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DUKE POWER COMPANY

EMERGENCY DOSE ASSESSMENT MANUAL

November 8, 1991

EMERGENCY DOSE ASSESSMENT MANUAL
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DUKE POWER COMPANY

OFF-SITE DOSE PROJECTIONS

FOR OCONEE NUCLEAR STATION

1.0 Purpose

This procedure describes a method for projecting dose commitment from a noble gas and/or iodine release through the containment, the unit vent, and/or the steam relief valves during an emergency.

2.0 References

2.1 PT/0/A/230/01, Radiation Monitor Check

2.2 HP/1,2,3/A/1009/17, Operating Procedure for Post-Accident Containment Air Sampling System

2.3 HP/0/B/1009/15, Procedure for Sampling and Quantifying High Level Gaseous, Radioiodine, and Particulate Radioactivity

2.4 ONS Technical Specification, Appendix A, Section 3.1.4 Reactor Coolant System Activity

2.5 Offsite Dose Calculation Manual (ODCM)

2.6 Regulatory Guide 1.4, Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors

2.7 Regulatory Guide 1.109, Calculations of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I

2.8 NuReg-0396, EPA 520/1-78-016, Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans In Support of Light Water Nuclear Power Plants

2.9 NuReg-0654, FEMA-REP-1, Rev. 1, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants

2.10 Oconee Nuclear Station Class A Computer Model Validation (File: NUC-0306)

2.11 Letter from R. P. Todd, 1-3-86, re: R. B. Containment Leak Flow Rate File: ON-750.25

2.12 RP/0/B/1000/01, Emergency Classification Procedure

3.0 Limits and Precautions

3.1 This procedure is an alternative method of dose assessment to the Class A Atmospheric Dispersion Model Computer Code.

3.2 This procedure applies to releases made from Oconee Nuclear Station only. Many of the values contained in this procedure are site specific.

3.3 It is assumed that the whole body dose from an iodine release is very small compared to the thyroid dose, therefore this procedure does not consider iodine whole body dose.

3.4 This procedure considers all releases to be ground level releases and that meteorological data are fifteen minute averages.

3.5 Once a sector has been added to the list of affected sectors, it shall not be removed except under the direction of the Dose Assessment Coordinator.

3.6 Once the Crisis Management Center (CMC) has been activated, the doses calculated by the Technical Support Center (TSC) dose assessment group, should be compared with those calculated by the CMC before a protective action recommendation is made.

3.7 Vent releases can occur through more than one unit at a time. Check unit vent monitors on all 3 units during a vent release.

4.0 Procedure

4.1 Meteorology Assessment

4.1.1 Record the following information on Enclosure 5.1.

Note: The sources of data are listed in order of preference in the flowchart on Enclosure 5.1.

4.1.1.1 Unit(s) affected.

4.1.1.2 Date and time of reactor trip.

4.1.1.3 Report number.

4.1.1.4 Name of person preparing report.

4.1.1.5 Time Meteorological data taken.

4.1.1.6 Wind speed in miles per hour.

4.1.1.7 Direction from which the wind is blowing in degrees from North (North = 0).

4.1.1.8 Temperature gradient in degrees centigrade ($\Delta T^{\circ}C$).

$$2.24 = (28{,}320\ \frac{ml}{ft^3})(\frac{1\ Ci}{1E6\ \mu Ci})(0.3\ \frac{\mu Ci/ml}{mR/hr})(\frac{63{,}330\ ft^3/2}{120\ sec})$$

where: 28,320 = a conversion factor which converts cubic feet to milliliters

$\frac{1\ Ci}{1E6\mu Ci}$ = an activity conversion factor

$0.3\ \frac{\mu Ci/ml}{mR/hr}$ = a correlation value relating activity concentration to RIA's 16 and 17 response

$63{,}330\ ft^n$ = Steam volume released in a 2 minute (120 seconds) period. This is based on releasing 1.5E5 lbs of steam at 1050 psia with a 2 minute average steam release rate of $0.4222\ ft^n/lb\text{-}m$.

2 = The point at which the sum of RIA's 16 and 17 readings are averaged.

4.2.1.2 Record Q_{NG} on Enclosure 5.3.

4.2.1.3 Determine the iodine release rate, Q_I (Ci/sec), by the following method:

$$Q_I = Q_{NG} \times I_{rat}$$

Where:

Q_{NG} = Noble Gas Release Rate (Ci/sec) determined in Section 4.2.1.1.

I_{rat} = ratio of I-131 equiv./Xe-133 equiv. from Enclosure 5.6.

4.2.1.4 Record Q_I on Enclosure 5.3.

4.2.2 Containment Assessment (Enclosure 5.7)

4.2.2.1 Determine the noble gas release rate, $Q_{NG}\ \frac{Ci}{sec}$, by one of the following methods;

4.2.2.1.1 Based on RIA 57/58 readings, as follows:

$$Q_{NG} = R/hr \times CF\ \frac{Ci\text{-}hr}{sec\text{-}ml\text{-}R/hr} \times LR\ \frac{ml}{hr}$$

Where:

R/hr = RIA 57 or 58 reading in R/hr.

CF = Correction factor per Enclosure 5.8.

LR = Leak rate in ml/hr by one of the following methods:

based upon containment pressure, LR = Realistic Leak Rate, RLR, Enclosure 5.9 (per Reference 2.10).

based upon an opening in (failure of) containment wall or penetration, LR = Opening In Containment, OIC, with supplied value being the diameter of the opening, Enclosure 5.9 (per Reference 2.11).

based upon design leakage rate, LR = 5.6E6 (per Reference 2.10).

4.2.2.1.2 Based on survey instrument, as follows:

$$Q_{NG} = R/hr \times CF \frac{Ci\text{-}hr}{sec\text{-}ml\text{-}R/hr} \times LR \frac{ml}{hr}$$

Where:

R/hr = survey instrument (PIC-6A) reading in R/hr.

CF = correction factor per Enclosure 5.8.

LR = Leak Rate in ml/hr as determined in Step 4.2.2.1.1 above.

4.2.2.1.3 Based on PAG sample as follows:

$$Q_{NG} = Conc. \times 2.78E\text{-}10 \frac{Ci\text{-}hr}{sec\text{-}\mu Ci} \times LR \frac{ml}{hr}$$

Where:

Conc. = the Xe-133 equiv. sample data (µCi/ml) from PAG sample.

2.78E-10 = units correction factor (1E - 6 Ci/µCi)(1 hr/3600 sec)

LR = Leak Rate in ml/hr as determined in Step 4.2.2.1.1 above.

Where:

RIA = RIA reading in cpm or R/hr.

- Use RIA-45 if reading < 1E7 cpm Use RIA-46 if RIA-45 is > 1E7 cpm and RIA-46 is < 1E7 cpm Use RIA-56 if both RIA-45 and 46 are > 1E7 cpm

CF = correction factor per Enclosure 5.11.

CFM = unit vent flow rate in ft ^{3}/minute.

4.2.3.1.2 Based on unit vent sample as follows:

Q_{NG} = U-1 (Conc x 4.72E-4 X CFM) +
U-2 (Conc x 4.72E-4 x CFM) +
U-3 (Con x 4.72E-4 x CFM)

Where:

Conc. = the Xe-133 equiv. sample data in µCi/ml.

$4.72E\text{-}4 \frac{\text{Ci-min-ml}}{\text{sec-ft}^3\text{-}\mu\text{Ci}}$ = units correction factor

$\frac{1\text{Ci}}{1E6\mu\text{Ci}} \times \frac{1 \text{ minute}}{60 \text{ seconds}} \times \frac{1 \text{ ml}}{3.5314E\text{-}5 \text{ ft}^3}$

CFM = unit vent flow rate ft^3/minute

4.2.3.2 Record the noble gas release rate, Q_{NG}, on Enclosure 5.3.

4.2.3.3 Determine the iodine release rate, $Q_I \frac{\text{Ci}}{\text{sec}}$, by one of the following methods for <u>each</u> affected unit.

4.2.3.3.1 Based on Q_{NG} as follows:

$Q_I = Q_{NG} \times I_{rat}$

Where:

Q_{NG} = noble gas release rate determined in Section 4.2.3.1.

I_{rat} = ratio of I-131 equiv./Xe-133 equiv. from Enclosure 5.6.

4.2.3.3.2 Based on unit vent sample as follows:

Q_I = U-1(Conc. x 4.72E-4 x CFM) +
U-2 (Conc. x 4.72E-4 x CFM) +
U-3 (Conc. x 4.72E-4 x CFM)

Where:

Conc. = I-131 equiv. sample data in µCi/ml.

4.72E-4 = units conversion factor

CFM = unit vent flow rate in ft^3/minute

4.2.3.4 Record iodine release rate, Q_I, on Enclosure 5.3.

4.3 Dose Assessment (Enclosure 5.3)

4.3.1 Determine whole body dose due to noble gas as follows:

4.3.1.1 Determine the total noble gas release rate, TQ_{NG}, by adding Q_{NG} values from all source terms.

4.3.1.1.1 Record TQ_{NG} on Enclosure 5.3.

4.3.1.2 Determine the projected whole body dose in mrem, D_{WB}, for appropriate distances (1, 2, 5 and 10 miles unless specified otherwise) by:

NOTE: D_{RWB} $\frac{mrem}{hr}$ on Enclosure 5.3 is the whole body dose rate due to noble gas and is calculated for information or for use in other calculations.

$D_{WB} = TQ_{NG} \times X/Q \times 3.36E4 \times 2$

Where:

TQ_{NG} = total noble gas release rate, determined in Step 4.3.1.1.

X/Q = two-hour relative concentration value divided by wind speed, determined in Step 4.1.2.2.

3.36E4 = the adult whole body dose conversion factor in $\frac{mrem\text{-}m^3}{hr\text{-}Ci}$ (per Reference 2.10).

4.3.3.3.2 Recommend a Site Area Emergency if the dose rate at the site boundary $\geq$ 50 $\frac{mrem}{hr}$ whole body or $\geq$ 250 $\frac{mrem}{hr}$ thyroid (I-131 Equiv. $\geq$ 1.11E-7 $\mu Ci/ml$.

4.3.3.3.3 Recommend a General Emergency if the dose rate at the site boundary $\geq$ 500 $\frac{mrem}{hr}$ whole body or $\geq$ 2500 $\frac{mrem}{hr}$ thyroid (I-131 equiv. $\geq$ 1.1E-6 $\mu Ci/ml$).

4.4 Determine if a release has been made using SLC Limits

	Release Status
Case 1 - Normal conditions	No release
Case 2 - Normal conditions plus event conditions are less than or equal to SLC Limits * Reactor Building Pressure > 1 psig with increased activity * OTSG Tube Leak * Increased Vent Activity * Field Team Activity	Release within operating Limits Projected Dose as follows: Whole Body $\leq$ 1.01E-2 $\frac{mrem}{hr}$ and Thyroid $\leq$ 1.71E-1 $\frac{mrem}{hr}$
NOTE: No dose projections are required for the counties/ state for Case 2.	
Case 3 - Normal conditions plus event conditions are greater than SLC Limits	Release Projected Dose as follows: Whole Body > 1.01E-2 $\frac{mrem}{hr}$ or Thyroid > 1.71E-1 $\frac{mrem}{hr}$

5.0 Enclosures

5.1 Oconee Meteorology, 1 Page, 10/91

5.2 Oconee Two-Hour Relative Concentration Factors (CH), 1 Page, 10/91

5.3 Oconee Dose Assessment Report For Emergency Notification 2 Pages, 10/91

5.4 Oconee Protective Action Zones Determinations, 2 Pages, 10/91

5.5 Oconee Source Term Assessment-Steam Relief Valves, 1 Page, 10/91

5.6 Oconee I-131 Equivalent/Xe-133 Equivalent Ratio, 1 Page, 10/91

5.7 Oconee Source Term Assessment-Containment, 1 Page, 10/91

5.8 Oconee Containment Noble Gas Correction Factor, 1 Page, 10/91

5.9 Oconee Containment Leakage Rate, 1 Page, 10/91

5.10 Oconee Source Term Assessment-Unit Vent, 1 Page, 10/91

5.11 Oconee Unit Vent Noble Gas Correction Factor, 1 Page, 10/91

OCONEE TWO-HOUR RELATIVE CONCENTRATION FACTORS (CH)

EDA-4

Temperature Difference ΔT°C	Stability Class	Distance (Miles)									
		1	2	3	4	5	6	7	8	9	10
< -0.95	A	1.8E-6	6.2E-7	4.3E-7	3.4E-7	2.8E-7	2.4E-7	2.1E-7	1.8E-7	1.7E-7	1.5E-7
-0.95 to -0.86	B	1.7E-5	4.2E-6	1.9E-6	1.1E-6	6.7E-7	4.7E-7	3.5E-7	2.7E-7	2.1E-7	1.7E-7
-0.85 to -0.76	C	4.6E-5	1.4E-5	6.4E-6	3.8E-6	2.6E-6	1.8E-6	1.4E-6	1.1E-6	8.8E-7	7.4E-7
-0.75 to -0.26	D	1.2E-4	5.2E-5	2.9E-5	1.8E-5	1.4E-5	1.0E-5	8.0E-6	6.7E-6	5.7E-6	4.9E-6
-0.25 to +0.74	E	2.7E-4	1.0E-4	5.9E-5	4.0E-5	3.0E-5	2.3E-5	1.8E-5	1.6E-5	1.4E-5	1.1E-5
+0.75 to +2.0	F	5.3E-4	2.3E-4	1.4E-4	9.6E-5	7.3E-5	5.8E-5	4.7E-5	4.0E-5	3.4E-5	3.0E-5
> +2.0	G	8.8E-4	4.5E-4	2.9E-4	2.0E-4	1.5E-4	1.2E-4	1.0E-4	8.8E-5	7.5E-5	6.6E-5

OCONEE DOSE ASSESSMENT REPORT FOR EMERGENCY NOTIFICATION

EDA-4

Report Date/Time:_____/_____ Reviewed by:_____

1. [A] THIS IS A DRILL [B] THIS IS AN ACTUAL EMERGENCY NUMBER_____

9. EMERGENCY INVOLVES: ____Release above normal operating limits
____Release below normal operating limits (no projected dose required)

[A] NO RELEASE (IF A. go to item 14.)
[B] POTENTIAL RELEASE
[C] A RELEASE IS OCCURRING: Started _____ Expected Duration _____
[D] A RELEASE HAS OCCURRED: Started _____ Stopped _____

10. TYPE OF RELEASE: ☐ Ground Level

[A] RADIOACTIVE GASES
[B] RADIOACTIVE LIQUIDS
[C] RADIOACTIVE PARTICULATES
[D] OTHER _____

11. RELEASE: ☐ CURIES PER SEC.

	Stm Relief	Contain.	Vent	Total Ci/sec
[A] NOBLE GASES	Q_{NG}_____ Stm Relief +	Q_{NG}_____ Contain. +	Q_{NG}_____ Vent =	_____ Total Ci/sec TQ_{NG}
[C] IODINES	Q_I _____ +	Q_I_____ +	Q_I_____ =	_____ TQ_I

[B] IODINE/NOBLE GAS RATIO (If available) _____

[D] OTHER _____

13. ESTIMATES OF PROJECTED OFFSITE DOSE:
☐ NEW ☐ UNCHANGED DURATION:_____HRS.

Whole Body

Mile TQ_{NG}	x	CH / Wind Speed	x 3.36E4 =	D_{RWB} mrem/hr	x 2 =	D_{WB} mrem
			3.36E4			
			3.36E4			
			3.36E4			
			3.36E4			

OCONEE PROTECTIVE ACTION ZONES DETERMINATION

EDA-4

1. Determine PAZ by completing one of the options under A or B, using meteorological data from Enclosure 5.1. Record the PAZ on Enclosure 5.3.

   A. Daytime (1000-1600 hrs.)

      1) Wind speed ≥ 5 mph for tower or river wind direction; use the table below.

      2) Wind speed < 5 mph for tower or river wind direction. Assume Sectors A0, A1, B1, C1, D1, E1, and F1 are affected. Then use the table below to determine additional PAZ.

      3) For NWS wind direction. Assume all sectors are affected (A0, A1 through F1, A2 through F2).

   B. Nighttime (1600-1000 hrs.)

      (If river wind direction is unavailable, assume 70°-210°.)

      1) If river wind direction is between 210°-70°, use Option A (Daytime).

      2) If river wind direction is between 70°-210°, assume all sectors are affected (A0, A1 through F1, A2 through F2).

Wind Direction	Protective Action Zones
14.1°-27°	A0, C1, C2, D1, D2, E1, E2
27.1°-42°	A0, C1, D1, D2, E1, E2
42.1°-66°	A0, D1, D2, E1, E2
66.1°-85°	A0, D1, D2, E1, E2, F2
85.1°-104°	A0, D1, D2, E1, E2, F1, F2
104.1°-129°	A0, E1, E2, F1, F2
129.1°-156°	A0, A1, A2, E1, E2, F1, F2
156.1°-175°	A0, A1, A2, E1, F1, F2
175.1°-181°	A0, A1, A2, F1, F2
181.1°-219°	A0, A1, A2, B1, B2, F1, F2
219.1°-255°	A0, A1, A2, B1, B2
255.1°-271°	A0, A1, A2, B1, B2, C1, C2
271.1°-297°	A0, B1, B2, C1, C2
297.1°-312°	A0, B1, B2, C1, C2, D2
312.1°-345°	A0, B1, B2, C1, C2, D1, D2
345.1°-14°	A0, C1, C2, D1, D2

OCONEE PROTECTIVE ACTION ZONES DETERMINATION

EDA-4

2.* Submit protective action guides to the Offsite Radiological Coordinator based on the calculated dose from Enclosure 5.3 and the following information.

A) Recommend Evacuation of Population in affected area. For doses:

> 5 Rem Whole Body or,

> 25 Rem Thyroid

B) Recommend evacuation of children and pregnant women, and sheltering of remainder of personnel in the affected area. For doses:

1-5 Rem Whole Body or,

5-25 Rem Thyroid

C) Recommend no action. For doses:

< 1 Rem Whole Body or,

< 5 Rem Thyroid

*NOTE: For all evacuations, recommend that the remainder of the 10 mile emergency planning zone remain indoors.

OCONEE I-131 EQUIVALENT/Xe-133 EQUIVALENT RATIO

EDA-4

Time Since Trip (hrs)	Ratio Based On LOCA (Column 1)	Ratio Based On Core Melt (Column 2)
0	4.83E-3	2.24E-3
2	6.16E-3	1.06E-2
4	7.09E-3	1.56E-2
8	8.31E-3	2.79E-2
24	9.76E-3	7.40E-2
48	1.02E-2	1.10E-1
100	1.09E-2	1.34E-1
250	1.43E-2	1.79E-1
500	2.26E-2	2.90E-1
720	3.32E-2	4.31E-1

NOTE: A) For VENT releases in which I_{rat} is utilized to determine I-131 equiv. concentration, apply the appropriate correction from the table below. Ratios are per Reference 2.10.

1. LOCA , use column 1 (BASED ON LOCA).
2. LOCA through charcoal filters, divide column 1 value by 100.
3. Core damage, use column 2 (BASED ON CORE MELT).
4. Core damage through charcoal filters, divide column 2 value by 100.
5. Tube rupture, use 3.32E-5.
6. New fuel accident, use 2.23E-4.
7. Old fuel accident, use 7.18E-4.
8. Gas decay tank, assume no radioiodine released, only noble gases are considered to be released from gas tank.

B) For Steam Release Valve releases in which Irat is utilized to determine I-131 eq concentration, apply the appropriate correction from the table below. Ratios are per Reference 2.10.

1. LOCA, divide Column 1 values by 100.
2. Core Melt, divide Column 2 valves by 100.

OCONEE SOURCE TERM ASSESSMENT-CONTAINMENT
EDA-4

Unit(s) 1 2 3 (circle one)

Report # _____

Reactor Trip _____/_____ (date / time)

Projection based on data on _____/_____ (date / time)

Calculations based on: Core Melt/LOCA (circle one)

Containment pressure _____ psig

LR = _____ ml/hr

LR based on (check one):
_____Realistic Leak Rate (Encl. 5.9)
_____Opening in Containment (Encl. 5.9) (circle one) 1" 2" 4" 6" 8" 12" 18" 48" Diameter opening
_____Design Leak Rate (5.6E6)

Noble Gas
Based on RIA-57 and 58

RIA (or PIC-6A) Reading	R/hr	X CF	Ci - hr / sec-ml-R/hr (Encl. 5.8)	X LR ml/hr	= Q_{NG} Ci/sec
_____	X	_____	X	_____	= _____

Based on PAG sample

Conc.	µCi/ml	x	2.78E-10 Ci-hr/sec-µCi	x LR ml/hr	= Q_{NG} Ci/sec
_____		x	2.78E-10	x _____	= _____

Iodine
Based on Irat

Q_{NG} Ci/sec	x	I_{rat} (Encl. 5.6)	= Q_I Ci/sec
_____	x	_____	= _____

Based on PAG sample

Conc.	µCi/ml	x	2.78E-10 Ci-hr/sec-µCi	x LR ml/hr	= Q_I Ci/sec
_____		x	2.78E-10	x _____	= _____

Prepared By: _____

OCONEE CONTAINMENT LEAKAGE RATE

EDA-4

Leak Rate versus Pressure (RLR)*

Pressure (psig)	Leakage Rate (ml/hr)
1	1.00E5
5	4.734E5
10	9.693E5
15	1.443E6
20	1.916E6
25	2.389E6
30	2.885E6
35	3.314E6
37	3.471E6
40	3.652E6
42	3.764E6
45	3.922E6
47	4.012E6
50	4.103E6
52	4.148E6
55	4.193E6
57	4.215E6
59	4.238E6

*NOTE: (Per Reference 2.10)

Leak Rate versus Size Opening (OIC)**

Opening Diameter (inches)	Actual ft^n/hr	Actual ml/hr
1	15,100	4.276E8
2	60,400	1.710E9
4	241,600	6.842E9
6	543,500	1.540E10
8	966,200	2.737E10
12	2,174,000	6.158E10
18	4,892,000	1.386E11
48	34,785,000	9.853E11

**Note: (Per Reference 2.11)

1) For all pressure greater than 30 psia and temperature greater than 280°F (conservative for lower temperatures or pressures).

2) Leak rates for 12 inches and larger are more than one reactor building volume per hour. In an accident, these leak rates could not exist for more than a few minutes.

3) Size opening is diameter of the opening.

OCONEE SOURCE TERM ASSESSMENT-UNIT VENT

EDA-4

Unit(s) 1 2 3 Report # _____

Reactor Trip _____/_____ Projections based on: _____/_____
date / time date / time

Calculations on: Core Melt/LOCA
(circle one)

Noble Gas: Based on ☐45 ☐46 ☐56

RIA 45, 46 or 56 cpm or R/hr value	X	Appropriate Correction Factor (Enclosure 5.11)	X	Vent Flow CFM	= Q_{NG} $\frac{Ci}{sec}$	Q_{NG} Total (add U-1,2,3)
U-1)_____	X	_____		_____	= _____	
U-2)_____	X	_____		_____	= _____	
U-3)_____	X	_____		_____	= _____	_____

Vent Sample Activity $\frac{\mu Ci}{ml}$	X	4.72E-4	$\frac{Ci\text{-}min\text{-}ml}{sec\text{-}ft^n\text{-}\mu Ci}$	X	Vent Flow CFM	= Q_{NG} $\frac{Ci}{sec}$
_____	X	4.72E-4		X	_____	= _____

Iodine
Based on I/Xe ratio

Q_{NG} Total $\frac{Ci}{sec}$	X	I_{rat} (Encl. 5.6)	= Q_I $\frac{Ci}{sec}$
_____	X	_____	= _____

Based on Unit Vent Sample

Vent Sample Activity $\frac{\mu Ci}{ml}$	X	4.72E-4	$\frac{Ci\text{-}min\text{-}ml}{sec\text{-}ft^n\text{-}\mu Ci}$	X	Vent Flow CFM	= Q_I $\frac{Ci}{sec}$
_____	X	4.72E-4		X	_____	= _____

Prepared By: _____

OCONEE UNIT VENT NOBLE GAS CORRECTION FACTOR*

EDA-4

Time Since Trip (hrs.)	RIA-45 Core Melt	RIA-46 Core Melt	RIA-56 Core Melt
0	8.874E-11	1.647E-08	1.472E-03
2	1.261E-10	6.183E-08	6.651E-04
4	1.133E-10	2.072E-07	5.990E-04
8	8.336E-11	2.837E-07	4.358E-04
24	4.446E-11	2.025E-07	2.476E-04
48	3.450E-11	1.732E-07	2.113E-04
100	3.144E-11	1.628E-07	2.071E-04
250	3.162E-11	1.605E-07	1.943E-04
500	2.860E-11	1.581E-07	1.613E-04
720	2.164E-11	1.605E-07	1.340E-04

Units in Ci-min/sec-ft^3-cpm
or Ci-min/sec-ft^3-R/hr

Other Accidents
LOCA
LOCA thru Filter
Tube Rupture
Old Fuel
Gas Tank
RIA-45 Use 2.164E-11
RIA-46 use 1.605E-7
RIA-56 use 1.340E-4
New Fuel
RIA-45 use 3.144E-11
RIA-46 use 1.628E-7
RIA-56 use 2.071E-4

*Correction factors per Reference 2.10 x 2.832E4 ml/ft^3 x 1 min/60 sec x 1m^3/1E6 ml