Duquesne Light
Health Physics Department

A9.621

REVISION	0	1	2	3

Subject Assessment Of The Doses In The Unit 2 Control Room Due To A Locked Rotor Accident At Unit 2 Assuming 18% Failed Fuel	ERS-MPD-91-035	PAGE 1 OF 56

Reference
RCM RP ______ EPP ______ T/S ______ EM ______ DCP ______ Other ______
RIP

Review Category
☒ RSC Req'd ☐ RSC Not Req'd ☐ 10 CFR 50.59 Required

Purpose To calculate the doses to the control room personnel resulting from the Locked Rotor Accident at Unit 2. Assumption of 18% fuel damage and the use of the new fuel is made.

Rev.		
	by / date chk / date app / date	
3	by / date chk / date app / date	
2	by / date chk / date app / date	
1	by / date chk / date app / date	
0	by Mark Duranko date 10/22/91 chk Dan [illegible] date 10/24/91 app (for RSC 11-6-91) [illegible] date 11/6/91	**Checklist** ☒ Purpose ☒ Assumptions ☒ Methodology ☒ Input Data ☒ Results ☒ References **Attachments** ☐ Data Sheets ☒ Illustrations ☒ Printouts ☐ Code Listings

■ BV RECORDS CENTER
■ CALCULATION FILE
■ MGR, Health Physics
■ DIR, RadEng
■ DIR, RadOps-1
■ DIR, RadOps-2
☐ DIR, RadHealth
■ DIR, EnvSvcs.
■ Trng Dept.
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☐ ______

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DISCUSSION

This analysis is made to document the Control Room (CR) dose estimate for a Locked Rotor Accident (LRA) at Unit 2.

This analysis is similar to that done for the Unit 1 LRA, documented in Reference [1], except that the offsite doses are not included in this analysis. They were documented in Calculation ERS-MPD-91-022, Reference [2]. References [1] and [2] should be consulted for further information concerning the background for this calculation.

METHODOLOGY

This analysis will be performed using the TRAILS code documented in Reference [3]. TRAILS is a simple FORTRAN program that mechanizes the solution of first order linear equations and dose calculations. Although the code is documented in detail in Reference [3], the more significant methodologies, constants, and assumptions incorporated into the code are listed below:

The code implements a model of the release that incorporates one or two compartments (or nodes) prior to the release to the environment. The transport of radioactive material through the system is governed by simple first order linear equations based on the postulated flow rates and the radionuclide decay constants.

The offsite dose calculational methods are those provided in Regulatory Guide 1.4 [Ref: 4]. Thyroid dose conversion factors and breathing rates are those provided in TID14844 [Ref: 5] and Regulatory Guide 1.4. The average energy per disintegration for included isotopes (Kr, Xe, I) were calculated from the spectra data provided in the DRALIST data library [Ref: 6], which is a subset of the ORNL Evaluated Nuclear Structure Data File, and which is available in hardcopy as DOE/TIC-11026 [Ref: 7]. This data source was used in lieu of the suggested 6th Edition, Table Of Isotopes, which is no longer in print.

The Control Room is treated as a compartment with variable (by time step) intake, filtration, X/Q, breathing rate, and exhaust rates.

For this analysis the duration Control Room doses (30 days) will be analyzed.

The release modeling that will be utilized is similar to that used by SWEC in the evaluation of the combined Control Room habitability in 1987 [Ref: 8,9]. In that analysis, SWEC performed an evaluation of Control Room doses due to a locked rotor accident at Unit 1 in order to meet Unit 2 licensing commitments, assuming no fuel failures.

Since the Control Room doses are sensitive to the timing of Control Room isolation initiated by area radiation monitors, an evaluation of the Control Room dose rate at various times post-accident is assessed first.

Based on these results, an isolation time is postulated and included as an analysis assumption during evaluation of Control Room dose over the duration of the accident.

The analyses address the following release components:

1. Release of iodine activity from the three steam generators due to technical specification primary-to-secondary leakage. Iodine partitioning is assumed. The activity is based on 18% fuel clad failure, with the fuel clad activity based on Standard Review Plan assumptions (i.e., 30% Kr-85, 10% all others), with the exception of I-131, which is assumed to be 12% in keeping with the conclusions of NUREG/CR-5009 [Ref: 10].

2. Same as #1, but for noble gases with no credit for partitioning.

3. Release of activity released into the RCS and hence to the three steam generators by an iodine spike that occurs concurrent with the locked rotor. RCS leak rate based on technical specifications.

4. Release of the initial activity contained in the steam in all three steam generators at time =0. This activity based on technical specifications.

5. Release of the initial activity of iodine contained in the secondary liquid in all three steam generators at time = 0. (Noble gases are assumed to be in the steam space). This activity based on technical specifications.

Releases from steam generators are based on the steam mass releases described in Reference 11.

INPUT DATA/ASSUMPTIONS

1. General Methodology Based On SRP 15.3.3-15.3.4 [10]
2. Core Inventory From Table 11.1-1 Based On 2766 MWt [11]
3. Core-Gap Fractions
   Kr-85 0.30 [11]
   I-131 0.12 [12]
   Other 0.10 [11]
   The assumptions of References 11 and 12 are included, even though they are not specifically applicable to a locked rotor accident. This is conservative.
4. Fraction Of Rods In DNB = 18% [13]
5. Fraction of Rods Assumed Failed = 18% (Section 15.3.3) [10]
6. Concurrent Spike Appearance Rates, uCi/sec (Tbl. 15.0-10) [11]
   I-131 1.36E6
   I-132 2.52E6
   I-133 3.08E6
   I-134 3.68E6
   I-135 2.81E6
7. Concurrent Spike Duration 0-4 Hours (Tbl. 15.3-3) [11]
   Assume appearance rates are 1/500 for 4-8 hours
8. RCS Volume = 4.2E5 lbs. (Tbl. 11.1-3) [11]
9. RCS Primary-To-Secondary Leakage = 1 gpm Total (Tbl. 15.3-3) [11]
10. Steam Generator Mass (Tbl. 15.3-3) [11]
    Liquid = 99300 lbs.
    Steam = 8700 lbs.

11. Steam Generator Mass Release (Tbl. 15.3-3) [11]
    0-2 hours = 443,878 lbs.
    2-8 hours = 793,644 lbs.
12. Iodine Partitioning In Steam Generators = 0.01 (Tbl. 15.3-3) [11]
13. Duration Of Plant Cooldown By Secondary System (Tbl. 15.3-3) [11]
    i.e., duration of release = 8 hours
14. X/Q Values For The Control Room (Sec/M^3) [14]

0-8 hr	- 1.59E-4	24-96 hr	- 5.96E-5
8-24 hr	- 7.86E-5	96-720 hr	- 3.76E-5

15. Control Room Volume: 1.73E5 cu.ft. (Sec. 6.4) [11]
16. Control Room Normal Intake: 500 cu.ft./min. (Sec. 6.4) [11]
    300 cu.ft./min. From Unit 1 And 200 cu.ft./min. From Unit 2
17. Control Room Pressurization Rate: 690 cu.ft./min. (Sec. 6.4) [11]
18. Control Room Infiltration: 10 cu.ft./min. (Sec. 6.4) [11]
19. Control Room Filter Efficiency: 95% [15]
    To account for the filter bypass indicated in Item 18, this is modified by:
    $$\frac{690(.95) + 10(0)}{690 + 10} = .936$$
20. Control Room Purge Flow: 19800 cu.ft./min. (based on the recirculation fan flow rate which can be used to purge the CR) [11]
21. Purge Initiation At 8 Hours [11]
22. Purge Duration .5 Hours [9]

CONTROL ROOM MODELING, DOSE RATE EVALUATION

For the dose rate evaluation, the Control Room intake and exhaust are set to 500 cu.ft./min., with no filtration. Time steps selected were based on trial calculations which identified the most likely times for the dose rate to reach the safety limit of 1 mR/hr. Note that this value is different than the alarm setpoint of the Control Room monitors. This is explained in Reference [17].

A chart showing the dose rate versus time was prepared. It is included as Attachment 1. The print outs from the TRAILS runs are included as Attachment 2.

The chart shows that the safety limit of 1 mrem/hour is reached at about 2320 seconds (~40 minutes) after the start of the accident. Since it is reasonable to assume operator manual actions after 30 minutes, it will be assumed that the operators will manually initiate isolation at T = 30 minutes.

CONTROL ROOM MODELING, DOSE EVALUATION

In order to be consistent with the results above, the Control Room isolation was assumed to occur at 1800 seconds or 30 minutes.

For the one hour period after isolation the only intake is the unfiltered 10 cu.ft./min. infiltration. The exhaust is equal to the pressurization rate of 690 cu.ft./min. plus the infiltration for a total of 700 cu ft./min.

At one hour following isolation, the Control Room ventilation realigns for filtered intake up to 1000 cu.ft./min. In accordance with the U2 UFSAR, the clean-up rate is 690 cu.ft./min. This is added to the 10 cu.ft./min. infiltration to yield 700 cu.ft./min. exfiltration. The air intake necessary to maintain this is the same 700 cu.ft./min. This ventilation continues until eight hours after the start of the accident.

At eight hours a Control Room purge is initiated. It continues until 8.5 hours at which time the normal system arrangement is restored.

CALCULATION

Source term development, determination of transfer lamodas, and release modeling is the same as in Reference [1] and are not repeated here.

The addition of the CR to the calculation is accomplished by insertion of suitable parameters for the flows, volumes, filtration rates, and X/Q values.

The X/Q parameters were determined by NUS Corporation using the methodology in Reference [14].

The print outs from the cases are included as Attachment 3.

RESULTS

The results and total from the five cases are as follows:

	Gamma Dose (mrem)	Beta Dose (mrem	Thyroid Dose (mrem)
Case 1	6.23E-2	4.31E-1	1.07E+3
2	1.07E+1	1.48E+2	0
3	5.16E-4	3.41E-3	7.39E0
4	1.74E-5	1.23E-4	4.44E-1
5	1.34E-4	1.08E-3	3.58E0
Total (mrem)	1.08E+1	1.48E+2	1.08E+3

CONCLUSION

The dose limits in GDC 19, Reference [16] and the Standard Review Plan, Reference [10] are : Whole Body gamma - 5 rem
Thyroid - 30 rem
Beta Skin dose - 30 rem

The doses developed in this package are: Whole Body gamma - 1.08E-2 rem
Thyroid - 1.08 rem
Beta Skin dose - 1.48E-1 rem

The analysis of the Locked Rotor Accident shows that the Control Room doses are acceptable and the new fuel can be used, but requires that manual isolation of the Control Room occur at 30 minutes after the start of the accident.

REFERENCES

1. ERS-SFL-89-021, Safety Analysis Of The Dose Consequences Of A Locked Rotor Accident At BVPS-1 With 18% Fuel Failure -- EAB, LPZ, Control Room, 1989

2. ERS-MPD-91-022, Offsite Dose Consequences Of A Locked Rotor Accident At Unit 2 With 18% Failed Fuel

3. DLC, Calculation ERS-SFL-089-020, TRAILS: Transport Of Radioactive Material In Linear Systems, 1989

4. NRC, Assumptions Used For Evaluating The Potential Radiological Consequences Of A Loss Of Coolant Accident For Pressurized Water Reactors, Regulatory Guide 1.4, 1974

5. USAEC, Calculation Of Distance Factors For Power And Test Reactor Sites, TID-14844, 1962

6. ORNL, DRALIST: Radioactive Decay Data For Application To Radiation Dosimetry And Radiological Assessments, DLC-80, 1981

7. D. C. Kocher, Radioactive Decay Data Tables, DOE/TIC-11026, 1981

8. SWEC, Calculation 12241-UR(B)-449, Doses In The BV1 And BV2 Combined Control Room Due To A Locked Rotor Accident And A Loss Of Non-Emergency AC Power To Station Auxiliaries Accident At Unit 1 With 500 cfm Normal Ventilation, 1987

9. SWEC, Calculation 12241-UR(VB)-456, Combined BV1-BV2 Control Room Habitability Due To Design Basis Accidents (Except LOCA) At BV1, 1987

10. NRC, Standard Review Plan For The Review Of Safety Analysis Reports For Nuclear Power Plants, LWR Edition, NUREG-0800, 1984

11. DLC, Unit 2 Updated Final Safety Analysis Report

12. NRC, Assessment Of The Use Of Extended Burnup Fuel In Light Water Power Reactors, NUREG/CR-5009, 1988

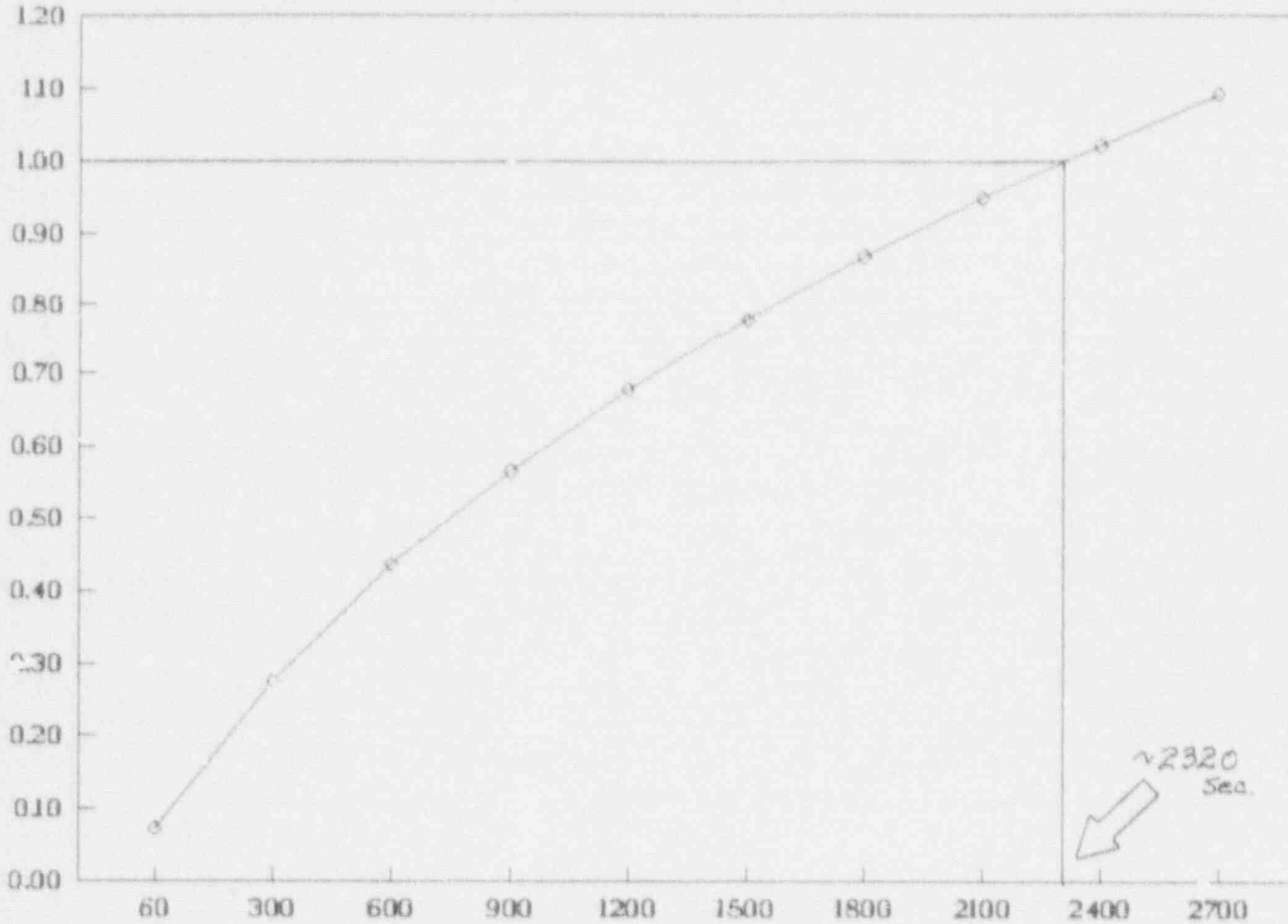
13. Westinghouse, ltr 89DL*-G-0055, dtd 7/13/89, Rods In DNB For Locked Rotor Event

14. Halliburton NUS Environmental Corporation ltr ARP-91-444, dtd 10/8/91, Control Room X/Q Values For BVPS (Attachment 4)

15. USNRC, Safety Evaluation Report, related to the operation of BVPS, Unit 2

CONTROL ROOM ALARM RESPONSE

mrem / hr vs. seconds



Total from all cases for times shown.

CONTROL ROOM ALARM RESPONSE TABLE

Doses obtained from the calculations shown in Attachment 2.
Units are mrem/hr and seconds.

TIME	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	TOTAL
60	7.97E-06	7.19E-02	3.12E-10	7.04E-06	1.17E-06	7.19E-[illegible]
300	1.92E-04	2.74E-01	2.31E-08	6.86E-06	5.79E-06	2.74E-01
600	7.39E-04	4.36E-01	1.78E-07	6.64E-06	1.14E-05	4.37E-01
900	1.60E-03	5.63E-01	5.82E-07	6.44E-06	1.68E-05	5.65E-01
1200	2.73E-03	6.74E-01	1.34E-06	6.24E-06	2.20E-05	6.77E-01
1500	4.11E-03	7.72E-01	2.54E-06	6.05E-06	2.70E-05	7.76E-01
1800	5.69E-03	8.60E-01	4.27E-06	5.88E-06	3.19E-05	8.66E-01
2100	7.47E-03	9.40E-01	6.59E-06	5.70E-06	3.66E-05	9.48E-01
2400	9.40E-03	1.01E+00	9.57E-06	5.54E-06	4.11E-05	1.02E+00
2700	1.15E-02	1.08E+00	1.33E-05	5.38E-06	4.55E-05	1.09E+00

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TRAILS — Transport of Radioactive Material in Linear Systems. v1 1
Case 1 P to S leak. Iodines. 18% F F . CR Dose Rate w/o isol

	COMP RCS		COMP 3 SGs		COMP Control Room (VOLUME 1 730E+05 Cu Ft)	
INITIAL	0 000E+00	KR-83m Ci	0 000E+00	KR-83m	0 000E+00	KR-83m
	0 000E+00	KR-85m	0 000E+00	KR-85m	0 000E+00	KR-85m
	0 000E+00	KR-85	0 000E+00	KR-85	0 000E+00	KR-85
	0 000E+00	KR-87	0 000E+00	KR-87	0 000E+00	KR-87
	0 000E+00	KR-88	0 000E+00	KR-88	0 000E+00	KR-88
	0 000E+00	KR-89	0 000E+00	KR-89	0 000E+00	KR-89
	0 000E+00	KR-90	0 000E+00	KR-90	0 000E+00	KR-90
	0 000E+00	XE-131M	0 000E+00	XE-131M	0 000E+00	XE-131M
	0 000E+00	XE-133M	0 000E+00	XE-133M	0 000E+00	XE-133M
	0 000E+00	XE-133	0 000E+00	XE-133	0 000E+00	XE-133
	0 000E+00	XE-135M	0 000E+00	XE-135M	0 000E+00	XE-135M
	0 000E+00	XE-135	0 000E+00	XE-135	0 000E+00	XE-135
	0 000E+00	XE-137	0 000E+00	XE-137	0 000E+00	XE-137
	0 000E+00	XE-138	0 000E+00	XE-138	0 000E+00	XE-138
	1 490E+06	I-131	0 000E+00	I-131	0 000E+00	I-131
	1 780E+06	I-132	0 000E+00	I-132	0 000E+00	I-132
	2 880E+06	I-133	0 000E+00	I-133	0 000E+00	I-133
	3 240E+06	I-134	0 000E+00	I-134	0 000E+00	I-134
	2 520E+06	I-135	0 000E+00	I-135	0 000E+00	I-135
ACT MULT (to uCi)	1 000E+06		1 000E+00		1 000E+00	
PRODUCTION, uCi/s	0 000E+00	KR-83m	0 000E+00	KR-83m		
	0 000E+00	KR-85m	0 000E+00	KR-85m		
	0 000E+00	KR-85	0 000E+00	KR-85		
	0 000E+00	KR-87	0 000E+00	KR-87		
	0 000E+00	KR-88	0 000E+00	KR-88		
	0 000E+00	KR-89	0 000E+00	KR-89		
	0 000E+00	KR-90	0 000E+00	KR-90		
	0 000E+00	XE-131M	0 000E+00	XE-131M		
	0 000E+00	XE-133M	0 000E+00	XE-133M		
	0 000E+00	XE-133	0 000E+00	XE-133		
	0 000E+00	XE-135M	0 000E+00	XE-135M		
	0 000E+00	XE-135	0 000E+00	XE-135		
	0 000E+00	XE-137	0 000E+00	XE-137		
	0 000E+00	XE-138	0 000E+00	XE-138		
	0 000E+00	I-131	0 000E+00	I-131		
	0 000E+00	I-132	0 000E+00	I-132		
	0 000E+00	I-133	0 000E+00	I-133		
	0 000E+00	I-134	0 000E+00	I-134		
	0 000E+00	I-135	0 000E+00	I-135	INTAKE	1 000E+01 CFM
REMOVAL	3 309E-07 1/sec		2 069E-06 1/sec		1 000E+01 cfm	
NUC 1-14 REL FR		0 000E+00		0 000E+00	INTAKE REDUCT	0 000E+00
NUC 15-20 REL FR		0 000E+00		0 000E+00	INTAKE FILTER	0 000E+00

[illegible] DAT 1 15-OCT-1991 11:06 Page 2

TRAIL Transport of Radioactive Material in Linear Systems, v1.[illegible]
Case 1 P to S leak, Iodines, 18% F.F. ; CR Dose Rate w/o isol

MULTIPLIERS=====

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	[illegible].000E+01	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	[illegible].000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
3	[illegible].000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
4	[illegible].000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
5	1.[illegible]0E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
6	1.500E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
7	1.[illegible]0E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
8	[illegible].190E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
9	[illegible].400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
10	[illegible]	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00

		------- CONTROL ROOM -------			---- ENVIRONMENT ----	
		X/Q s/M3	Breathing M3/s	Occupancy	X/Q s/M3	Breathing M3/s
		1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS=====

STEP	TIME					
1	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
2	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
3	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
4	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
5	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
6	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
7	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
8	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
9	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00
10	[illegible]	1.590E-04	1.00	1.00	0.000E+00	1.00

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TRAILS -- Transport of Radioactive Material in Linear Systems. v1 1
Case 1 P to S leak. Iodines. 18% F F . CR Dose Rate w/o isol

		RCS		3 SGs		AVERAGE		CONTROL ROOM		
		CURRENT	INTEGRD	CURRENT	INTEGRD	RELEASED	RELEASE	CURRENT	CURRENT	INTEGRD
STEP	TIME	uCi	uCi-sec	uCi	uCi-sec	uCi	uCi/sec	uCi	uCi/cc	uCi-sec
I 131	INITIAL	1 490E+12		0 000E+00				0 000E+00		
I 131	TOTALS		4 016E+15		1 790E+12	3 704E+06				1 218E+05
I 132	INITIAL	1 780E+12		0 000E+00				0 000E+00		
I 132	TOTALS		4 300E+15		1 845E+12	3 818E+06				1 231E+05
I 133	INITIAL	2 880E+12		0 000E+00				0 000E+00		
I 133	TOTALS		7 676E+15		3 409E+12	7 053E+06				2 316E+05
I 134	INITIAL	1 240E+12		0 000E+00				0 000E+00		
I 134	TOTALS		6 597E+15		2 653E+12	5 489E+06				1 711E+05
I 135	INITIAL	2 520E+12		0 000E+00				0 000E+00		
I 135	TOTALS		6 540E+15		2 878E+12	5 955E+06				1 946E+05
ALL NUCLIDES		9 826E+12		8 758E+09				8 799E+02	1 796E-07	

@ STEP 10

TRAIL Transport of Radioactive Material in Linear Systems, v1 ;
Case 1 P to S leak, Iodines, 18% F F CR Dose Rate w/o isol

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-131 TOTALS	0 00E+00		0 00E+00		0 00E+00		1 19E-04		1 09E-03		1 29E+01	
I-132 TOTALS	0 00E+00		0 00E+00		0 00E+00		7 24E-04		2 83E-03		4 67E-01	
I-133 TOTALS	0 00E+00		0 00E+00		0 00E+00		3 60E-04		4 45E-03		6 56E+00	
I-134 TOTALS	0 00E+00		0 00E+00		0 00E+00		1 15E-03		4 88E-03		3 03E-01	
I-135 TOTALS	0 00E+00		0 00E+00		0 00E+00		7 86E-04		3 37E-03		1 71E+00	
ALL NUCLIDES												
0 [illegible]167 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	6 66E-08	7 97E-06	3 38E-07	4 06E-05	3 77E-04	4 52E-02
0 0833 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	6 72E-06	1 92E-04	3 43E-05	9 83E-04	3 90E-02	1 [illegible]E+00
0 1667 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	3 90E-05	7 39E-04	2 00E-04	3 80E-03	2 33E-01	4 45E+00
0 2500 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	9 77E-05	[illegible] 50E-03	5 04E-04	8 27E-03	6 00E-01	9 93E+00
0 3333 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	1 81E-04	2 73E-03	9 39E-04	1 42E-02	1 14E+00	1 75E+01
0 4167 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+0[illegible]	2 85E-04	4 11E-03	1 49E-03	2 15E-02	1 86E+00	2 71E+01
0 5000 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+0[illegible]	4 09E-04	5 69E-03	2 15E-03	3 00E-02	2 75E+00	3 88E+01
0 5833 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	5 49E-04	7 47E-03	2 90E-03	3 96E-02	3 80[illegible]	5 23E+01
0 6667 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	7 03E-04	9 40E-03	3 74E-03	5 02E-02	5 01E+00	6 78E+01
0 7500 h	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	0 00E+00	8 70E-04	1 15E-02	4 66E-03	6 17E-02	6 38E+00	8 52E+01
TOTALS	0 00E+00		0 00E+00		0 00E+00		3 14E-07		1 66E-02		2 10E+01	

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TRS — Transport of Radioactive Material in Linear Systems. v1 1
2 P to S leak. Nbl Gases 18% F F .non-equil . CR Dose Rate w/o isol

	COMP Not used for 2A		COMP RCS 18% F F .3 SGs		COMP Control Room VOLUME 1 730E+05 Cu Ft	
INITIAL	0 000E+00	KR-83m	2 160E+05	KR-83m Ci	0 000E+00	KR-83m
	0 000E+00	KR-85m	5 400E+05	KR-85m	0 000E+00	KR-85m
	0 000E+00	KR-85	3 730E+04	KR-85	0 000E+00	KR-85
	0 000E+00	KR-87	1 060E+06	KR-87	0 000E+00	KR-87
	0 000E+00	KR-88	1 490E+06	KR-88	0 000E+00	KR-88
	0 000E+00	KR-89	1 980E+06	KR-89	0 000E+00	KR-89
	0 000E+00	KR-90	0 000E+00	KR-90	0 000E+00	KR-90
	0 000E+00	XE-131M	7 570E+03	XE-131M	0 000E+00	XE-131M
	0 000E+00	XE-133M	6 680E+04	XE-133M	0 000E+00	XE-133M
	0 000E+00	XE-133	2 880E+06	XE-133	0 000E+00	XE-133
	0 000E+00	XE-135M	7 560E+05	XE-135M	0 000E+00	XE-135M
	0 000E+00	XE-135	7 380E+05	XE-135	0 000E+00	XE-135
	0 000E+00	XE-137	2 520E+06	XE-137	0 000E+00	XE-137
	0 000E+00	XE-138	2 520E+06	XE-138	0 000E+00	XE-138
	0 000E+00	I-131	0 000E+00	I-131	0 000E+00	I-131
	0 000E+00	I-132	0 000E+00	I-132	0 000E+00	I-132
	0 000E+00	I-133	0 000E+00	I-133	0 000E+00	I-133
	0 000E+00	I-134	0 000E+00	I-134	0 000E+00	I-134
	0 000E+00	I-135	0 000E+00	I-135	0 000E+00	I-135
ACT MULT (to uCi)	1 000E+00		1 000E+06		1 000E+00	
PRODUCTION uCi/s	0 000E+00	KR-83m	0 000E+00	KR-83m		
	0 000E+00	KR-85m	0 000E+00	KR-85m		
	0 000E+00	KR-85	0 000E+00	KR-85		
	0 000E+00	KR-87	0 000E+00	KR-87		
	0 000E+00	KR-88	0 000E+00	KR-88		
	0 000E+00	KR-89	0 000E+00	KR-89		
	0 000E+00	KR-90	0 000E+00	KR-90		
	0 000E+00	XE-131M	0 000E+00	XE-131M		
	0 000E+00	XE-133M	0 000E+00	XE-133M		
	0 000E+00	XE-133	0 000E+00	XE-133		
	0 000E+00	XE-135M	0 000E+00	XE-135M		
	0 000E+00	XE-135	0 000E+00	XE-135		
	0 000E+00	XE-137	0 000E+00	XE-137		
	0 000E+00	XE-138	0 000E+00	XE-138		
	0 000E+00	I-131	0 000E+00	I-131		
	0 000E+00	I-132	0 000E+00	I-132		
	0 000E+00	I-133	0 000E+00	I-133		
	0 000E+00	I-134	0 000E+00	I-134		
	0 000E+00	I-135	0 000E+00	I-135	INTAKE 1 000E+01 CFM	
REMOVAL	0 000E+00 1/sec		3 309E-07 1/sec		1 000E+01 cfm	
NUC 1-14 REL FR	0 000E+00		0 000E+00		INTAKE REDUCT	0 000E+00
NUC 15-20 REL FR	0 000E+00		0 000E+00		INTAKE FILTER	0 000E+00

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TRAIL Transport of Radioactive Material in Linear Systems. v1 1
Case 3 P to S leak. Nbl Gases. 18% F F (non-equil) . CR Dose Rate w/o isol

MULTIPLIERS====:

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	6 000E+01	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
2	3 000E+02	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
3	6 000E+02	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
4	9 000E+02	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
5	1 200E+03	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
6	1 500E+03	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
7	1 800E+03	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
8	2 100E+03	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
9	2 400E+03	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00
10	2 700E+03	0 000E+00	1 00	0 000E+00	0 000E+00	1 00	0 000E+00	50 0	50 0	0 000E+00

	-------- CONTROL ROOM --------			---- ENVIRONMENT ----	
	X/Q	Breathing	Occupancy	X/Q	Breathing
	s/M3	M3/s		s/M3	M3/s
	1 000E+00	3 470E-04	1 000E+00	1 000E+00	3 470E-04

MULTIPLIERS====:

STEP	TIME, s					
1	6 000E+01	1 590E-04	1 00	1 00	0 000E+00	1 00
2	3 000E+02	1 590E-04	1 00	1 00	0 000E+00	1 00
3	6 000E+02	1 590E-04	1 00	1 00	0 000E+00	1 00
4	9 000E+02	1 590E-04	1 00	1 00	0 000E+00	1 00
5	1 200E+03	1 590E-04	1 00	1 00	0 000E+00	1 00
6	1 500E+03	1 590E-04	1 00	1 00	0 000E+00	1 00
7	1 800E+03	1 590E-04	1 00	1 00	0 000E+00	1 00
8	100E+03	1 590E-04	1 00	1 00	0 000E+00	1 00
9	400E+03	1 590E-04	1 00	1 00	0 000E+00	1 00
10	700E+03	1 590E-04	1 00	1 00	0 000E+00	1 00

TRAILS — Transport of Radioactive Material in Linear Systems. v1 1
Case 2 P to S leak. Nbl Gases. 18% F F . non-equil . CR Dose Rate w/o isol

STEP	TIME	Not used for 2A CURRENT uCi	INTEGRD uCi-sec	RCS 18% F F .3 SGs CURRENT uCi	INTEGRD uCi-sec	RELEASED uCi	AVERAGE RELEASE uCi/sec	CONTROL ROOM CURRENT uCi	CURRENT uCi/cc	INTEGRD uCi-sec
KR-83m	INITIAL	0 000E+00		2 160E+11				0 000E+00		
KR-83m	TOTALS		0 000E+00		5 075E+14	1 679E+08				7 769E+06
KR-85m	INITIAL	0 000E+00		5 400E+11				0 000E+00		
KR-85m	TOTALS		0 000E+00		1 376E+15	4 553E+08				2 167E+07
KR-85	INITIAL	0 000E+00		3 730E+10				0 000E+00		
KR-85	TOTALS		0.000E+00		1 007E+14	3 331E+07				1 617E+06
KR-87	INITIAL	0 000E+00		1 060E+12				0 000E+00		
KR-87	TOTALS		0 000E+00		2 348E+15	7 770E+08				3 518E+07
KR-8F	INITIAL	0 000E+00		1 490E+12				0 000E+00		
KR-88	TOTALS		0 000E+00		3 675E+15	1 216E+09				5 723E+07
KR-89	INITIAL	0 000E+00		1 980E+12				0 000E+00		
KR-89	TOTALS		0 000E+00		5 415E+14	1 792E+08				1 814E+06
XE-131M	INITIAL	0 000E+00		7 570E+09				0 000E+00		
XE-131M	TOTALS		0 000E+00		2 041E+13	6 754E+06				3 277E+05
XE-133M	INITIAL	0 000E+00		6 680E+10				0 000E+00		
XE-133M	TOTALS		0 000E+00		1 794E+14	5 936E+07				2 876E+06
XE-13:	INITIAL	0 000E+00		2 880E+12				0 000E+00		
XE-13:	TOTALS		0 000E+00		7 756E+15	2 567E+09				1 245E+08
XE-135M	INITIAL	0 000E+00		7 560E+11				0 000E+00		
XE-135M	TOTALS		0 000E+00		8 730E+14	2 889E+08				9 631E+06
XE-135	INITIAL	0 000E+00		7 380E+11				0 000E+00		
XE-135	TOTALS		0 000E+00		1 936E+15	6 406E+08				3 080E+07
XE-137	INITIAL	0 000E+00		2 520E+12				0 000E+00		
XE-137	TOTALS		0 000E+00		8 352E+14	2 764E+08				3 + 76E+06
XE-138	INITIAL	0 000E+00		2 520E+12				0 000E+00		
XE-138	TOTALS		0 000E+00		2 742E+15	9 075E+08				2 922E+07
ALL NUCLIDES @ STEP 10		0 000E+C9		6 636E+12				2 087E+05	4 261E 05	

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TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
Case 2: P to S leak, Nbl Gases, 18% F.F., non-equil., CR Dose Rate w/o isol

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	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
KR-83m												
TOTALS	0.00E+00		0.00E+00		0.00E+00		5.18E-05		1.39E-02		0.00E+00	
KR-85m												
TOTALS	0.00E+00		0.00E+00		0.00E+00		8.77E-03		2.60E-01		0.00E+00	
KR-85												
TOTALS	0.00E+00		0.00E+00		0.00E+00		9.12E-06		1.90E-02		0.00E+00	
KR-87												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.16E-02		2.19E+00		0.00E+00	
KR-88												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.87E-01		9.80E-01		0.00E+00	
KR-89												
TOTALS	0.00E+00		0.00E+00		0.00E+00		8.54E-03		1.16E-01		0.00E+00	
XE-131M												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.69E-05		2.19E-03		0.00E+00	
XE-133M												
TOTALS	0.00E+00		0.00E+00		0.00E+00		3.06E-04		2.57E-02		0.00E+00	
XE-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.45E-02		7.92E-01		0.00E+00	
XE-135M												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.06E-02		4.33E-02		0.00E+00	
XE-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.96E-02		4.60E-01		0.00E+00	
XE-137												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.63E-03		2.82E-01		0.00E+00	
XE-138												
TOTALS	0.00E+00		0.00E+00		0.00E+00		8.44E-02		8.66E-01		0.00E+00	
ALL NUCLIDES												
0.0167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-04	7.19E-02	1.09E-02	1.29E+00	0.00E+00	0.00E+00
0.0833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-02	2.74E-01	1.90E-01	4.25E+00	0.00E+00	0.00E+00
0.1667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E-02	4.36E-01	4.19E-01	5.85E+00	0.00E+00	0.00E+00
0.2500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.16E-02	5.63E-01	5.29E-01	6.92E+00	0.00E+00	0.00E+00
0.3333 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-02	6.74E-01	6.17E-01	7.94E+00	0.00E+00	0.00E+00
0.4167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.32E-02	7.72E-01	7.02E-01	8.93E+00	0.00E+00	0.00E+00
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.[illegible]0E-02	8.60E-01	7.83E-01	9.89E+00	0.00E+00	0.00E+00
0.5833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.50E-02	9.40E-01	8.61E-01	1.08E+01	0.00E+00	0.00E+00
0.6667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.14E-02	1.01E+00	9.33E-01	1.16E+01	0.00E+00	0.00E+00
0.7500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.72E-02	1.[illegible]9E+00	1.00E+00	1.24E+01	0.00E+00	0.00E+00
TOTALS	0.00E+00		0.00E+00		0.00E+00		5.07E-01		6.04E+00		0.00E+00	

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TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
Case 3 CONCURRENT SPIKE: Iodines only : CR Dose Rate w/o isol

	COMP RCS	COMP 3 SGs	COMP Control Room VOLUME 1.730E+05 Cu Ft
INITIAL	0.000E+00 KR-83m	0.000E+00 KR-83m	0.000E+00 KR-83m
	0.000E+00 KR-85m	0.000E+00 KR-85m	0.000E+00 KR-85m
	0.000E+00 KR-85	0.000E+00 KR-85	0.000E+00 KR-85
	0.000E+00 KR-87	0.000E+00 KR-87	0.000E+00 KR-87
	0.000E+00 KR-88	0.000E+00 KR-88	0.000E+00 K -88
	0.000E+00 KR-89	0.000E+00 KR-89	0.000E+00 KR-89
	0.000E+00 KR-90	0.000E+00 KR-90	0.000E+00 KR-90
	0.000E+00 XE-131M	0.000E+00 XE-131M	0.000E+00 XE-131M
	0.000E+00 XE-133M	0.000E+00 XE-133M	0.000E+00 XE-133M
	0.000E+00 XE-133	0.000E+00 XE-133	0.000E+00 XE-133
	0.000E+00 XE-135M	0.000E+00 XE-135M	0.000E+00 XE-135M
	0.000E+00 XE-135	0.000E+00 XE-135	0.000E+00 XE-135
	0.000E+00 XE-137	0.000E+00 XE-137	0.000E+00 XE-137
	0.000E+00 XE-138	0.000E+00 XE-138	0.000E+00 XE-138
	0.000E+00 I-131	0.000E+00 I-131	0.000E+00 I-131
	0.000E+00 I-132	0.000E+00 I-132	0.000E+00 I-132
	0.000E+00 I-133	0.000E+00 I-133	0.000E+00 I-133
	0.000E+00 I-134	0.000E+00 I-134	0.000E+00 I-134
	0.000E+00 I-135	0.000E+00 I-135	0.000E+00 I-135
ACT MULT (to uCi)	1.000E+00	1.000E+00	1.000E+00
PRODUCTION, uCi/s	0.000E+00 KR-83m	0.000E+00 KR-83m	
	0.000E+00 KR-85m	0.000E+00 KR-85m	
	0.000E+00 KR-85	0.000E+00 KR-85	
	0.000E+00 KR-87	0.000E+00 KR-87	
	0.000E+00 KR-88	0.000E+00 KR-88	
	0.000E+00 KR-89	0.000E+00 KR-89	
	0.000E+00 KR-90	0.000E+00 KR-90	
	0.000E+00 XE-131M	0.000E+00 XE-131M	
	0.000E+00 XE-133M	0.000E+00 XE-133M	
	0.000E+00 XE-133	0.000E+00 XE-133	
	0.000E+00 XE-135M	0.000E+00 XE-135M	
	0.000E+00 XE-135	0.000E+00 XE-135	
	0.000E+00 XE-137	0.000E+00 XE-137	
	0.000E+00 XE-138	0.000E+00 XE-138	
	1.360E+06 I-131	0.000E+00 I-131	
	2.520E+06 I-132	0.000E+00 I-132	
	3.080E+06 I-133	0.000E+00 I-133	
	3.600E+06 I-134	0.000E+00 I-134	
	2.810E+06 I-135	0.000E+00 I-135	INTAKE 1.000E+01 CFM
REMOVAL	3.309E-07 1/sec	2.069E-06 1/sec	1.000E+01 cfm
NUC 1-14 REL FR	0.000E+00	0.000E+00	INTAKE REDUCT 0.000E+00
NUC 15-20 REL FR	0.000E+00	0.000E+00	INTAKE FILTER 0.000E+00

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TRAILS Transport of Radioactive Mater--l in Linear Systems. v1.1
Case 3: CONCURRENT SPIKE. Iodines only - Dose Rate w/o isol

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	6.000E+01	1.00	1.00	0.000E+00	0.000E+00	1.90	0.000E+00	50.0	50.0	0.000E+00
2	3.000E+02	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
3	6.000E+02	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
4	9.000E+02	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
5	1.200E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
6	1.500E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
7	1.800E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
8	2.100E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
9	2.400E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
10	2.700E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00

	CONTROL ROOM X/Q s/M3	CONTROL ROOM Breathing M3/s	CONTROL ROOM Occupancy	ENVIRONMENT X/Q s/M3	ENVIRONMENT Breathing M3/s
	1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS====>

STEP	TIME, s					
1	6.000E+01	1.590E-04	[illegible]	1.00	0.000E+00	1.00
2	3.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
3	6.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
6	1.500E+03	[illegible]	1.00	1.00	0.000E+00	1.00
7	1.800E+03	[illegible]	1.00	1.00	0.000E+00	1.00
8	2.100E+03	[illegible]	1.00	1.00	0.000E+00	1.00
9	2.400E+03	[illegible]	1.00	1.00	0.000E+00	1.00
10	2.700E+03	[illegible]	1.00	1.00	0.000E+00	1.00

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
Case 3: CONCURRENT SPIKE, Iodines only , CR Dose Rate w/o isol

STEP	TIME	RCS CURRENT uCi	RCS INTEGRD uCi-sec	3 SGs CURRENT uCi	3 SGs INTEGRD uCi-sec	RELEASED uCi	AVERAGE RELEASE uCi/sec	CONTROL ROOM CURRENT uCi	CONTROL ROOM CURRENT uCi/cc	CONTROL ROOM INTEGRD uCi-sec
I-131	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-131	TOTALS		4.951E+12		1.461E+09	3.022E+03				7.520E+01
I-132	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-132	TOTALS		8.528E+12		2.443E+09	5.054E+03				1.233E+02
I-133	INITIAL	[illegible]		0.000E+00				0.000E+00		
I-133	TOTALS		1.113E+13		3.299E+09	6.826E+03				1.701E+02
I-134	INITIAL	0.000E+00		0.00				0.000E+00		
I-134	TOTALS		1.111E+13		2.991E+09	6.189E+03				1.453E+02
I-135	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-135	TOTALS		9.976E+12		2.931E+09	6.064E+03				1.504E+02
ALL NUCLIDES @ STEP 10		3.275E+10		1.412E+07				9.386E-01	1.916E-10	

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TRAILS --- Transport of Radioactive Material in Linear Systems. v1.1
Case 7. CONCURRENT SPIKE. Iodines only - CR Dose Rate w/o isol

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-131												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.35E-08		6.72E-07		7.98E-03	
I-132												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.25E-07		2.84E-06		4.67E-04	
I-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.65E-07		3.27E-06		4.82E-03	
I-134												
TOTALS	0.00E+00		0.00E+00		0.00E+00		9.78E-07		4.14E-06		2.57E-04	
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		6.08E-07		2.60E-06		1.32E-05	
ALL NUCLIDES												
0.0167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-12	3.12E-10	1.44E-11	1.72E-09	7.72E-08	5.25E-06
0.0833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.87E-10	2.31E-08	3.88E-09	1.14E-07	5.24E-06	1.48E-04
0.1667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E-09	1.78E-07	4.20E-08	8.88E-07	4.29E-05	8.79E-04
0.2500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E-08	5.82E-07	1.59E-07	2.92E-06	1.59E-04	2.92E-03
0.3333 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.04E-08	1.34E-06	4.05E-07	6.76E-06	4.10E-04	6.91E-03
0.4167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-07	2.54E-06	8.20E-07	1.29E-05	8.49E-04	1.35E-02
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.85E-07	4.27E-06	1.44E-06	2.17E-05	1.53E-03	2.32E-02
0.5833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.54E-07	6.59E-06	2.31E-06	3.37E-05	2.49E-03	3.66E-02
0.6667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-07	9.57E-06	3.47E-06	4.91E-05	3.79E-03	5.43E-02
0.7500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.53E-07	1.33E-05	4.89E-06	6.83E-05	5.47E-03	7.69E-02
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.65E-06		1.35E-05		1.47E-02	

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TRAIT -- Transport of Radioactive Material in Linear Systems. v1.1
-ase 4. Initial Steam Release Noble Gases & Iodines. CR Dose Rate w/o isol

	COMP Not used for 4		COMP 3 Sus. Initial Steam Rel		COMP Control Room	
			VOLUME		1.730E+05 Cu Ft	
INITIAL	0.000E+00	KR-83m	5.779E-05	KR-83m Ci	0.000E+00	KR-83m
	0.000E+00	KR-85m	2.810E-04	KR-85m	0.000E+00	KR-85m
	0.000E+00	KR-85	1.480E-03	KR-85	0.000E+00	KR-85
	0.000E+00	KR-87	1.610E-04	KR-87	0.000E+00	KR-87
	0.000E+00	KR-88	4.290E-04	KR-88	0.000E+00	KR-88
	0.000E+00	KR-89	1.350E-05	KR-89	0.000E+00	KR-89
	0.000E+00	KR-90	0.000E+00	KR-90	0.000E+00	KR-90
	0.000E+00	XE-131M	1.440E-05	XE-131M	0.000E+00	XE-131M
	0.000E+00	XE-133M	4.13[illegible]E-04	XE-133M	0.000E+00	XE-133M
	0.000E+00	XE-133	3.520E-03	XE-133	0.00[illegible]E+00	XE-133
	0.000E+00	XE-135M	1.460E-04	XE-135M	0.000E+00	XE-135M
	0.000E+00	XE-135	4.310E-04	XE-135	0.000E+00	XE-135
	0.000E+00	XE-137	2.190E-05	XE-137	0.000E+00	XE-137
	0.000E+00	XE-138	9.030E-05	XE-138	0.000E+00	XE-138
	0.[illegible]00E+00	I-131	8.130E-03	I-131	0.000E+00	I-131
	0.000E+00	I-132	2.400E-03	I-132	0.000E+00	I-132
	0.000E+00	I-133	1.160E-03	I-133	0.000E+00	I-133
	0.000E+00	I-134	5.360E-04	I-134	0.000E+00	I-134
	0.[illegible]E+00	I-135	5.210E-03	I-135	0.000E+00	I-135
ACT MULT (to uCi)	1.[illegible]E+00		1.000E+06		1.000E+00	
PRODUCTION uCi/s	0.000E+00	KR-83m	0.000E+00	KR-83m		
	0.000E+00	KR-85m	0.000E+00	KR-85m		
	0.000E+00	KR-85	0.000E+00	KR-85		
	0.000E+00	KR-87	0.000E+00	KR-87		
	0.000E+00	KR-88	0.000E+00	KR-88		
	0.000E+00	KR-89	0.000E+00	KR-89		
	0.000E+00	KR-90	0.000E+00	KR-90		
	0.000E+00	XE-131M	0.000E+00	XE-131M		
	0.000E+00	XE-133M	0.000E+00	XE-133M		
	0.000E+00	XE-133	0.000E+00	XE-133		
	0.000E+00	XE-135M	0.000E+00	XE-135M		
	0.000E+00	XE-135	0.000E+00	XE-135		
	0.000E+00	XE-137	0.000E+00	XE-137		
	0.[illegible]E+00	XE-138	0.000E+00	XE-138		
	0.000E+00	I-131	0.000E+00	I-131		
	0.000E+00	I-132	0.000E+00	I-132		
	0.000E+00	I-133	0.000E+00	I-133		
	0.000E+00	I-134	0.000E+00	I-134		
	0.000E+00	I-135	0.000E+00	I-135	INTAKE	1.000E+01 CFM
REMOVAL	0.000E+00	1/sec	1.285E-01	1/sec	1.000E+01	cfm
NUC 1-14 REL FR	0.000E+00		0.000E+00		INTAKE REDUCT	0.000E+00
NUC 15-20 REL FR	0.000E+00		0.000E+00		INTAKE FILTER	0.000E+00

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TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
Case 4. Initial Steam Release-Noble Gases & Iodines. CR Dose Rate w/o isol

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	6.000E+01	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	3.000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
3	6.000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
4	9.000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
5	1.200E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
6	1.500E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
7	1.800E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
8	2.100E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
9	2.400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
10	2.700E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00

		CONTROL ROOM			ENVIRONMENT	
		X/Q s/M3	Breathing M3/s	Occupancy	X/Q s/M3	Breathing M3/s
		1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS====>

STEP	TIME, s					
1	6.000E+01	1.590E-04	1.00	1.00	0.000E+00	1.00
2	3.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
3	6.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
6	1.500E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
7	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
8	2.100E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
9	2.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
10	2.700E+03	1.590E-04	1.00	1.00	0.000E+00	1.00

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TRAILS -- Transpo'ts of Radioactive Material in Linear Systems v1 1
Case 4 Initial Steam Release.Noble Gases & Iodines CR Dose Rate w/o isol

STEP	TIME	Not used for 4 CURRENT uCi	Not used for 4 INTEGRD uCi-sec	3 SGs. Initial Steam CURRENT uCi	3 SGs. Initial Steam INTEGRD uCi-sec	RELEASED uCi	AVERAGE RELEASE uCi/sec	CONTROL ROOM CURRENT uCi	CONTROL ROOM CURRENT uCi/cc	CONTROL ROOM INTEGRD uCi-sec
KR-83m	INITIAL	0 000E+00		5 770E+01				0 000E+00		
KR-83m	TOTALS		0 000E+00		4 487E+02	5 765E+01				4 737E+00
KR-85m	INITIAL	0 000E+00		2 810E+02				0 000E+00		
KR-85m	TOTALS		0 000E+00		2 186E+03	2 809E+02				2 498E+01
KR-85	INITIAL	0 000E+00		1 480E+03				0 000E+00		
KR-85	TOTALS		0 000E+00		1 152E+04	1 480E+03				1 391E+02
KR-87	INITIAL	0 000E+00		1 610E+02				0 000E+00		
KR-87	TOTALS		0 000E+00		1 251E+03	1 608E+02				1 249E+01
KR-88	INITIAL	0 000E+00		4 290E+02				0 000E+00		
KR-88	TOTALS		0 000E+00		3 337E+03	4 288E+02				3 694E+01
KR-89	INITIAL	0 000E+00		1 350E+01				0 000E+00		
KR-89	TOTALS		0 000E+00		1 022E+02	1 313E+01				1 330E-01
XE-131M	INITIAL	0 000E+00		1 440E+01				0 000E+00		
XE-131M	TOTALS		0 000E+00		1 121E+02	1 440E+0				1 352E+00
XE-133M	INITIAL	0 000E+00		4 130E+02				0 000E+00		
XE-133M	TOTALS		0 000E+00		3 214E+03	4 130E+02				3 864E+01
XE-133	INITIAL	0 000E+00		3 520E+03				0 000E+00		
XE-133	TOTALS		0 000E+00		2 739E+04	3 520E+03				3 302E+02
XE-135M	INITIAL	0 000E+00		1 460E+02				0 000E+00		
XE-135M	TOTALS		0 000E+00		1 130E+03	1 452E+02				6 002E+00
XE-135	INITIAL	0 000E+00		4 310E+02				0 000E+00		
XE-135	TOTALS		0 000E+00		3 354E+03	4 309E+02				3 941E+01
XE-137	INITIAL	0 000E+00		2 190E+01				0 000E+00		
XE-137	TOTALS		0 000E+00		1 665E+02	2 140E+01				2 619E-01
XE-138	INITIAL	0 000E+00		9 030E+01				0 000E+00		
XE-138	TOTALS		0 000E+00		6 983E+02	8 973E+01				3 503E+00
I-131	INITIAL	0 000E+00		8 130E+03				0 000E+00		
I-131	TOTALS		0 000E+00		6 327E+04	8 130E+03				7 632E+02
I-132	INITIAL	0 000E+00		2 400E+03				0 000E+00		
I-132	TOTALS		0 000E+00		1 866E+04	2 398E+03				2 025E+02
I-133	INITIAL	0 000E+00		1 160E+03				0 000E+00		
I-133	TOTALS		0 000E+00		9 027E+03	1 160E+03				1 077E+02
I-134	INITIAL	0 000E+00		5 360E+02				0 000E+00		
I-134	TOTALS		0 000E+00		4 164E+03	5 351E+02				3 830E+01
I-135	INITIAL	0 000E+00		5 210E+03				0 000E+00		
I-135	TOTALS		0 000E+00		4 054E+04	5 209E+03				4 715E+02

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TRAILC Transport of Radioactive Material in Linear Systems, v1.1
Case 4: Initial Steam Release Noble Gases & Iodines, CR Dose Rate w/o isol

	Not used for 4		3 SGs, Initial Steam		AVERAGE		CONTROL ROOM		
	CURRENT	INTEGRD	CURRENT	INTEGRD	RELEASED	RELEASE	CURRENT	CURRENT	INTEGRD
STEP TIME	uCi	uCi-sec	uCi	uCi-sec	uCi	uCi/sec	uCi	uCi/cc	uCi-sec
ALL NUCLIDES	0.000E+00		0.000E+00				7.548E-01	1.541E-10	
@ STEP 10									

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
Case 4. Initial Steam Release Noble Gases & Iodines. CR Dose Rate w/o isol

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE ...
KR-83M TOTALS	0.00E+00		0.00E+00		0.00E+00		3.16E-11		8.50E-09		0.00E+00	
KR-85M TOTALS	0.00E+00		0.00E+00		0.00E+00		1.01E-08		2.99E-07		0.00E+00	
KR-85 TOTALS	0.00E+00		0.00E+00		0.00E+00		7.85E-10		1.64E-06		0.00E+00	
KR-87 TOTALS	0.00E+00		0.00E+00		0.00E+00		2.54E-08		7.76E-07		0.00E+00	
KR-88 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.85E-07		6.32E-07		0.00E+00	
KR-89 TOTALS	0.00E+00		0.00E+00		0.00E+00		6.26E-10		8.50E-09		0.00E+00	
XE-131M TOTALS	0.00E+00		0.00E+00		0.00E+00		6.97E-11		9.03E-09		0.00E+00	
XE-133M TOTALS	0.00E+00		0.00E+00		0.00E+00		4.11E-09		3.45E-07		0.00E+00	
XE-133 TOTALS	0.00E+00		0.00E+00		0.00E+00		3.84E-08		2.10E-06		0.00E+00	
XE-135M TOTALS	0.00E+00		0.00E+00		0.00E+00		6.63E-09		2.70E-08		0.00E+00	
XE-135 TOTALS	0.00E+00		0.00E+00		0.00E+00		2.51E-08		5.88E-07		0.00E+00	
XE-137 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.26E-10		2.19E-08		0.00E+00	
XE-138 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.01E-08		1.04E-07		0.00E+00	
I-131 TOTALS	0.00E+00		0.00E+00		0.00E+00		7.46E-07		6.82E-06		8.00E-02	
I-132 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.1[illegible]E-06		4.56E-06		7.67E-04	
I-133 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.68E-07		2.57E-06		3.05E-02	
I-134 TOTALS	0.00E+00		0.00E+00		0.00E+00		2.58E-07		1.09E-06		[illegible]	

TRAIL — Transport of Radioactive Material in Linear Systems, v1.1
Case 4: Initial Steam Release Noble Gases & Iodines, CR Dose Rate w/o isol

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.90E-06		8.16E-06		4.14E-03	
ALL N CLIDES												
0.0167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.87E-08	7.04E-06	3.73E-07	4.47E-05	1.06E-03	1.27E-01
0.0833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E-07	6.86E-06	2.94E-06	4.36E-05	8.41E-03	1.25E-01
0.1667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.62E-07	6.64E-06	3.58E-06	4.23E-05	1.04E-02	1.23E-01
0.2500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.45E-07	6.44E-06	3.47E-06	4.11E-05	1.02E-02	1.21E-01
0.3333 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E-07	6.24E-06	3.38E-06	4.00E-05	1.00E-02	1.20E-01
0.4167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.12E-07	6.05E-06	3.29E-06	3.90E-05	9.89E-03	1.18E-01
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.97E-07	5.88E-06	3.20E-06	3.80E-05	9.74E-03	1.16E-01
0.5833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.83E-07	5.70E-06	3.12E-06	3.70E-05	9.59E-03	1.14E-01
0.6667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.69E-07	5.54E-06	3.04E-06	3.61E-05	9.44E-03	1.12E-01
0.7500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-07	5.38E-06	2.97E-06	3.52E-05	9.30E-03	1.11E-01
TOTALS	0.00E+00		0.00E+00		0.00E+00		4.57E-06		2.94E-05		8.80E-02	

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TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
Case 5. Initial Sec Liquid Iodines. CR Dose Rate w/o isol

	COMP Not used for 5	COMP 3 SGs. Initial Sec Liq	COMP Control Room VOLUME 1.730E+05 Cu Ft
INITIAL	0.000E+00 KR-83m	0.000E+00 KR-83m Ci	0.000E+00 KR-83m
	0.000E+00 KR-85m	0.000E+00 KR-85m	0.000E+00 KR-85m
	0.000E+00 KR-85	0.000E+00 KR-85	0.000E+00 KR-85
	0.000E+00 KR-87	0.000E+00 KR-87	0.000E+00 KR-87
	0.000E+00 KR-88	0.000E+00 KR-88	0.000E+00 KR-88
	0.000E+00 KR-89	0.000E+00 KR-89	0.000E+00 KR-89
	0.000E+00 KR-90	0.000E+00 KR-90	0.000E+00 KR-90
	0.000E+00 XE-131M	0.000E+00 XE-131M	0.000E+00 XE-131M
	0.000E+00 XE-133M	0.000E+00 XE-133M	0.000E+00 XE-133M
	0.000E+00 XE-133	0.000E+00 XE-133	0.000E+00 XE-133
	0.000E+00 XE-135M	0.000E+00 XE-135M	0.000E+00 XE-135M
	0.000E+00 XE-135	0.000E+00 XE-135	0.000E+00 XE-135
	0.000E+00 XE-137	0.000E+00 XE-137	0.000E+00 XE-137
	0.000E+00 XE-138	0.000E+00 XE-138	0.000E+00 XE-138
	0.000E+00 I-131	9.280E+00 I-131	0.000E+00 I-131
	0.000E+00 I-132	2.740E+00 I-132	0.000E+00 I-132
	0.000E+00 I-133	1.330E+01 I-133	0.000E+00 I-133
	0.000E+00 I-134	6.120E-02 I-134	0.000E+00 I-134
	0.000E+00 I-135	5.950E+00 I-135	0.000E+00 I-135
ACT MULT (to uCi)	1.000E+00	1.000E+06	1.000E+00
PRODUCTION uCi/s	0.000E+00 KR-83m	0.000E+00 KR-83m	
	0.000E+00 KR-85m	0.000E+00 KR-85m	
	0.000E+00 KR-85	0.000E+00 KR-85	
	0.000E+00 KR-87	0.000E+00 KR-87	
	0.000E+00 KR-88	0.000E+00 KR-88	
	0.000E+00 KR-89	0.000E+00 KR-89	
	0.000E+00 KR-90	0.000E+00 KR-90	
	0.000E+00 XE-131M	0.000E+00 XE-131M	
	0.000E+00 XE-133M	0.000E+00 XE-133M	
	0.000E+00 XE-133	0.000E+00 XE-133	
	0.000E+00 XE-135M	0.000E+00 XE-135M	
	0.000E+00 XE-135	0.000E+00 XE-135	
	0.000E+00 XE-137	0.000E+00 XE-137	
	0.000E+00 XE-138	0.000E+00 XE-138	
	0.000E+00 I-131	0.000E+00 I-131	
	0.000E+00 I-132	0.000E+00 I-132	
	0.000E+00 I-133	0.000E+00 I-133	
	0.000E+00 I-134	0.000E+00 I-134	
	0.000E+00 I-135	0.000E+00 I-135	INTAKE 1.000E+01 CFM
REMOVAL	0.000E+00 1/sec	2.029E-06 1/sec	1.000E+01 cfm
NUC 1-14 REL FR	0.000E+00	0.000E+00	INTAKE REDUCT 0.000E+00
NUC 15-20 REL FR	0.000E+00	0.000E+00	INTAKE FILTER 0.000E+00

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TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
Case 7. Initial Ser. Liquid Iodines. CR Dose Rate w/o isol

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	6.000E+01	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	3.000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
3	6.000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
4	9.000E+02	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
5	1.200E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
6	1.500E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
7	1.800E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
8	2.100E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
9	2.400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
10	2.700E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	0.0	0.000E+00

	---- CONTROL ROOM ----			---- ENVIRONMENT ----	
	X/Q	Breathing	Occupancy	X/Q	Breathing
	s/M3	M3/s		s/M3	M3/s
	1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS====>

STEP	TIME, s					
1	6.000E+01	1.590E-04	1.00	1.00	0.000E+00	1.00
2	3.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
3	6.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+02	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
6	1.500E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
7	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
8	2.100E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
9	2.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
10	2.700E+03	1.590E-04	1.00	1.00	0.000E+00	1.00

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TRAILS --- Transport of Radioactive Material in Linear Systems. v1.1
Case 5: Initial Sec. Liquid Iodines. CR Dose Rate w/o isol

STEP	TIME	Not used for 5 CURRENT uCi	Not used for 5 INTEGRD uCi-sec	3 SGs. Initial Sec L CURRENT uCi	3 SGs. Initial Sec L INTEGRD uCi-sec	RELEASED uCi	AVERAGE RELEASE uCi/sec	CONTROL ROOM CURRENT uCi	CONTROL ROOM CURRENT uCi/cc	CONTROL ROOM INTEGRD uCi-sec
I-131	INITIAL	0.000E+00		9.280E+06						
I-131	TOTALS		0.000E+00		2.495E+10	5.163E+04		0.000E+00		2.506E+03
I-132	INITIAL	0.000E+00		2.740E+06						
I-132	TOTALS		0.000E+00		6.604E+09	1.366E+04		0.000E+00		6.389E+02
I-133	INITIAL	0.000E+00		1.330E+07						
I-133	TOTALS		0.000E+00		3.537E+10	7.317E+04		0.000E+00		3.539E+03
I-134	INITIAL	0.000E+00		6.120E+04						
I-134	TOTALS		0.000E+00		1.243E+08	2.573E+02		0.000E+00		1.128E+01
I-135	INITIAL	0.000E+00		5.950E+06						
I-135	TOTALS		0.000E+00		1.541E+10	3.188E+04		0.000E+00		1.528E+03
ALL NUCLIDES @ STEP 10		0.000E+00		2.978E+07				5.869E+00	1.198E-09	

TRAD -- Transport of Radioactive Material in Linear Systems. v1.1
Case 5 Initial Set Liquid Iodines, CR Dose Rate w/o isol

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-131												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.45E-06		2.24E-05		2.63E-01	
I-132												
TOTALS	0.00E+00		0.00E+00		0.00E+00		3.75E-06		1.47E-05		2.42E-03	
I-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		5.51E-06		6.81E-05		1.00E-01	
I-134												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.60E-08		3.22E-07		2.00E-05	
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		6.17E-06		2.64E-05		1.34E-02	
ALL NUCLIDES												
0.0167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.80E-09	1.17E-06	7.06E-08	8.47E-06	1.97E-04	2.36E-02
0.0833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E-07	5.79E-06	1.68E-06	4.19E-05	4.71E-03	1.17E-01
0.1667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.17E-07	1.14E-05	5.19E-06	8.26E-05	1.46E-02	2.33E-01
0.2500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-06	1.68E-05	8.54E-06	1.22E-04	2.41E-02	3.46E-01
0.3333 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-06	2.20E-05	1.18E-05	1.61E-04	3.35E-02	4.57E-01
0.4167 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E-06	2.70E-05	1.50E-05	1.98E-04	4.26E-02	5.65E-01
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.46E-06	3.19E-05	1.80E-05	2.35E-04	5.17E-02	6.73E-01
0.5833 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E-06	3.66E-05	2.10E-05	2.70E-04	6.05E-02	7.79E-01
0.6667 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.24E-06	4.11E-05	2.39E-05	3.04E-04	6.92E-02	8.82E-01
0.7500 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.61E-06	4.55E-05	2.68E-05	3.38E-04	7.78E-02	9.84E-01
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.80E-05		1.32E-04		3.79E-01	

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TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
1 18% F.F. P-S Iodines

	COMP RCS		COMP 3 SGs		COMP Control Room (VOLUME 1.730E+05 Cu Ft)	
INITIAL	0.000E+00	KR-83m Ci	0.000E+00	KR-83m	0.000E+00	KR-83m
	0.000E+00	KR-85m	0.000E+00	KR-85m	0.000E+00	KR-85m
	0.000E+00	KR-85	0.000E+00	KR-85	0.000E+00	KR-85
	0.000E+00	KR-87	0.000E+00	KR-87	0.000E+00	KR-87
	0.000E+00	KR-88	0.000E+00	KR-88	0.000E+00	KR-88
	0.000E+00	KR-89	0.000E+00	KR-89	0.000E+00	KR-89
	0.000E+00	KR-90	0.000E+00	KR-90	0.000E+00	KR-90
	0.000E+00	XE-131M	0.000E+00	XE-131M	0.000E+00	XE-131M
	0.000E+00	XE-133M	0.000E+00	XE-133M	0.000E+00	XE-133M
	0.000E+00	XE-133	0.000E+00	XE-133	0.000E+00	XE-133
	0.000E+00	XE-135M	0.000E+00	XE-135M	0.000E+00	XE-135M
	0.000E+00	XE-135	0.000E+00	XE-135	0.000E+00	XE-135
	0.000E+00	XE-137	0.000E+00	XE-137	0.000E+00	XE-137
	0.000E+00	XE-138	0.000E+00	XE-138	0.000E+00	XE-138
	1.490E+06	I-131	0.000E+00	I-131	0.000E+00	I-131
	1.780E+06	I-132	0.000E+00	I-132	0.000E+00	I-132
	2.880E+06	I-133	0.000E+00	I-133	0.000E+00	I-133
	3.240E+06	I-134	0.000E+00	I-134	0.000E+00	I-134
	2.520E+06	I-135	0.000E+00	I-135	0.000E+00	I-135
ACT MULT (to uCi):	1.000E+06		1.000E+00		1.000E+00	
PRODUCTION, uCi/s:	0.000E+00	KR-83m	0.000E+00	KR-83m		
	0.000E+00	KR-85m	0.000E+00	KR-85m		
	0.000E+00	KR-85	0.000E+00	KR-85		
	0.000E+00	KR-87	0.000E+00	KR-87		
	0.000E+00	KR-88	0.000E+00	KR-88		
	0.000E+00	KR-89	0.000E+00	KR-89		
	0.000E+00	KR-90	0.000E+00	KR-90		
	0.000E+00	XE-131M	0.000E+00	XE-131M		
	0.000E+00	XE-133M	0.000E+00	XE-133M		
	0.000E+00	XE-133	0.000E+00	XE-133		
	0.000E+00	XE-135M	0.000E+00	XE-135M		
	0.000E+00	XE-135	0.000E+00	XE-135		
	0.000E+00	XE-137	0.000E+00	XE-137		
	0.000E+00	XE-138	0.000E+00	XE-138		
	0.000E+00	I-131	0.000E+00	I-131		
	0.000E+00	I-132	0.000E+00	I-132		
	0.000E+00	I-133	0.000E+00	I-133		
	0.000E+00	I-134	0.000E+00	I-134		
	0.000E+00	I-135	0.000E+00	I-135	INTAKE 1.000E+01 CFM	
REMOVAL:	3.309E-07	1/sec	2.069E-06	1/sec	1.000E+01	cfm
NUC 1-14 REL FR:		1.000E+00		1.000E+00	INTAKE REDUCT:	0.000E+00
NUC 15-20 REL FR:		1.000E+00		1.000E+00	INTAKE FILTER:	9.360E-01

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
1 18% F.F. P-B Iodines

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	1.800E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	5.400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	1.00	70.0	0.000E+00
3	7.200E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
4	9.000E+03	0.000E+00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
5	1.440E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
6	2.880E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
7	3.060E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.980E+03	1.980E+03	0.000E+00
8	8.640E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
9	3.456E+05	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
10	2.592E+06	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00

		------- CONTROL ROOM -------			---- ENVIRONMENT ----	
		X/Q s/M3	Breathing M3/s	Occupancy	X/Q s/M3	Breathing M3/s
		1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS====>

STEP	TIME, s					
1	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
2	5.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
3	7.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.440E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
6	2.880E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
7	3.060E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
8	8.640E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
9	3.456E+05	5.960E-05	1.00	1.00	0.000E+00	1.00
10	2.592E+06	3.760E-05	1.00	1.00	0.000E+00	1.00

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
1 18% F.F. P-S Iodines

		RCS		3 SGs			AVERAGE	------------CONTROL ROOM------------		
		CURRENT	INTEGRD	CURRENT	INTEGRD	RELEASED	RELEASE	CURRENT	CURRENT	INTEGRD
STEP	TIME	uCi	uCi-sec	uCi	uCi-sec	uCi	uCi/sec	uCi	uCi/cc	uCi-sec
I-131	INITIAL	1.490E+12		0.000E+00				0.000E+00		
I-131	TOTALS		1.086E+18		2.950E+17	2.540E+08				6.708E+06
I-132	INITIAL	1.780E+12		0.000E+00				0.000E+00		
I-132	TOTALS		2.118E+16		8.277E+13	7.956E+07				1.6[illegible]E+06
I-133	INITIAL	2.880E+12		0.000E+00				0.000E+00		
I-133	TOTALS		3.004E+17		1.06[illegible]E+16	4.220E+08				1.078E+07
I-134	INITIAL	3.240E+12		0.000E+00				0.000E+00		
I-134	TOTALS		1.473E+16		2.204E+13	3.549E+07				6.261E+05
I-135	INITIAL	2.920E+12		0.000E+00				0.000E+00		
I-135	TOTALS		8.554E+16		9.627E+14	2.606E+08				6.209E+06
ALL NUCLIDES @ STEP 10		4.759E+10		6.459E+10				0.000E+00	0.000E+00	

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
1 18% F.F P-S Iodines

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-131												
TOTALS	0.00E+00		0.00E+00		0.00E+00		6.56E-03		6.00E-02		7.03E+02	
I-132												
TOTALS	0.00E+00		0.00E+00		0.00E+00		9.68E-03		3.79E-02		6.24E+00	
I-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.68E-02		2.07E-01		3.05E+02	
I-134												
TOTALS	0.00E+00		0.00E+00		0.00E+00		4.22E-03		1.79E-02		1.11E+00	
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.51E-02		1.07E-01		5.45E+01	
ALL NUCLIDES												
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03	5.47E-03	7.54E-03	2.90E-02	9.70E+00	3.81E+01
[illegible] 5000 h	0.00E+00	0.00E+00	0.?0E+00	0.00E+00	0.00E+00	0.00E+00	4.43E-03	3.64E-03	2.43E-02	2.08E-02	3.61E+01	3.44E+01
[illegible] 0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.15E-03	4.93E-03	1.25E-02	2.91E-02	2.18E+01	[illegible].23E+01
2.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E-03	5.30E-03	1.53E-02	3.23E-02	2.88E+01	6.26E+01
4.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.28E-03	6.99E-03	5.94E-02	4.61E-02	1.27E+02	1.05E+02
8.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-02	1.18E-02	2.86E-01	8.95E-02	7.67E+02	2.54E+02
8.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-03	3.65E-04	1.25E-02	2.80E-03	3.57E+01	8.13E+00
24.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-03	1.04E-05	1.22E-02	[illegible].01E-04	4.08E+01	4.51E-01
96.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.05E-05	[illegible].14E-11	5.03E-04	1.10E-1?	2.46E+00	1.07E-06
720.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-11	0.00E+00	6.02E-10	0.00E+00	6.01E-06	0.00E+00
TOTALS	0.00E+00		0.00E+00		0.00E+00		6.23E-02		4.31E-01		1.07E+03	

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TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
2 18% F.F. P-S Noble Gases in 3 SGs

	COMP: NOT USED IN THIS CASE	COMP: 3 SGs	COMP: Control Room VOLUME: 1.730E+05 Cu Ft
INITIAL:	0.000E+00 KR-83m	2.160E+05 KR-83m Ci	0.000E+00 KR-83m
	0.000E+00 KR-85m	5.400E+05 KR-85m	0.000E+00 KR-85m
	0.000E+00 KR-85	3.730E+04 KR-85	0.000E+00 KR-85
	0.000E+00 KR-87	1.063E+06 KR-87	0.000E+00 KR-87
	0.000E+00 KR-88	1.490E+06 KR-88	0.000E+00 KR-88
	0.000E+00 KR-89	1.980E+06 KR-89	0.000E+00 KR-89
	0.000E+00 KR-	0.000E+00 KR-90	0.000E+00 KR-90
	0.000E+00 XE-131M	7.570E+03 XE-131M	0.000E+00 XE-131M
	0.000E+00 XE-133M	6.680E+04 XE-133M	0.000E+00 XE-133M
	0.000E+00 XE-133	2.880E+06 XE-133	0.000E+00 XE-133
	0.000E+00 XE-135M	7.560E+05 XE-135M	0.000E+00 XE-135M
	0.000E+00 XE-135	7.380E+05 XE-135	0.000E+00 XE-135
	0.000E+00 XE-137	2.520E+06 XE-137	0.000E+00 XE-137
	0.000E+00 XE-138	2.520E+06 XE-138	0.000E+00 XE-138
	0.000E+00 I-131	0.000E+00 I-131	0.000E+00 I-131
	0.000E+00 I-132	0.000E+00 I-132	0.000E+00 I-132
	0.000E+00 I-133	0.000E+00 I-133	0.000E+00 I-133
	0.000E+00 I-134	0.000E+00 I-134	0.000E+00 I-134
	0.000E+00 I-135	0.000E+00 I-135	0.000E+00 I-135
ACT MULT (to uCi):	1.000E+00	1.000E+06	1.000E+00
PRODUCTION, uCi/s:	0.000E+00 KR-83m	0.000E+00 KR-83m	
	0.000E+00 KR-85m	0.000E+00 KR-85m	
	0.000E+00 KR-85	0.000E+00 KR-85	
	0.000E+00 KR-87	0.000E+00 KR-87	
	0.000E+00 KR-88	0.000E+00 KR-88	
	0.000E+00 KR-89	0.000E+00 KR-89	
	0.000E+00 KR-90	0.000E+00 KR-90	
	0.000E+00 XE-131M	0.000E+00 XE-131M	
	0.000E+00 XE-133M	0.000E+00 XE-133M	
	0.000E+00 XE-133	0.000E+00 XE-133	
	0.000E+00 XE-135M	0.000E+00 XE-135M	
	0.000E+00 XE-135	0.000E+00 XE-135	
	0.000E+00 XE-137	0.000E+00 XE-137	
	0.000E+00 XE-138	0.000E+00 XE-138	
	0.000E+00 I-131	0.000E+00 I-131	
	0.000E+00 I-132	0.000E+00 I-132	
	0.000E+00 I-133	0.000E+00 I-133	
	0.000E+00 I-134	0.000E+00 I-134	
	0.000E+00 I-135	0.000E+00 I-135	INTAKE: 1.000E+01 CFM
REMOVAL:	0.000E+00 1/sec	3.309E-07 1/sec	1.000E+01 cfm
NUC 1-14 REL FR:	0.000E+00	0.000E+00	INTAKE REDUCT: 0.000E+00
NUC 15-20 REL FR:	0.000E+00	0.000E+00	INTAKE FILTER: 9.360E-01

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
2 18% F.F. P-S Noble Gases in 3 SGs

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	[illegible]	XREM	XRF
1	1.[illegible]0E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	[illegible]	50.0	0.000E+00
2	5.400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	1.00	70.0	0.000E+00
3	[illegible].200E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
4	9.000E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
5	1.440E+04	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
6	2.880E+04	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
7	3.060E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.980E+03	1.980E+03	0.000E+00
8	8.640E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
9	3.456E+05	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
10	2.592E+06	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00

		-------- CONTROL ROOM --------			---- ENVIRONMENT ----	
		X/Q	Breathing	Occupancy	X/Q	Breathing
		s/M3	M3/s		s/M3	M3/s
		1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS====>

STEP	TIME, s					
1	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
2	5.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
3	7.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.[illegible]0E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.440E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
6	2.880E+04	1.590E-04	1.00	1.00	0.000E+00	[illegible]
7	3.060E+04	7.860E-05	1.00	1.00	0.000E+00	[illegible]
8	8.640E+04	7.860E-05	1.00	1.00	0.000E+00	[illegible]
9	3.456E+05	5.960E-05	1.00	1.00	0.000E+00	1.00
10	2.592E+06	3.760E-05	1.00	1.00	0.000E+00	1.00

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
2 18% F.F. P-S Noble Gases in 3 SGs

STEP	TIME	NOT USED IN THIS CAS CURRENT uCi	NOT USED IN THIS CAS INTEGRD uCi-sec	3 SGs CURRENT uCi	3 SGs INTEGRD uCi-sec	RELEASED uCi	AVERAGE RELEASE uCi/sec	CONTROL ROOM CURRENT uCi	CONTROL ROOM CURRENT uCi/cc	CONTROL ROOM INTEGRD uCi-sec
KR-83m	INITIAL	0.000E+00		2.160E+11				0.000E+00		
KR-83m	TOTALS		0.000E+00		2.047E+15	6.449E+08				1.192E+08
KR-85m	INITIAL	0.000E+00		5.400E+11				0.000E+00		
KR-85m	TOTALS		0.000E+00		1.250E+16	2.941E+09				8.158E+08
KR-85	INITIAL	0.000E+00		3.730E+10				0.000E+00		
KR-85	TOTALS		0.000E+00		9.552E+16	3.538E+08				1.314E+08
KR-87	INITIAL	0.000E+00		1.060E+12				0.000E+00		
KR-87	TOTALS		0.000E+00		6.986E+15	2.28[illegible]E+09				3.189E+08
KR-88	INITIAL	0.000E+00		1.490E+12				0.000E+00		
KR-88	TOTALS		0.000E+00		2.188E+16	6.220E+09				1.464E+09
KR-89	INITIAL	0.000E+00		1.980E+12				0.000E+00		
KR-89	TOTALS		0.000E+00		5.415E+14	1.792E+06				1.811E+06
XE-131M	INITIAL	0.000E+00		7.570E+09				0.000E+00		
XE-131M	TOTALS		0.000E+00		9.156E+15	7.1[illegible]E+07				2.628E+07
XE-133M	INITIAL	0.000E+00		6.680E+10				0.000E+00		
XE-133M	TOTALS		0.000E+00		1.807E+16	6.014E+08				2.176E+08
XE-133	INITIAL	0.000E+00		2.880E+12				0.000E+00		
XE-133	TOTALS		0.000E+00		1.830E+18	2.672E+10				9.819E+09
XE-135M	INITIAL	0.000E+00		7.560E+11				0.000E+00		
XE-135M	TOTALS		0.000E+00		1.005E+15	3.325E+06				1.186E+07
XE-135	INITIAL	0.000E+00		7.380E+11				0.000E+00		
XE-135	TOTALS		0.000E+00		3.466E+16	5.245E+09				1.684E+09
XE-137	INITIAL	[illegible]E+00		2.520E+12				0.000E+00		
XE-137	TOTALS		0.000E+00		8.35[illegible]E+14	2.765E+08				3.367E+06
XE-138	INITIAL	0.000E+00		2.520E+12				0.000E+00		
XE-138	TOTALS		0.000E+00		3.081E+15	1.019E+09				3.459E+07
ALL NUCLIDES		0.000E+00		9.212E+10				0.000E+00	0.000E+00	

@ STEP 10

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TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
2 18% F.F. P-S Noble Gases in 3 SGs

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
KR-83m												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.95E-04		2.14E-01		0.00E+00	
KR-85m												
TOTALS	0.00E+00		0.00E+00		0.00E+00		3.30E-01		9.78E+00		0.00E+00	
KR-85												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.41E-04		1.55E+00		0.00E+00	
KR-87												
TOTALS	0.00E+00		0.00E+00		0.00E+00		6.49E-0[illegible]		1.98E+01		0.00E+00	
KR-88												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.34E+00		2.51E+01		0.00E+00	
KR-89												
TOTALS	0.00E+00		0.00E+00		0.00E+00		8.52E-03		1.16E-01		0.00E+00	
XE-131M												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.36E-03		1.75E-01		0.00E+00	
XE-133M												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.32E-02		1.94E+00		0.00E+00	
XE-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.14E+00		6.24E+01		0.00E+00	
XE-135M												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.31E-02		5.33E-02		0.00E+00	
XE-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.07E+00		2.51E+01		0.00E+00	
XE-137												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.62E-03		2.81E-01		0.00E+00	
XE-138												
TOTALS	0.00E+00		0.00E+00		0.00E+00		9.99E-02		1.03E+00		0.00E+00	
ALL NUCLIDES												
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+06	0.00E+00	0.00E+00	2.49E-01	9.10E-01	3.05E+00	1.09E+01	0.00E+00	0.00E+00
1.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.24E-01	4.56E-01	7.20E+00	5.24E+00	0.00E+00	0.00E+00
2.0000 h	0.00E+00	0.00E+00	0.00E+05	0.00E+00	[illegible]	0.00E+00	3.73E-01	1.01E+00	4.28E+00	1.16E+01	0.00E+00	0.00E+00
2.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	[illegible]	0.00E+00	6.00E-01	1.37E+00	6.92E+00	1.59E+01	0.00E+00	0.00E+00
4.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E+00	1.78E+00	2.87E+01	2.20E+01	0.00E+00	0.00E+00
8.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.11E+00	1.41E+00	9.07E+01	2.40E+01	0.00E+00	0.00E+00
8.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.95E-01	4.17E-02	3.34E+00	7.44E-01	0.00E+00	0.00E+00
24.0000 h	0.00E+00	0.00E+00	0.00E+00	[illegible]	[illegible]	0.00E+00	1.32E-01	6.65E-04	3.27E+00	3.12E-02	0.00E+00	0.00E+00
96.0000 h	0.00E+00	0.00E+00	0.00E+00	[illegible]	[illegible]	0.00E+00	3.36E-03	1.24E-09	1.68E-01	7.09E-08	0.00E+00	0.00E+00
720.0000 h	0.00E+00	0.00E+00	0.00E+00	[illegible]	[illegible]	0.00E+00	6.92E-09	0.00E+00	3.96E-07	0.00E+00	0.00E+00	0.00E+00
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.07E+01		1.48E+02		0.00E+00	

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
3-18% F.F. Concurrent Iodine Spike

	COMP RCS	COMP 3 SGs	COMP Control Room VOLUME 1.730E+05 Cu ft
INITIAL	0.000E+00 KR-83m	0.000E+00 KR-83m	0.000E+00 KR-83m
	0.000E+00 KR-85m	0.000E+00 KR-85m	0.C [illegible]E+00 KR-85m
	0.000E+00 KR-85	0.000E+00 KR-85	0.000E+00 KR-85
	0.000E+00 KR-87	0.000E+00 KR-87	0.000E+J0 KR-87
	0.000E+00 KR-88	0.000E+00 KR-88	0.000E+00 KR-88
	0.000E+00 KR-89	0.000E+00 KR-89	0.000E+00 KR-89
	0.000E+00 KR-90	0.000E+00 KR-90	0.000E+00 KR-90
	0.000E+00 XE-131M	0.000E+00 XE-131M	0.000E+00 XE-131M
	0.000E+00 XE-133M	0.000E+00 XE-133M	0.000E+00 XE-133M
	0.000E+00 XE-133	0.000E+00 XE-133	0.000E+00 XE-133
	0.000E+00 XE-135M	0.000E+00 XE-135M	0.000E+00 XE-135M
	0.000E+00 XE-135	0.000E+00 XE-135	0.000E+00 XE-135
	0.000E+00 XE-137	0.000E+00 XE-137	0.000E+00 XE-137
	0.000E+00 XE-138	0.000E+00 XE-138	0.000E+00 XE-138
	0.000E+00 I-131	0.000E+00 I-131	0.000E+00 I-131
	0.000E+00 I-132	0.000E+00 I-132	0.000E+00 I-132
	0.000E+00 I-133	0.000E+00 I-133	0.000E+00 I-133
	0.000E+00 I-134	0.000E+00 I-134	0.000E+00 I-134
	0.000E+00 I-135	0.000E+00 I-135	0.000E+00 I-135
ACT.MULT (to uCi)	1.000E+00	1.000E+00	1.000E+00
PRODUCTION. uCi/s	0.000E+00 KR-83m	0.000E+00 KR-83m	
	0.000E+00 KR-85m	0.000E+00 KR-85m	
	0.000E+00 KR-85	0.000E+00 KR-85	
	0.000E+00 KR-87	0.000E+00 KR-87	
	0.000E+00 KR-88	0.000E+00 KR-88	
	0.000E+00 KR-89	0.000E+00 KR-89	
	0.000E+00 KR-90	0.000E+00 KR-90	
	0.000E+00 XE-131M	0.000E+00 XE-131M	
	0.000E+00 XE-133M	0.000E+00 XE-133M	
	0.000E+00 XE-133	0.000E+00 XE-133	
	0.000E+00 XE-135M	0.000E+00 XE-135M	
	0.000E+00 XE-135	0.000E+00 XE-135	
	0.000E+00 XE-137	0.000E+00 XE-137	
	0.000E+00 XE-138	0.000E+00 XE-138	
	1.360E+06 I-13.	0.000E+00 I-131	
	2.520E+06 I-132	0.000E+00 I-132	
	3.080E+06 I-133	0.000E+00 I-133	
	3.680E+06 I-134	0.000E+00 I-134	
	2.810E+06 I-135	0.000E+00 I-135	INTAKE 1.000E+01 CFM
REMOVAL	3.309E-07 1/sec	2.069E-06 1/sec	1.000E+01 cfm
NUC 1-14 REL FR	0.000E+00	0.000E+00	INTAKE REDUCT 0.000E+00
NUC 15-20 REL FR	0.000E+00	0.000E+00	INTAKE FILTER 9.360E-01

TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
3-18% F.F Concurrent Iodine Spike

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	1.800E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	5.400E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	1.00	70.0	0.000E+00
3	7.200E+03	1.00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
4	9.000E+03	1.00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
5	1.440E+04	1.00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
6	2.880E+04	2.000E-03	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
7	3.060E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.980E+03	1.980E+03	0.000E+00
8	8.640E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
9	3.456E+05	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
10	2.592E+06	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00

		--------- CONTROL ROOM ---------			---- ENVIRONMENT ---	
		X/Q	Breathing	Occupancy	X/Q	Breathing
		s/M3	M3/s		s/M3	M3/s
		1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04
MULTIPLIERS====>						
STEP	TIME, s					
1	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
2	5.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
3	7.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.440E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
6	2.880E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
7	3.060E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
8	8.640E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
9	3.456E+05	5.960E-05	1.00	1.00	0.000E+00	1.00
10	2.592E+06	3.760E-05	1.00	1.00	0.000E+00	1.00

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
3-18% F.F. Concurrent Iodine Spike

		RCS		3 SGs			AVERAGE	CONTROL ROOM		
		CURRENT	INTEGRD	CURRENT	INTEGRD	RELEASED	RELEASE	CURRENT	CURRENT	INTEGRD
STEP	TIME	uCi	uCi-sec	uCi	uCi-sec	uCi	uCi/sec	uCi	uCi/cc	uCi-sec
I-131	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-131	TOTALS		1.429E+16		3.981E+15	1.904E+06				4.314E+04
I-132	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-132	TOTALS		4.327E+14		1.697E+12	1.145E+06				1.817E+04
I-133	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-133	TOTALS		4.635E+15		1.653E+14	3.808E+06				8.260E+04
I-134	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-134	TOTALS		2.414E+14		3.618E+11	4.475E+05				4.626E+03
I-135	INITIAL	0.000E+00		0.000E+00				0.000E+00		
I-135	TOTALS		1.376E+15		1.554E+13	2.604E+06				5.141E+04
ALL NUCLIDES @ STEP 10		6.328E+08		8.554E+08				0.000E+00	0.000E+00	

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
3-18% F.F. Concurrent Iodine Spike

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-131												
TOTALS	0.00E+00		0.00E+00		0.00E+00		4.22E-05		3.86E-04		4.52E+00	
I-132												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.07E-04		4.18E-04		6.89E-02	
I-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.29E-04		1.59E-03		2.34E+00	
I-134												
TOTALS	0.00E+00		0.00E+00		0.00E+00		3.11E-05		1.32E-04		8.19E-03	
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.08E-04		8.90E-04		4.52E-01	
ALL NUCLIDES												
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E-06	3.99E-06	5.33E-06	2.05E-05	5.69E-03	2.23E-02
1.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.80E-06	3.69E-06	2.01E-05	2.01E-05	2.50E-02	2.74E-02
2.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.10E-06	1.23E-05	2.24E-05	6.75E-05	3.10E-02	9.50E-02
2.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.61E-06	1.79E-05	4.23E-05	1.01E-04	6.20E-02	1.52E-01
4.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.96E-05	4.53E-05	2.90E-04	2.71E-04	4.88E-01	4.77E-01
8.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-04	1.41E-04	2.77E-03	9.75E-04	6.08E+00	2.26E+00
8.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.96E-05	4.28E-06	1.36E-04	3.01E-05	3.17E-01	7.21E-02
24.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-05	1.02E-07	1.25E-04	9.76E-07	3.58E-01	3.87E-03
96.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.85E-07	9.64E-14	4.79E-06	9.37E-13	2.10E-02	8.79E-09
720.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.30E-13	0.00E+00	5.12E-12	0.00E+00	4.94E-08	0.00E+00
TOTALS	0.00E+00		0.00E+00		0.00E+00		5.16E-04		3.41E-03		7.39E+00	

Duquesne Light
Health Physics Department
ERS-MPO-91-035
ATTACHMENT 3
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TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
4.18% F.F. 3SGs-5 Initial Steam Release

	COMP: NOT USED IN THIS CASE		COMP: 3 SGs Init Stm		COMP: Control Room VOLUME: 1.730E+05 Cu Ft	
INITIAL	0.000E+00	KR-83m	5.770E-05	KR-83m Ci	0.000E+00	KR-83m
	0.000E+00	KR-85m	2.810E-04	KR-85m	0.000E+00	KR-85m
	0.000E+00	KR-85	1.480E-03	KR-85	0.000E+00	KR-85
	0.000E+00	KR-87	1.610E-04	KR-87	0.000E+00	KR-87
	0.000E+00	KR-88	4.290E-04	KR-88	0.000E+00	KR-88
	0.000E+00	KR-89	1.350E-05	KR-89	0.000E+00	KR-89
	0.000E+00	KR-90	0.000E+00	KR-90	0.000E+00	KR-90
	0.000E+00	XE-131M	1.440E-05	XE-131M	0.000E+00	XE-131M
	0.000E+00	XE-133M	4.130E-04	XE-133M	0.000E+00	XE-133M
	0.000E+00	XE-133	3.520E-03	XE-133	0.000E+00	XE-133
	0.000E+00	XE-135M	1.460E-04	XE-135M	0.000E+00	XE-135M
	0.000E+00	XE-135	4.310E-04	XE-135	0.000E+00	XE-135
	0.000E+00	XE-137	2.190E-05	XE-137	0.000E+00	XE-137
	0.000E+00	XE-138	9.030E-05	XE-138	0.000E+00	XE-138
	0.000E+00	I-131	8.130E-03	I-131	0.000E+00	I-131
	0.000E+00	I-132	2.400E-03	I-132	0.000E+00	I-132
	0.000E+00	I-133	1.160E-03	I-133	0.000E+00	I-133
	0.000E+00	I-134	5.360E-04	I-134	0.000E+00	I-134
	0.000E+00	I-135	5.210E-03	I-135	0.000E+00	I-135
ACT_MULT (to uCi):	1.000E+00		1.000E+06		1.000E+00	
PRODUCTION, uCi/s:	0.000E+00	KR-83m	0.000E+00	KR-83m		
	0.000E+00	KR-85m	0.000E+00	KR-85m		
	0.000E+00	KR-85	0.000E+00	KR-85		
	0.000E+00	KR-87	0.000E+00	KR-87		
	0.000E+00	KR-88	0.000E+00	KR-88		
	0.000E+00	KR-89	0.000E+00	KR-89		
	0.000E+00	KR-90	0.000E+00	KR-90		
	0.000E+00	XE-131M	0.000E+00	XE-131M		
	0.000E+00	XE-133M	0.000E+00	XE-133M		
	0.000E+00	XE-133	0.000E+00	XE-133		
	0.000E+00	XE-135M	0.000E+00	XE-135M		
	0.000E+00	XE-135	0.000E+00	XE-135		
	0.000E+00	XE-137	0.000E+00	XE-137		
	0.000E+00	XE-138	0.000E+00	XE-138		
	0.000E+00	I-131	0.000E+00	I-131		
	0.000E+00	I-132	0.000E+00	I-132		
	0.000E+00	I-133	0.000E+00	I-133		
	0.000E+00	I-134	0.000E+00	I-134		
	0.000E+00	I-135	0.000E+00	I-135	INTAKE: 1.000E+01 CFM	
REMOVAL:	[illegible]E+00 1/sec		1.285E-01 1/sec		1.000E+01 cfm	
NUC 1-14 REL FR:	0.000E+00		0.000E+00		INTAKE REDUCT: 0.000E+00	
NUC 15-20 REL FR:	0.000E+00		0.000E+00		INTAKE FILTER: 9.360E-01	

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
4.18% F.F. 350s-S Initial Steam Release

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	1.800E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	5.400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	1.00	70.0	0.000E+00
3	7.200E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
4	9.000E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
5	1.440E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	70.0	70.0	1.00
6	2.880E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	70.0	70.0	1.00
7	3.060E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.980E+03	1.980E+03	0.000E+00
8	8.640E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
9	3.456E+05	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
10	2.592E+06	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00

--------- CONTROL ROOM ---------			---- ENVIRONMENT ---	
X/Q	Breathing	Occupancy	X/Q	Breathing
s/M3	M3/s		s/M3	M3/s
1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04

MULTIPLIERS====>

STEP	TIME, s					
1	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
2	5.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
3	7.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.440E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
6	2.880E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
7	3.060E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
8	8.640E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
9	3.456E+05	5.960E-05	1.00	1.00	0.000E+00	1.00
10	2.592E+06	3.760E-05	1.00	1.00	0.000E+00	1.00

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
4 18% F F 3SGs-S Initial Steam Release

STEP	TIME	NOT USED IN THIS CAS CURRENT uCi	INTEGRD uCi-sec	3 SGs Init Stm CURRENT uCi	INTEGRD uCi-sec	RELEASED uCi	AVERAGE RELEASE uCi/sec	CONTROL ROOM CURRENT uCi	CURRENT uCi/cc	INTEGRD uCi-sec
KR-83m	INITIAL	0.000E+00		5.770E+01				0.000E+00		
KR-83m	TOTALS		0.000E+00		4.487E+02	5.765E+01				1.264E+01
KR-85m	INITIAL	0.000E+00		2.810E+02				0.000E+00		
KR-85m	TOTALS		0.000E+00		2.186E+03	2.809E+02				9.296E+01
KR-85	INITIAL	0.000E+00		1.480E+03				0.000E+00		
KR-85	TOTALS		0.000E+00		1.152E+04	1.480E+03				7.197E+02
KR-87	INITIAL	0.000E+00		1.610E+02				0.000E+00		
KR-87	TOTALS		0.000E+00		1.251E+03	1.608E+02				2.794E+01
KR-88	INITIAL	0.000E+00		4.290E+02				0.000E+00		
KR-88	TOTALS		0.000E+00		3.337E+03	4.288E+02				1.184E+02
KR-89	INITIAL	0.000E+00		1.350E+01				0.000E+00		
KR-89	TOTALS		0.000E+00		1.022E+02	1.313E+01				1.329E-01
XE-131M	INITIAL	0.000E+00		1.440E+01				0.000E+00		
XE-131M	TOTALS		0.000E+00		1.121E+02	1.440E+01				6.954E+00
XE-133M	INITIAL	0.000E+00		4.130E+02				0.000E+00		
XE-133M	TOTALS		0.000E+00		3.214E+03	4.130E+02				1.935E+02
XE-133	INITIAL	0.000E+00		3.520E+03				0.000E+00		
XE-133	TOTALS		0.000E+00		2.739E+04	3.520E+03				1.685E+03
XE-135M	INITIAL	0.000E+00		1.460E+02				0.000E+00		
XE-135M	TOTALS		0.000E+00		1.130E+03	1.452E+02				6.720E+00
XE-135	INITIAL	0.000E+00		4.310E+02				0.000E+00		
XE-135	TOTALS		0.000E+00		3.354E+03	4.309E+02				1.712E+02
XE-137	INITIAL	0.000E+00		2.190E+01				0.000E+00		
XE-137	TOTALS		0.000E+00		1.665E+02	2.140E+01				2.617E-01
XE-138	INITIAL	0.000E+00		9.030E+01				0.000E+00		
XE-138	TOTALS		0.000E+00		6.983E+02	8.973E+01				3.846E+00
I-131	INITIAL	0.000E+00		8.130E+03				0.000E+00		
I-131	TOTALS		0.000E+00		6.327E+04	8.130E+03				3.914E+03
I-132	INITIAL	0.000E+00		2.400E+03				0.000E+00		
I-132	TOTALS		0.000E+00		1.866E+04	2.398E+03				5.969E+02
I-133	INITIAL	0.000E+00		1.160E+03				0.000E+00		
I-133	TOTALS		0.000E+00		9.027E+03	1.160E+03				5.145E+02
I-134	INITIAL	0.000E+00		5.360E+02				0.000E+00		
I-134	TOTALS		0.000E+00		4.164E+03	5.351E+02				7.096E+01
I-135	INITIAL	0.000E+00		5.210E+03				0.000E+00		
I-135	TOTALS		0.000E+00		4.054E+04	5.209E+03				1.930E+03

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
4 18% F F 3SGs-S Initial Steam Release

	NOT USED IN THIS CAS		3 SGs Init Stm		AVERAGE		CONTROL ROOM		
	CURRENT	INTEGRD	CURRENT	INTEGRD	RELEASED	RELEASE	CURRENT	CURRENT	INTEGRD
STEP TIME	uCi	uCi-sec	uCi	uCi-sec	uCi	uCi/sec	uCi	uCi/cc	uCi-sec
ALL NUCLIDES	0 000E+00		0 000E+00				0 000E+00	0 000E+00	

@ STEP 10

TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
4.18% F.F. 35Gs-S Initial Steam Release

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
KR-83m TOTALS	0.00E+00		0.00E+00		0.00E+00		8.43E-11		2.27E-08		0.00E+00	
KR-85m TOTALS	0.00E+00		0.00E+00		0.00E+00		3.76E-08		1.11E-06		0.00E+00	
KR-85 TOTALS	0.00E+00		0.00E+00		0.00E+00		4.06E-09		8.48E-06		0.00E+00	
KR-87 TOTALS	0.00E+00		0.00E+00		0.00E+00		5.68E-08		1.74E-06		0.00E+00	
KR-88 TOTALS	0.00E+00		0.00E+00		0.00E+00		5.93E-07		2.03E-06		0.00E+00	
KR-89 TOTALS	0.00E+00		0.00E+00		0.00E+00		6.25E-10		8.49E-09		0.00E+00	
XE-131M TOTALS	0.00E+00		0.00E+00		0.00E+00		3.59E-10		4.64E-08		0.00E+00	
XE-133M TOTALS	0.00E+00		0.00E+00		0.00E+00		2.06E-08		1.73E-06		0.00E+00	
XE-133 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.96E-07		1.07E-05		0.00E+00	
XE-135M TOTALS	0.00E+00		0.00E+00		0.00E+00		7.48E-09		3.02E-08		0.00E+00	
XE-135 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.09E-07		2.56E-06		0.00E+00	
XE-137 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.26E-10		2.18E-08		0.00E+00	
XE-138 TOTALS	0.00E+00		0.00E+00		0.00E+00		1.11E-08		1.14E-07		0.00E+00	
I-131 TOTALS	0.00E+00		0.00E+00		0.00E+00		3.83E-05		3.50E-05		4.10E-01	
I-132 TOTALS	0.00E+00		0.00E+00		0.00E+00		3.51E-06		1.37E-05		2.26E-03	
I-133 TOTALS	0.00E+00		0.00E+00		0.00E+00		8.01E-07		9.90E-06		1.46E-02	
I-134 TOTALS	0.00E+00		0.00E+00		0.00E+00		4.78E-07		2.02E-06		1.26E-04	

TRAILS -- Transport of Radioactive Material in Linear Systems. v1.1
4.18% F.F. 350s-S Initial Steam Release

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID INHAL	
	DOSE	DOSE RATE	DOSE	DOSE RATE	DOSE	DOSE RATE	DOSE	DOSE RATE	DOSE	DOSE RATE	DOSE	DOSE RATE
	mrem	mrem/hr	mrem	mrem/hr	mrem	mrem/hr	mrem	mrem/hr	mrem	mrem/hr	mrem	mrem/hr
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		7.80E-06		3.34E-05		1.70E-02	
ALL NUCLIDES												
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-06	6.43E-06	1.06E-05	4.11E-05	3.08E-02	1.21E-01
1.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.24E-06	4.23E-06	3.42E-05	7.84E-05	1.07E-01	9.41E-02
2.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-06	3.48E-06	1.30E-05	2.38E-05	4.42E-02	8.29E-02
2.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-06	2.87E-06	1.10E-05	2.01E-05	3.89E-02	7.30E-02
4.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.31E-06	1.66E-06	2.39E-05	1.24E-05	9.11E-02	5.00E-02
8.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.62E-06	4.55E-07	2.89E-05	3.80E-06	1.26E-01	1.83E-02
8.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-08	1.35E-08	5.33E-07	1.20E-07	2.58E-03	5.90E-04
24.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.73E-08	4.75E-10	5.66E-07	5.77E-09	3.08E-03	3.68E-05
96.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.48E-09	1.04E-15	3.14E-08	1.46E-14	2.07E-04	1.05E-10
720.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.85E-15	0.00E+00	8.28E-14	0.00E+00	5.95E-10	0.00E+00
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.74E-05		1.23E-04		4.44E-01	

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TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
5.18% F.F. 3SGs-S Initial Secondary Liquid Iodines

	COMP: NOT USED IN THIS CASE		COMP: 3 SGs Init. Sec Liq		COMP: Control Room	
					VOLUME: 1.730E+05 Cu Ft	
INITIAL:	0.000E+00	KR-83m	0.000E+00	KR-83m Ci	0.000E+00	KR-83m
	0.000E+00	KR-85m	0.000E+00	KR-85m	0.000E+00	KR-85m
	0.000E+00	KR-85	0.000E+00	KR-85	0.000E+00	KR-85
	0.000E+00	KR-87	0.000E+00	KR-87	0.000E+00	KR-87
	0.000E+00	KR-88	0.000E+00	KR-88	0.000E+00	KR-88
	0.000E+00	KR-89	0.000E+00	KR-89	0.000E+00	KR-89
	0.000E+00	KR-90	0.000E+00	KR-90	0.000E+00	KR-90
	0.000E+00	XE-131M	0.000E+00	XE-131M	0.000E+00	XE-131M
	0.000E+00	XE-133M	0.000E+00	XE-133M	0.000E+00	XE-133M
	0.000E+00	XE-133	0.000E+00	XE-133	0.000E+00	XE-133
	0.000E+00	XE-135M	0.000E+00	XE-135M	0.000E+00	XE-135M
	0.000E+00	XE-135	0.000E+00	XE-135	0.000E+00	XE-135
	0.000E+00	XE-137	0.000E+00	XE-137	0.000E+00	XE-137
	0.000E+00	XE-138	0.000E+00	XE-138	0.000E+00	XE-138
	0.000E+00	I-131	9.280E+00	I-131	0.000E+00	I-131
	0.000E+00	I-132	2.740E+00	I-132	0.000E+00	I-132
	0.000E+00	I-133	1.330E+01	I-133	0.000E+00	I-133
	0.000E+00	I-134	6.120E-02	I-134	0.000E+00	I-134
	0.000E+00	I-135	5.950E+00	I-135	0.000E+00	I-135
ACT MULT (to uCi):	1.000E+00		1.000E+06		1.000E+00	
PRODUCTION, uCi/s:	0.000E+00	KR-83m	0.000E+00	KR-83m		
	0.000E+00	KR-85m	0.000E+00	KR-85m		
	0.000E+00	KR-85	0.000E+00	KR-85		
	0.000E+00	KR-87	0.000E+00	KR-87		
	0.000E+00	KR-88	0.000E+00	KR-88		
	0.000E+00	KR-89	0.000E+00	KR-89		
	0.000E+00	KR-90	0.000E+00	KR-90		
	0.000E+00	XE-131M	0.000E+00	XE-131M		
	0.000E+00	XE-133M	0.000E+00	XE-133M		
	0.000E+00	XE-133	0.000E+00	XE-133		
	0.000E+00	XE-135M	0.000E+00	XE-135M		
	0.000E+00	XE-135	0.000E+00	XE-135		
	0.000E+00	XE-137	0.000E+00	XE-137		
	0.000E+00	XE-138	0.000E+00	XE-138		
	0.000E+00	I-131	0.000E+00	I-131		
	0.000E+00	I-132	0.000E+00	I-132		
	0.000E+00	I-133	0.000E+00	I-133		
	0.000E+00	I-134	0.000E+00	I-134		
	0.000E+00	I-135	0.000E+00	I-135	INTAKE: 1.000E+01 CFM	
REMOVAL:	0.000E+00 1/sec		2.069E-06 1/sec		1.000E+01 cfm	
NUC 1-14 REL FR:	0.000E+00		0.000E+00		INTAKE REDUCT: 0.000E+00	
NUC 15-20 REL FR:	0.000E+00		0.000E+00		INTAKE FILTER: 9.360E-01	

TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
5.18% F.F. 350s-S Initial Secondary Liquid Iodines

MULTIPLIERS====>

STEP	TIME	XPR	XREM	XRF	XPR	XREM	XRF	XPR	XREM	XRF
1	1.800E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	50.0	50.0	0.000E+00
2	5.400E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	1.00	70.0	0.000E+00
3	7.200E+03	0.000E+00	1.00	0.000E+00	0.000E+00	1.00	0.000E+00	70.0	70.0	1.00
4	9.000E+03	0.000E+00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
5	1.440E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
6	2.880E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.596	0.000E+00	70.0	70.0	1.00
7	3.060E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.980E+03	1.980E+03	0.000E+00
8	8.640E+04	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
9	3.456E+05	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00
10	2.592E+06	0.000E+00	1.00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	50.0	50.0	0.000E+00

		--------- CONTROL ROOM ---------			---- ENVIRONMENT ---	
		X/Q	Breathing	Occupancy	X/Q	Breathing
		s/M3	M3/s		s/M3	M3/s
MULTIPLIERS====>		1.000E+00	3.470E-04	1.000E+00	1.000E+00	3.470E-04
STEP	TIME, s					
1	1.800E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
2	5.400E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
3	7.200E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
4	9.000E+03	1.590E-04	1.00	1.00	0.000E+00	1.00
5	1.440E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
6	2.880E+04	1.590E-04	1.00	1.00	0.000E+00	1.00
7	3.060E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
8	8.640E+04	7.860E-05	1.00	1.00	0.000E+00	1.00
9	3.456E+05	5.960E-05	1.00	1.00	0.000E+00	1.00
10	2.592E+06	3.760E-05	1.00	1.00	0.000E+00	1.00

TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
3 18% F.F. 3SGs-B Initial Secondary Liquid Iodines

		NOT USED IN THIS CAS		3 SGs Init	Sec Liq		AVERAGE	CONTROL ROOM		
		CURRENT	INTEGRD	CURRENT	INTEGRD	RELEASED	RELEASE	CURRENT	CURRENT	INTEGRD
STEP	TIME	uCi	uCi-sec	uCi	uCi-sec	uCi	uCi/sec	uCi	uCi/cc	uCi-sec
I-131	INITIAL	0.000E+00		9.280E+06				0.000E+00		
I-131	TOTALS		0.000E+00		8.255E+12	3.728E+05				2.460E+04
I-132	INITIAL	0.000E+00		2.740E+06				0.000E+00		
I-132	TOTALS		0.000E+00		3.215E+10	4.848E+04				2.876E+03
I-133	INITIAL	0.000E+00		1.330E+07				0.000E+00		
I-133	TOTALS		0.000E+00		1.385E+12	4.824E+05				3.141E+04
I-134	INITIAL	0.000E+00		6.120E+04				0.000E+00		
I-134	TOTALS		0.000E+00		2.763E+08	5.241E+02				2.691E+01
I-135	INITIAL	0.000E+00		5.950E+06				0.000E+00		
I-135	TOTALS		0.000E+00		1.983E+11	1.722E+05				1.091E+04
ALL NUCLIDES @ STEP 10		0.000E+00		6.703E+05				0.000E+00	0.000E+00	

TRAILS -- Transport of Radioactive Material in Linear Systems, v1.1
5 18% F.F. 350s-S Initial Secondary Liquid Iodines

	ENVIRONMENT						CONTROL ROOM					
	PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL		PHOTON-SUBMG		BETA-SUBMG		THYROID-INHAL	
	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr	DOSE mrem	DOSE RATE mrem/hr
I-131												
TOTALS	0.00E+00		0.00E+00		0.00E+00		2.40E-05		2.20E-04		2.58E+00	
I-132												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.69E-05		6.62E-05		1.09E-02	
I-133												
TOTALS	0.00E+00		0.00E+00		0.00E+00		4.89E-05		6.04E-04		8.90E-01	
I-134												
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.81E-07		7.68E-07		4.76E-05	
I-135												
TOTALS	0.00E+00		0.00E+00		0.00E+00		4.41E-05		1.89E-04		9.58E-02	
ALL NUCLIDES												
0.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.18E-06	3.19E-05	5.99E-05	2.35E-04	1.71E-01	6.74E-01
1.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E-05	2.36E-05	2.06E-04	1.30E-04	6.06E-01	5.44E-01
2.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-05	2.23E-05	8.80E-05	1.73E-04	2.70E-01	5.35E-01
2.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-05	2.02E-05	8.27E-05	1.59E-04	2.60E-01	5.04E-01
4.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-05	1.55E-05	2.13E-04	1.28E-04	6.97E-01	4.31E-01
8.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.73E-05	9.49E-06	4.06E-04	8.45E-05	1.47E+00	3.23E-01
8.5000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-06	2.98E-07	1.18E-05	2.67E-06	4.54E-02	1.04E-02
24.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-06	1.11E-08	1.23E-05	1.13E-07	5.28E-02	6.00E-04
96.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.59E-08	1.55E-14	5.74E-07	1.47E-13	3.31E-03	1.50E-09
720.0000 h	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.59E-14	0.00E+00	8.14E-13	0.00E+00	8.44E-09	0.00E+00
TOTALS	0.00E+00		0.00E+00		0.00E+00		1.34E-04		1.08E-03		3.58E+00	

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HALLIBURTON NUS
Environmental Corporation

ARP-91-444
October 8, 1991

Mr. Steve La Vie
Duquesne Light Company
Beaver Valley Power Station
P. O. Box 4
Shippingport, PA 15077

Subject: Control Room X/Q Values for BVPS

References:
1) HALLIBURTON NUS Proposal No. P8808127
2) Duquesne Light Company Purchase Order No. D068239
3) Telecon From S. La Vie to M. Septoff August 9, 1991
4) Letter from J. Ramsdell to M. Septoff August 15, 1991

Dear Steve:

This letter presents the X/Q values suitable for design basis accident releases from selected plant vents to the BVPS common control room intake. The methodology used is presented by Ramsdell in NUREG/CR-5055 as modified by NUREG/CP-0116, by discussions with Ramsdell in September 1991 (Reference 4) and a paper presented in Atmospheric Environment, Volume 24B, No. 3, pp 377-388, 1990. The work was performed in accordance with the description contained in Reference 3 as approved by reference 2. It is noted that all work was performed using approved project procedures in accordance with the HALLIBURTON NUS ESD Quality Assurance Manual, Revision 6.

Tables 1 and 2 presents the X/Q values for the selected plant vents for Unit 1 and Unit 2, respectively, for averaging periods of 0-8 hours, 8-24 hours, 1-4 days, and 4-30 days. The release points, distances and directions to the common control room intake, and building cross sectional areas were those provided in an analysis performed by Stone and Webster Corporation using the Murphy and Campe methodology. Duquesne Light Company provided this information to us on September 6, 1991. Five years of meteorological data for the period January 1986 through December 1990 were used. Results of the Murphy and Campe methodology are also presented in the tables for comparison. It is seen that, for the 0-8 hr averaging period reductions in X/Q values as compared to those obtained using the Murphy and Campe methodology range from a factor of 2 to over an order of magnitude.

Mr. Steve La Vie
ARP-91-444
October 8, 1991
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A report describing the methodology and results with a comparison with the Murphy and Campe methodology suitable for presentation to the NRC will be prepared. The computer code and its documentation will be provided with the report. Further, as we discussed, a scientific paper could also be prepared suitable for presentation at a DOE/NRC Nuclear Air Cleaning Conference.

As part of HALLIBURTON NUS Quality Assurance procedures a Division Quality Assurance Review Board (DQARB) was convened to review the technical and quality aspects of the analysis. The results of the DQARB indicate that (1) the documentation for the computer code generated for the analysis should be revised to provide additional information related to code identification and its use, and (2) the need to clarify the relationship between the test cases and the hand calculations used to verify the correct operation of the code. Therefore, the results provided in the tables should be considered as preliminary until the DQARB approves the documentation, receives the clarification, and completes its review. It is expected that this will be completed early next week.

If you have any questions please call me.

Sincerely,

Mike

Michael Septoff
Project Manager

Enclosures
cc: A. Toblin
W. McIntire

TABLE 1 DESIGN BASIS ACCIDENT X/Q VALUES (sec/m3) FOR SELECTED BVPS PLANT VENTS TO THE COMMON CONTROL ROOM INTAKE - UNIT 1

Release Point	Methodology	0-8 hr	8-24 hr	1-4 day	4-30 day
Containment Edge	Ramsdell Murphy-Campe	4.33E-4 2.88E-3	2.04E-4 1.90E-3	1.46E-4 6.62E-4	8.84E-5 1.41E-4
Containment Top	Ramsdell Murphy-Campe	2.73E-4 2.51E-3	1.28E-4 1.66E-3	9.17E-5 5.77E-4	5.57E-5 1.23E-4
Auxiliary Building	Ramsdell Murphy-Campe	4.30E-3 8.24E-3	2.01E-3 6.01E-3	1.49E-3 2.32E-3	9.25E-4 6.18E-4
Main Steamvalve	Ramsdell Murphy-Campe	7.60E-4 2.97E-3	3.51E-4 1.94E-3	2.59E-4 6.92E-4	1.58E-4 1.54E-4
Service Building	Ramsdell Murphy-Campe	6.25E-4 7.47E-3	3.04E-4 5.09E-3	2.36E-4 1.88E-3	1.57E-4 4.93E-4
Turbine Building	Ramsdell Murphy-Campe	2.43E-3 7.81E-3	1.22E-3 5.55E-3	8.90E-4 2.11E-3	6.26E-4 7.11E-4
Gas Waste Storage Vault	Ramsdell Murphy-Campe	5.11E-4 2.03E-2	2.15E-4 1.51E-2	1.65E-4 5.99E-3	1.14E-4 1.32E-3

TABLE 2 DESIGN BASIS ACCIDENT X/Q VALUES (sec/m3) FOR SELECTED BVPS PLANT VENTS TO THE COMMON CONTROL ROOM INTAKE - UNIT 2

Release Point	Methodology	0-8 hr	8-24 hr	1-4 day	4-30 day
Containment Edge	Ramsdell Murphy-Campe	1.88E-4 4.16E-3	9.32E-5 2.81E-3	7.06E-5 1.09E-3	4.18E-5 1.58E-4
Containment Top	Ramsdell Murphy-Campe	1.20E-4 3.65E-3	5.91E-5 2.47E-3	4.45E-5 9.56E-4	2.64E-5 1.39E-4
Auxiliary Building	Ramsdell Murphy-Campe	1.04E-3 1.33E-2	5.15E-4 9.30E-3	4.04E-4 3.94E-3	2.46E-4 1.20E-3
Main Steamvalve	Ramsdell Murphy-Campe	1.59E-4 7.75E-3	7.86E-5 5.63E-3	5.96E-5 1.99E-3	3.76E-5 3.26E-4
Service Building	Ramsdell Murphy-Campe	2.21E-4 5.42E-3	1.11E-4 3.62E-3	8.51E-5 1.43E-3	5.17E-5 3.31E-4
Turbine Building	Ramsdell Murphy-Campe	2.72E-4 6.46E-3	1.43E-4 4.90E-3	1.10E-4 2.00E-3	6.30E-5 5.75E-4
Gas Waste Storage Vault	Ramsdell Murphy-Campe	1.74E-3 1.23E-1	9.[illegible]6E-4 1.04E-1	7.69E-4 5.08E-2	5.55E-4 2.00E-2

ATTACHMENT B

Beaver Valley Power Station, Unit No.2

Additional Information - Proposed Technical Specification Change No. 57

Information copy of the UFSAR changes to address the radiological consequences of a locked rotor accident

of a HEPA filter and carbon adsorber with effective iodine removal efficiency of 95 percent. These emergency supply filtration units and associated air handling equipment are designed to Seismic Category 1 and Safety Class 3 requirements.

A control room air manifold system which consists of flexible hose connections to air storage bottles is provided to ensure chlorine-free air for up to six (6) hours. The manifold system is located within the common control room and is provided with sufficient lengths of flexible hoses to reach all vital areas of the common control room.

In addition, a sufficient quantity of portable self-contained breathing apparatus and protective clothing are provided for the operators who are located in the control room. This equipment is located in the locker rooms near the control room.

The evaluation of radiation exposure to personnel in the main control room envelope examined the contribution from the four LOCA sources defined in Section 6.4.2.5. In addition, the inhalation dose from inleakage into the main control room of radionuclides in the external cloud was also examined for each of the DBAs considered in Chapter 15. Dose calculations are based on the source terms and pertinent parameters defined in Chapter 15 for each DBA, the flux-to-dose conversion factors given in Table 6.4-2 and the appropriate inhalation dose conversion factors described in TID 14844 by Di Nunno (et al 1962).

The limiting design basis accident for the main control room personnel whole body gamma and beta skin dose is the LOCA. The small line break outside containment (SLB) is the limiting DBA for the thyroid dose.

Exposure from inhalation is principally attributable to airborne radioactivity in the main control room envelope due to:

1. Intake prior to main control room isolation,

2. Inleakage during main control room isolation, or

3. Post-isolation ventilation intake.

AND THE LOCKED ROTOR ACCIDENT (LRA)

The CIB signal isolates the control room almost immediately after a LOCA. For DBAs that do not cause a CIB signal, control room isolation is initiated by a high radiation signal from redundant Category 1 area monitors centrally located in the BVPS-2 control room except for the main steamline break (MSLB) which does not initiate a high radiation signal. For the MSLB manual operator action by t=30 min post-accident is needed to maintain habitability.

AND THE LOCKED ROTOR ACCIDENT

The analyses considers a conservative selection of parameters to calculate the thyroid dose. Ventilation intake prior to control room

— PROPOSED —

isolation and an assumed 10 cfm unfiltered inleakage are the main contributors to the thyroid dose. The maximum normal ventilation intake rate of 500 cfm (for both BVPS-1 and BVPS-2 intakes) prior to isolation and an minimum clean up rate of 690 cfm post-isolation are used to maximize the dose estimate. The post-isolation clean-up rate is based on BVPS-1 control room pressurization test data adjusted for the combined control room volume. The analysis also assumes coincident loss of offsite power.

For Condition IV DBAs which do not initiate a CIB signal, the accident duration is 8 hours (except for the fuel handling accident (FHA) AND THE LOCKED ROTOR ACCIDENT (LRA) ~~,~~ for which releases are assumed to continue over a 30-day period). Control room doses for those DBAs that do not initiate a CIB signal (except for the FHA) are therefore based on purging the control room 8 hours after accident initiation.

The information and data required to develop the radiological consequences for the main control room are presented in the respective sections describing the design basis accident analysis.

The main control room dose presented in Table 15.0-13 has been calculated to be less than the limit specified in General Design Criterion 19 and the main control room may, therefore, be safely occupied during any condition of operation.

6.4.4.2 Toxic Gas Protection

The main control room design provides protection of the personnel in the main control room from any toxic effects from spills of chemicals stored onsite. The effects of spills of chemicals along transportation routes are evaluated in Section 2.2.3.

In the event of a toxic gas release, main control room habitability is maintained by isolating the air intake, recirculating air conditioned air, and by maintaining a positive pressure using compressed air for 1 hour, after which, the main control room will remain isolated for the duration of the accident.

Redundant, sensitive, and automatic Seismic Category I detection and isolation equipment is provided for the detection of chlorine gas.

The storage areas of toxic gases and chemicals that could produce toxic gases are shown in Table 6.4-3 and on Figure 6.4-5.

6.4.5 Inspection and Testing Requirements

The major items of equipment that maintain the habitability of the main control room are the emergency supply filtration units, their fans,

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15.0.9.2 Activities in the Fuel Pellet Clad Gap

For accident analysis, the core gap activities are based on the guidance provided in Regulatory Guides 1.25 and 1.77. The noble gas and iodine inventory in the fuel gap region is assumed to be 10 percent (30 percent for Kr-85 and 12 percent for I-131 for the fuel handling accident) of the core inventory. The values are presented in Table 15.0-7.

AND THE LOCKED ROTOR ACCIDENT

the environment resulting from each accident are presented in the respective sections.

Accident atmospheric dispersion coefficients (X/Q) for the exclusion area boundary and low population zone were used to calculate the potential offsite doses. The 0.5 percent sector-dependent X/Q values, presented in Table 15.0-11, were determined as described in Section 2.3.4. Main control room X/Q values for the LOCA are also given in Table 15.0-11.

The atmospheric releases given in each accident section are used in conjunction with the appropriate X/Q values of Table 15.0-11 to calculate the potential offsite doses for the corresponding accidents and the potential control room dose due to a LOCA. The methodology for determining the doses is discussed in Appendix 15A. The resulting EAB and LPZ doses are presented in Table 15.0-12 for all postulated accidents. The potential dose to main control room personnel due to a LOCA is presented in Table 15.0-13.

For all cases the potential offsite doses are within the limits of 10 CFR 100, while the potential doses for the main control room due to a LOCA are within the limits of GDC 19 of Appendix A to 10 CFR 50.

15.0.13 References for Section 15.0

Bordelon F.M. et al 1974a. SATAN-VI Program: Comprehensive Space Time Dependent Analysis of Loss-of-Coolant. WCAP-8302 (Proprietary) and WCAP-8306.

Bordelon F.M. et al 1974b. LOCTA-IV Program: Loss-of-Coolant Transient Analysis. WCAP-8305.

Burnett, T.W.T. et al 1972. LOFTRAN Code Description. WCAP-7907, June 1972. (Also supplementary information in letter from T.M. Anderson, NS-TMS-1802, May 26, 1978 and NS-TMS-1824, June 16, 1978.)

Hunin C. 1972. FACTRAN, A FORTRAN IV Code Thermal Transients in a UO_2 Fuel Rod. WCAP-7908.

Risher, Jr. D.H. and Barry R.F. 1975. TWINKLE - A Multi-Dimensional Neutron Kinetics Computer Code. WCAP-7979-P-A (Proprietary) and WCAP-8028-A, (Non-Proprietary).

U.S. Nuclear Regulatory Commission (USNRC) 1972. Assumptions Used for Evaluating the Potential Radiological Consequence of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors. Safety Guide 25.

USNRC 1974. Assumption Used for Evaluating a Control Rod Ejection Accident for Pressurized Water Reactors. Regulatory Guide 1.77.

Ⓐ INSERT
(ATTACHED)

— PROPOSED —

PROPOSED INSERT FOR PAGE 150-15 REFERENCE SECTION

DURANKO, M.P. 1991. OFFSITE DOSE CONSEQUENCES OF A LOCKED ROTOR ACCIDENT AT UNIT 2 WITH 18% FAILED FUEL, ERS-MPD-91-022.

DURANKO, M.P. 1991. ASSESSMENT OF THE DOSES IN THE UNIT 2 CONTROL ROOM DUE TO A LOCKED ROTOR ACCIDENT AT UNIT 2 ASSUMING 18% FAILED FUEL.

-PROPOSED-

— Proposed —

TABLE 15.0-12

POTENTIAL DOSES DUE TO POSTULATED ACCIDENTS
(Rem)

Postulated Accident	FSAR Section	Exclusion Area Boundary			Low Population Zone*		
		Thyroid	Whole Body Gamma	Beta Skin	Thyroid	Whole Body Gamma	Beta Skin
Main steam line break	15.1.5						
Pre-accident iodine spike		10.5	1.2×10^{-2}	4.6×10^{-3}	1.5	1.4×10^{-3}	1×10^{-4}
Concurrent iodine spike		9.1	2.2×10^{-2}	6.7×10^{-3}	3.2	6.8×10^{-3}	2.2×10^{-3}
Loss of nonemergency ac power to the station auxiliaries	15.2.6	1.5×10^{-1}	5.2×10^{-4}	4.1×10^{-4}	2.1×10^{-2}	6.5×10^{-5}	6.8×10^{-5}
Locked rotor	15.3.3	3.25E+1 $\cancel{2.6\times10^{-1}}$	3.41 $\cancel{9.8\times10^{-4}}$	2.09 $\cancel{5.2\times10^{-4}}$	1.44E+1 $\cancel{1.7\times10^{-1}}$	3.48E-1 $\cancel{4.2\times10^{-4}}$	2.17E-1 1.7×10^{-4}
Rod ejection	15.4.8						
Containment leakage		4.1×10^{1}	1.9×10^{-1}	6.5×10^{-2}	2.0	9.2×10^{-3}	3.2×10^{-3}
Secondary side		2.2×10^{-1}	5.1×10^{-1}	3.7×10^{-1}	1.1×10^{-2}	2.5×10^{-2}	1.8×10^{-2}
Small line break - loss-of-coolant	15.6.2	1.6×10^{1}	7.0×10^{-2}	2.4×10^{-2}	8.2×10^{-1}	3.4×10^{-3}	$1.2\ 10^{-3}$
Steam generator tube rupture	15.6.3						
Pre-accident iodine spike		11.7	6.8×10^{-2}	5.2×10^{-2}	1.0	3.6×10^{-3}	2.7×10^{-3}
Concurrent iodine spike		6.0	7.3×10^{-2}	5.2×10^{-2}	1.0	4.6×10^{-3}	3.0×10^{-3}
Loss-of-coolant	15.6.5						
Containment leakage		2.7×10^{2}	5.3	2.5	1.3×10^{1}	2.6×10^{-1}	1.2×10^{-1}
ECCS leakge		8.3×10^{-1}	1.3×10^{-2}	5.1×10^{-3}	6.3×10^{-1}	1.2×10^{-2}	1.1×10^{-2}
Waste gas system rupture	15.7.1						
Line rupture		-	3.1×10^{-1}	1.9×10^{-1}			
Tank rupture		-	1.6×10^{-1}	1.5			
Fuel handling	15.7.4	2.9×10^{1}	2.33	6.58	1.4	1.1×10^{-1}	3.2×10^{-1}

NOTE:

*For duration of accident

2. Locked Rotor with Two Loops Operating

   The transient results for this case are shown on Figure 15.3-21 through 15.3-24. The results of these calculations are also summarized in Table 15.3-2. The peak RCS pressure is slightly higher than for the previous case, but is still less than that which would cause stresses to exceed the faulted condition stress limits. The cladding temperature transient is still well below the 2,700°F limit.

3. Locked Rotor with Three Loops Operating, Loss of Power to the Remaining Pumps

   The transient results for this case are shown on Figures 15.3-17 through 15.3-20. The results of these calculations are summarized in Table 15.3-2b. The peak RCS pressure reached during the transient is less than that which would cause stresses to exceed the faulted condition stress limits. Also, the peak cladding surface temperature is considerably less than 2,700°F. Both the peak RCS pressure and the peak cladding surface temperature for this case are similar to the 3-loop transient with power available as discussed on the previous page.

The calculated sequence of events for the three cases analyzed is shown in Table 15.3-1. Figures 15.3-17 and 15.3-21 show that the core flow reaches a new equilibrium value by 10 seconds. With the reactor tripped, a stable plant condition will eventually be attained. Normal plant shutdown may then proceed.

Following reactor trip, Beaver Valley Power Station - Unit 2 (BVPS-2) will approach a stabilized condition at hot standby; normal plant operating procedures may then be followed to maintain a hot condition or to cool the plant to cold shutdown. The operating procedures would call for operator action to control RCS boron concentration and pressurizer level using the CVCS, and to maintain steam generator level through control of the main feedwater system or AFWS. Any action required of the operator to maintain BVPS-2 in a stabilized condition will be in a time frame in excess of ten minutes following reactor trip.

ASSUMING 18% FAILED FUEL

15.3.3.3 Radiological Consequences

The radiological consequences of a postulated locked rotor accident are analyzed ~~with the primary and secondary coolant concentrations assumed to be at Technical Specification limits~~. The primary to secondary system leakage rate is at the Technical Specification value of 1 gpm. ~~No gap activity is assumed to be released into the primary coolant since there is no fuel failure postulated~~. The primary coolant and secondary side iodine and noble gas concentrations are presented in Table 15.0-8.

PRIOR TO THE START OF THE ACCIDENT

—PROPOSED—

TABLE 15.3-3

PARAMETERS USED FOR THE LOCKED ROTOR ACCIDENT

Parameter	Expected	Technical Specification
Power (MWt)	2,766	2,766
Fraction of fuel with defects {PRIOR TO THE ACCIDENT}	0.0012	.0026
Primary coolant concentrations {PRIOR TO THE ACCIDENT}	Table 11.1-2	Table 15.0-8
Secondary coolant concentrations {PRIOR TO THE ACCIDENT}	Table 11.1-6	Table 15.0-8
Primary to secondary leak rate (gpm)	0.009	1.0
Iodine partition factor in all steam generators prior to and during the accident	0.01	0.01
Duration of plant cooldown by secondary system after accident (hr)	8	8
Steam release from steam generators (lb)		
0-2 hr	443,878	443,878
2-8 hr	793,664	793,664
Feedwater flow to steam generators (lb)		
0-2 hr	527,065	527,065
2-8 hr	874,470	874,470
Steam generator fluid content/SG (lb)		
Liquid	99,300	99,300
Steam	8,700	8,700
Concurrent iodine spiking		
Release rates into primary coolant	Table 15.0-10	Table 15.0-10
Duration (hr)	4	4

—PROPOSED—

TABLE 15.3-4

LOCKED ROTOR ACCIDENT RELEASES
TO THE ENVIRONMENT

Nuclide		Total Releases (Ci) 0-2 Hr	0-8 Hr	
Kr-83m	3.60E+2	~~3.7×10^{-2}~~	~~6.7×10^{-2}~~	6.45E+2
Kr-85m	1.11E+3	~~2.3×10^{-1}~~	~~5.9×10^{-1}~~	2.94E+3
Kr-85	8.88E+1	~~1.3~~	~~5.3~~	3.54E+2
Kr-87	1.54E+3	~~8.7×10^{-2}~~	~~1.3×10^{-1}~~	2.28E+3
Kr-88	2.80E+3	~~3.0×10^{-1}~~	~~6.6×10^{-1}~~	6.22E+3
Kr-89	1.79E+2	~~4.8×10^{-4}~~	~~4.8×10^{-4}~~	1.79E+2
Xe-131m	1.80E+1	~~1.3×10^{-2}~~	~~5.1×10^{-2}~~	7.11E+1
Xe-133m	1.57E+2	~~3.5×10^{-1}~~	~~1.4~~	6.01E+2
Xe-133	6.82E+3	~~3.1~~	~~1.2×10^{1}~~	2.67E+4
Xe-135m	3.31E+2	~~7.9×10^{-2}~~	~~1.0~~	3.33E+2
Xe-135	1.63E+3	~~3.7×10^{-1}~~	~~2.2~~	5.25E+3
Xe-137	2.76E+2	~~9.2×10^{-4}~~	~~9.2×10^{-4}~~	2.77E+2
Xe-138	1.02E+3	~~1.5×10^{-2}~~	~~1.5×10^{-2}~~	1.02E+3
I-131	2.64E+1	~~2.2×10^{-1}~~	~~2.8~~	2.56E+2
I-132	2.13E+1	~~3.3×10^{-1}~~	~~4.3~~	8.08E+1
I-133	4.89E+1	~~3.5×10^{-1}~~	~~5.2~~	4.26E+2
I-134	2.16E+1	~~9.1×10^{-2}~~	~~5.3×10^{-2}~~	3.54E+1
I-135	3.89E+1	~~2.2×10^{-1}~~	~~3.3~~	2.64E+2

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