22E-10	2.81E-53	
Te-127		7.58E-07	8.6E-05	0.00031	0.00058	0.000501	0.000169	
Te-127m		1.01E-07	1.16E-05	4.28E-05	8.78E-05	0.000116	0.000165	
Te-129		2.02E-06	0.000207	0.000368	0.00023	0.000237	0.000227	
Te-129m		3.24E-07	3.7E-05	0.000137	0.000277	0.000345	0.00033	
Te-131m		9.65E-07	0.000108	0.000347	0.000491	0.000123	1.1E-10	
Te-132		9.52E-06	0.001076	0.003781	0.006717	0.004704	3.05E-05	
I-131	0.011118	0.011237	0.022093	0.036046	0.060793	0.075604	0.048982	
I-132	0.013941	0.012156	0.020723	0.009439	0.007226	0.00501	3.23E-05	
I-133	0.02219	0.022097	0.042161	0.057536	0.060266	0.008805	5E-11	
I-134	0.016657	0.011358	0.010162	0.000147	8.44E-10	2.57E-34		
I-135	0.02005	0.019265	0.03422	0.030401	0.010137	8.58E-06	2E-33	
Xe-133								
Xe-135								
Cs-134	0.002774	0.002806	0.003835	0.006563	0.010413	0.01283	0.018705	
Cs-136	0.000887	0.000896	0.001222	0.002064	0.003163	0.003335	0.001258	
Cs-137	0.001665	0.001684	0.002301	0.003939	0.006253	0.007724	0.011515	
Ba-139		2.96E-06	0.000204	3.7E-05	2.43E-08	6.06E-24		
Ba-140		4.69E-06	0.000534	0.001951	0.003851	0.004336	0.001724	
La-140		7.98E-08	1.45E-05	0.000238	0.001313	0.0038	0.001988	
La-141		3.73E-08	3.57E-06	4.59E-06	5.59E-07	2.26E-12	5.9E-60	
La-142		2.74E-08	1.99E-06	4.97E-07	7.64E-10	8.85E-24		
Ce-141		1.11E-07	1.27E-05	4.69E-05	9.47E-05	0.000118	0.000111	
Ce-143		1E-07	1.12E-05	3.66E-05	5.36E-05	1.57E-05	5.2E-11	
Ce-144		9.13E-08	1.04E-05	3.86E-05	7.88E-05	0.000104	0.000159	
Pr-143		4.02E-08	4.59E-06	1.73E-05	3.63E-05	4.64E-05	2.09E-05	
Nd-147		4.48E-08	5.09E-06	1.86E-05	3.65E-05	4E-05	1.27E-05	
Np-239		1.44E-06	0.000163	0.00056	0.000942	0.000517	4.01E-07	
Pu-238		3.19E-10	3.64E-08	1.35E-07	2.76E-07	3.66E-07	6.01E-07	
Pu-239		3.22E-11	3.67E-09	1.36E-08	2.79E-08	3.72E-08	6.11E-08	
Pu-240		4.42E-11	5.04E-09	1.87E-08	3.82E-08	5.06E-08	8.28E-08	
Pu-241		1.33E-08	1.52E-06	5.63E-06	1.15E-05	1.53E-05	2.49E-05	
Am-241		6.86E-12	7.82E-10	2.9E-09	5.98E-09	8.13E-09	1.61E-08	
Cm-242		1.73E-09	1.97E-07	7.29E-07	1.49E-06	1.95E-06	2.85E-06	
Cm-244		1.11E-10	1.26E-08	4.68E-08	9.58E-08	1.27E-07	2.07E-07	

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix K - Page: <u>K1</u> of <u>K7</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX K

TABLE DERIVATIONS

Final tables

Steam Line	A	B	C	D	Notes
dwg	731E611 #5	731E611 #6	731E611 #7	731E611 #8	
Pipe diameter (ft)	2	2	2	2	(nominal) ¹
Horizontal Length Vessel to inboard MSIV (ft)	44.34	30.49	29.41	43.83	
Total Length Vessel to inboard MSIV (ft)	51.50	33.99	32.82	50.83	
dwg	731E611 #1	731E611 #1	731E611 #1	731E611 #1	
in-between MSIVs (ft)	18.57	16.64	16.64	18.57	²
dwg	2841-2	2841-2	2841-2	2841-2	
MSIV to Header (ft)	263.31	259.79	252.78	249.27	³
Total length (ft)	326.22	306.92	298.83	311.68	³

keys below

Temperature vessel-header (F) 239.00 F
 Pressure Vessel (psia) 36.95
 Pressure steam line (psia) >14.7

Dry Well [27]	Pressure (psia)	Tempertaure (F)
Time (hr)		
0.02	42.28	297
7.96	36.95	239
24	31.5	221
Steam Line Wall [38]	>14.7	563
Drains [39]	>14.7	146
Condenser [39]	>14.7	107

Vessel to Header	A	B	C	D
Steam Line				
A_Surf_Up, A _S (ft ²)	652	614	598	623
A_Surf_total, A _{S_Totat} (ft ²)	2095	1950	1899	2002
A_flow (ft ²)	3.14	3.14	3.14	3.14
Volume (ft ³)	1047	975	950	1001
Flow, Q (scfh)	0	150	150	0
Flow, Q (cfs) ⁴	0.000	0.022	0.022	0.000

Steam Line	B	C	B	C
Particulate AEB 98-03	50th %	50th %	10th %	10th %
Settling Velocity, U _g (m/s)	0.00117	0.00117	0.00021	0.00021
Deposition coef, U _g A _S /Q	106	103	19	18
Particulate Deposition eff, η _{grav}	99.1%	99.0%	95.0%	94.9%
Decontamination Factor, DF	106	103	19	18
	0.00937	0.00962		

Elemental

Steam Line	B	C
Temperature (F) [38]	563	563
Deposition Velocity, U (cm/s)	0.0005222	0.0005222
Deposition rate, DR (1/s)	0.0000343	0.0000343
Resuspension rate, RR (1/s)	0.0000150	0.0000150
Elemental Deposition eff, η	45.71%	45.04%
Decontamination Factor, DF	1.8	1.8

Condenser

dwg	EC93877GA
Pipe outer diameter (ft)	0.0729
Number of Tubes	25000
Condenser Length (ft)	32
A_Surf_total, A _{S_Totat} (ft ²)	232500
A_flow_steam (ft ²)	1500
Volume_Steam (ft ³)	48000

Condenser

dwg	EC93877GA Sh1
Outer Pipe Diameter (ft)	0.0729
Pipe Length (ft)	40
Number of Tubes	25000
Height (ft)	17
Width (ft)	40
Length 1 shell (ft)	32
Volume Total (ft ³)	21760

Steam Line	B	C	B	C
Particulate AEB 98-03	50th %	50th %	10th %	10th %
Settling Velocity, U_g (m/s)	0.00117	0.00117	0.00021	0.00021
Deposition coef, $U_g A_g / Q$	$= (B30/0.3049) * C21 / C26$	$= (C30/0.3049) * D21 / D26$	$= (D30/0.3049) * C21 / C26$	$= (E30/0.3049) * D21 / D26$
Particulate Deposition eff, η_{grav}	$= 1 - (1/(1+B31))$	$= 1 - (1/(1+C31))$	$= 1 - (1/(1+D31))$	$= 1 - (1/(1+E31))$
Decontamination Factor, DF	=B31	=C31	=D31	=E31

Elemental	A	B	C	D	E	F	G	H	I
Temperature (F) [38]		=I20	=I20						
Deposition Velocity, U (cm/s)		$= EXP(2809/((B38+460)/1.8)-12.5)$	$= EXP(2809/((C38+460)/1.8)-12.5)$						
Deposition rate, DR (1/s)		$= B39 * 0.03281 * C22 / C24$	$= C39 * 0.03281 * D22 / D24$						
Resuspension rate, RR (1/s)		$= 0.0000432 * EXP(-600/((B38+460)/1.8))$	$= 0.0000432 * EXP(-600/((C38+460)/1.8))$						
Elemental Deposition eff, η		$= 1 - (1/(1+((B40-B41) * C24 / C26)))$	$= 1 - (1/(1+((C40-C41) * D24 / D26)))$						
Decontamination Factor, DF		=1/(1-B42)	=1/(1-C42)						

Condenser	
dwg	EC93877GA
Pipe outer diameter (ft)	=Condenser!E6
Number of Tubes	25000
Condenser Length (ft)	32
A_Surf_total, A_{s_Total} (ft ²)	=Condenser!K18
A_flow_steam (ft ²)	=Condenser!K19
Volume_Steam (ft ³)	=Condenser!K17

Condenser	
dwg	EC93877GA Sh1
Outer Pipe Diameter (ft)	=Condenser!E6
Pipe Length (ft)	=Condenser!C6
Number of Tubes	25000
Height (ft)	=Condenser!K13
Width (ft)	=Condenser!K14
Length 1 shell (ft)	32
Volume Total (ft ³)	=H49*H50*H51

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 Calc. No.: ALION-CAL-NPPD-3236-002
 Rev. Number: 1

sheet name = Stm Lines

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
2	Main Steam Line lengths																	
4	Inboard	Vessel to upstream MSIV								Inboard	Vessel to upstream MSIV							
5	Stm Line	A	B	C	D				dwg	731E611 #5	slope	731E611 #6	slope	731E611 #7	slope	731E611 #8	slope	
6	dwg	731E611 #5	731E611 #6	731E611 #7	731E611 #8				Stm Lin	A		B		C		D		
7	Dia	2	2	2	2	feet	452005404			2.5	1	2.4166	1	1.25	1	2.333	1	
8	Horiz	44.34	30.49	29.41	43.83	feet	148.06	mean=	14.333	0.5	7	0.5	6.833	0.5	14	0.5		
9	Total Length	51.50	33.99	32.82	50.83			37.0153	3.166	1	2.833	1	2.9166	1	3	1		
10	A_surf_up	88.67	60.97	58.81	87.67	ft^2			3.75	1	1.333	1	1.33	1	4	1		
11	A_surf_total	323.60	213.54	206.23	319.39	ft^2			1.25	1	0.5	1	0.5	1	1.25	1		
12	A_flow	3.14	3.14	3.14	3.14	ft^2			2.5	1	0.66	1	0.5833	1	2.5	1		
13	bends	450.00				degrees			4.25	1	4	1	4	1	2.5	1		
14	Volume	161.80	106.77	103.12	159.70	ft^3			4.5	1	0.833	1	1	1	3	1		
15									5	0.417	8.5833	1	1.66	1	1.5	3	1	
16									6	0.500	2.67	1	4	1	4.25	8.75	1	
17									7	0.583	2.75	1	3.5833	1	3.67	2.5	1	
18									8	0.667	1.25	1	3.667	1	3.66	2.75	1	
19									9	0.750			1.5	1	1.33	1	1.25	1
20									10	0.833	SUM=ler 51.5023		33.9859		32.8229		50.833	
21									11	0.917	sumProduct=horiz	44.3358		30.4859		29.4064		43.833
24	in-between	Between valves																
25	Stm Line	A	B	C	D													
26	dwg	731E611 #5	731E611 #6	731E611 #7	731E611 #8		452005404											
27	Dia	2	2	2	2	feet	452005404											
28	Horiz	18.57	16.64	16.64	18.57	feet												
29	A_surf_Up	37.15	33.27	33.27	37.15	ft^2												
30	A_surf_total	116.70	104.52	104.52	116.70	ft^2												
31	A_flow	3.14	3.14	3.14	3.14	ft^2												
32	bends	0.00				degrees												
33	Volume	58.35	52.26	52.26	58.35	ft^3												
36	Outboard	Downstream MSIV to pipes combine																
37	dwg	2841-2	2841-2	2841-2	2841-2	feet												
38	Stm Line	A	B	C	D		454010775											
39	Dia	2.00	2.00	2.00	2.00	feet												
40	Horiz	263.31	259.79	252.78	249.27	feet												
41	A_surf_Up	526.63	519.59	505.57	498.55	ft^2												
42	A_surf_total	1654.45	1632.33	1588.29	1566.23	ft^2												
43	A_flow	3.14	3.14	3.14	3.14	ft^2												
44	bends	450.00				degrees												
45	Volume	827.22	816.17	794.14	783.12	ft^3												
47	Stm Lines combine into a 36" line																	
48	part goes to primary containemnt isolationand leads to turbine																	
49	part goes on a 20" line toward valves BV1,2,3 and condensers																	
50	most goes past a boundary valve along a 2" line to the condensers.																	
51									Header	U	V	W	X					
52									Horiz	249.2738	252.784	259.7938	263.314					
									Vertical	14.42	14.42	14.42	14.42					

1	0.083
2	0.167
3	0.250
4	0.333
5	0.417
6	0.500
7	0.583
8	0.667
9	0.750
10	0.833
11	0.917

9.16667 1.67708
 20.125
 Per Rockwell drawing P-446396, 20 1/8 inches is the internal distance from the valve seat to its downstream end connection. 10.84 ft includes this internal distance; it is OK if it is OK


Sheet name = Condenser

A	B	C	D	E	F	G	H	I	J	K	L	M	N
2	Condenser & pipe sizes												
3													
4	Surface Area	length	outer diameter	outer diameter	Wall thickness	inner diameter	inner diameter	# tubes	flow area		flow		
5	ft^2	ft	in	ft	in	in	ft		ft^2		gpm		
6	465000	40	0.875	0.072917	0.028	0.819	0.06825	54217.66	186.5799628		631000		
7					22 BWG			50747.73					
8						condensing shell		51000				USAR XI 3.0 main condenser	
9	Asurf_up	148750 ft^2											
10								51000 dwg	EC93877GA		tif file		
11	Vol	7000 ft^3											
12		1 condenser											
13								Height	2*8' 6"		17 feet		
14								Width	39' 11.875"		40 feet		
15								Length (ea)	16'1.5"+15'10.5"		64 feet		2 condensers
16								Volume			43520 ft^3		
17								Steam volume			48000		1 condenser
18								Asurf			232500		in shell
19								Aflow			1500		

sheet name = Q, T & P

A	B	C	D	E	F	G	H	2
drywell free volume (ft^3)	1.32E+05							2
T & P								3
Steam line conditions								4
Wall temp (F)	563 F				Drassler			5
	8 hr							6
Dry Well Pressure	36.95	psia						7
Dry Well temperature	239	F						8
								9
Drain line (T, P)	146 F		14.7 psia					10
								11
Condenser (T, P)	107 F		14.7 psia		Drassler	14.7 std pressur		12
						60 std temper		13
FLOW								14
	scfm >> cfm							15
	[460+T_F]/[460+\$G\$15] * \$G\$14/P_psia * Q_scfm >> Q_cfm							16

			flow from dry well, 0 24	flow from dry well, 24-720				
	(scfh)	(scfm)	(cfm)	(cfm)				17
faulted steam line flow (MSIV)	150	2.500	1.337	0.668				18
other steam lines individual flow	150.0	2.500	1.337	0.6685		0.0212		19
							in each intact line	20
			flow in condenser 0-24 hr	flow in condenser 24-720 hr				21
Flow in condenser	300	5.000	5.452	5.4519				22
	(scfh)	(scfm)	(cfm)	(cfm)				23
Exhaust from condenser	300	5.000	5.452	5.4519				24

	Radiological Dose Analysis for a Loss of Coolant Accident (LOCA) at Cooper Nuclear Station
	Appendix L - Page: <u>L1</u> of <u>L3</u>
	Calc. No.: <u>ALION-CAL-NPPD-3236-002</u>
	Rev. Number: <u>1</u>

APPENDIX L

ALION QA Forms QAP 3.4.2



DESIGN CALCULATION AND ANALYSIS REVIEW CHECKLIST

Appendix L - Page: L2 of L3

CRITERIA	RESPONSE	COMMENTS
Document prepared, formatted & fully legible consistent with the following:		
Applicable Alion Project Plan has been reviewed to determine that the appropriate governing procedure(s) & quality requirements have been correctly implemented?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Appropriate Revisions of Forms were used (Design Calculation & Analysis Cover Page & Design Calculation & Analysis Review Checklist)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
All required sections are included	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Revision History clearly & accurately documents original or revision(s) made	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Correct header (title & page count)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Correct Appendix titles & page count	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Correct Attachment titles & page count	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Alion Intellectual Property (proprietary &/or confidential) identified on cover & each page?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Applicable to Appendix
The document title is consistent with contents?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
The objective(s) are clearly described?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Acceptance criteria clearly identified, reasonable & met?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Is the technical approach & basis used appropriate, clearly defined & referenced for the stated objectives?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Have the appropriate initial boundary conditions and plant operating modes been considered?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Technical inputs are clearly defined, identified, & appropriately referenced?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Codes, standards, &/or regulatory requirements are clearly defined, identified & appropriately referenced?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Assumptions are clearly defined & adequately justified, or flagged for further verification, (e.g. Open Item)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Mathematical derivations specify all mathematical steps necessary for the Reviewer to clearly understand the conclusions?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Empirical correlations used have been correctly applied?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Analytical steps verified without recourse to originator?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Calculations/analyses are clearly presented & consistent with the stated technical approach, design inputs & assumptions?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Results are clearly presented & reasonable (based on inputs)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Uncertainty in calculated results has been considered?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
The conclusions are clearly presented & reasonable?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
If a spreadsheet is used, have the values or formulas been manually verified?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
If uncontrolled software is used, is it clearly identified & results used only for supplemental insights?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Software:		
Was a controlled computer program used? <u>If No, reviewer may skip the next five (5) questions.</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Are computer programs clearly identified as to name & version #?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	



DESIGN CALCULATION AND ANALYSIS REVIEW CHECKLIST

Appendix L - Page: L3 of L3

CRITERIA	RESPONSE	COMMENTS
Are computer programs appropriate for intended use?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Where results rely on computer calculations, the work clearly references the supporting computer runs, & the input & output listings are provided?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Where computer calculations are used, appropriate analysis parameters are used.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
If client provided software, are terms of use clearly delineated?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Additional Criteria:		
Does this analysis support a modification? <u>If No, reviewer may skip the next seven (7) questions.</u>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Have impacts on plant design/licensing basis been considered and addressed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Have appropriate system interface impacts been considered and addressed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Applicable construction & operating experience has been considered?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
The specified parts, equipment, & processes are suitable for the required application?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Specified materials are compatible with each other & the design environmental conditions to which they will be exposed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Adequate maintenance, repair and design features, provisions & requirements are addressed, (including maintenance & in-service inspection accessibility)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Design considered radiation exposure to the public & plant personnel?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Is this a specialized or unique analysis that requires specific review items? If yes, list below or attach additional items.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

Add additional line items below (i.e. as many as needed): or See attached Yes No

CRITERIA	APPLICABLE	COMMENTS
	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

Notes:

1. If items above indicate "NO", the calculation is not acceptable unless an explanation is provided in the "Comments" block, (exceptions are shaded above).
2. Additional line items may be included (or attached) as necessary in the blank boxes provided above

Reviewed By:	Printed/Typed Name	Signature	8/19/08 Date
--------------	--------------------	-----------	-----------------