Superseded pages per Rev. 3 to Crisis Mgt. Plan dtd. 8/28/89

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50-269

DUKE POWER COMPANY

EMERGENCY DOSE ASSESSMENT MANUAL

August 11, 1989

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CRISIS MANAGEMENT PLAN

IMPLEMENTING PROCEDURE

EDA - 4

"Off-Site Dose Projections for
Oconee Nuclear Station"

K. E. Harris

Approved By

6/15/88

Date

Rev. 2
June 14, 1988

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

OFFSITE DOSE PROJECTIONS

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

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 ($\Delta T°C$).

4.1.1.9 Stability class, based on ΔT.

Note: Refer to flowchart on Enclosure 5.1 to determine stability class when ΔT is unavailable.

4.1.2 Determine the atmospheric dispersion parameters, X/Q $\frac{sec}{m^3}$ corresponding to the ΔT determined in Step 4.1.1.8, for each point of interest downwind.

Note: If specific points have not been requested, use the 1, 2, 5, and 10 mile values.

4.1.2.1 Record the appropriate two hour relative concentration value, CH, from Enclosure 5.2 onto Enclosure 5.3.

4.1.2.2 Convert the CH values to X/Q by,

$$X/Q \left(\frac{sec}{m^3} \right) = \frac{CH \text{ (MPH - Sec/m}^3)}{\text{Wind Speed MPH}}$$

4.1.2.3 Record results from Step 4.1.2.2 on Enclosure 5.3.

4.1.3 Protective Action Zone Determination (Enclosure 5.4)

4.1.3.1 Determine the protective action zones (PAZ) according to the guidance provided in Enclosure 5.4.

4.1.3.2 Circle the PAZ on Enclosure 5.3.

4.1.4 Recheck meteorological conditions every 15 minutes to ensure that additional PAZ are identified as necessary.

4.2 Source Term Assessment

4.2.1 Steam Relief Valve Assessment (Enclosure 5.5)

4.2.1.1 Determine the noble gas release rate, Q_{NG} Ci/sec, by the following method;

For RIA's 16 and 17;

$$Q_{NG} = (\text{RIA } \frac{mR}{hr})(2.24 \frac{Ci/sec}{mR/hr})$$

where: RIA = RIA 16 + RIA 17 readings in $\frac{mR}{hr}$

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

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

$63{,}330\ ft^3$ = 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 $0.4222\ ft^3$/lb-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, Qi (Ci/sec), by the following method:

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

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 Qi 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, 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 = correlation 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.

4.2.2.2 Record Q_{NG} on Enclosure 5.3.

4.2.2.3 Determine the iodine release rate,

Q_I $\frac{Ci}{sec}$, by one of the following methods:

4.2.2.3.1 Based on Q_{NG} as follows:

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

Where:

Q_{NG} = noble gas release rate determined in Section 4.2.2.1.

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

4.2.2.3.2 Based on PAG sample as follows:

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

Where:

Conc. = I-131 equivalent sample data (μCi/ml) from PAG sample.

2.78E-10 = units correction factor.

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

4.2.2.4 Record Q_I on Enclosure 5.3.

4.2.3 Unit Vent Assessment (Enclosure 5.10)

4.2.3.1 Determine the noble gas release rate,

Q_{NG} $\frac{Ci}{sec}$, by one of the following methods

for <u>each</u> affected unit:

4.2.3.1.1 Based on RIA 45, 46 or 56 on-scale reading as follows:

Q_{NG} = U-1 (RIA x CF x CFM) +
U-2 (RIA x CF x CFM) +
U-3 (RIA x CF x CFM)

Where:

RIA = RIA reading in cpm or R/hr.

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:

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

Where:

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

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

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

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, $Q_I \frac{Ci}{sec}$, 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:

$$Q_I = \text{U-1(Conc. x 4.72E-4 x CFM) + U-2 (Conc. x 4.72E-4 x CFM) + U-3 (Conc. x 4.72E-4 x CFM)}$$

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 rem, D_{WB}, for appropriate distances (1, 2, 5 and 10 miles unless specified otherwise) by:

NOTE: D_{RWB} $\frac{REM}{hr}$ 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.

$$D_{WB} = TQ_{NG} \times X/Q \times 33.6 \times 2$$

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.

33.6 = the adult whole body dose conversion factor in $\frac{rem\text{-}m^3}{hr\text{-}Ci}$.

2 = time period in hours over which dose is integrated.

4.3.1.2.1 Record D_{WB} on Enclosure 5.3.

4.3.2 Determine thyroid dose due to radioiodine as follows:

4.3.2.1 Determine the total iodine release rate, TQ_I, by adding Q_I values from all source terms.

4.3.2.1.1 Record TQ_I on Enclosure 5.3.

4.3.2.2 Determine the projected thyroid dose, D_T, for appropriate distances (1, 2, 5 and 10 miles unless specified otherwise) by:

NOTE: D_{RTHY} $\frac{REM}{hr}$ on Enclosure 5.3 is the thyroid dose rate due to iodine and is calculated for information or for use in other calculations.

$$D_T = TQ_I \times X/Q \times 2.26E6 \times 2$$

Where:

TQ_I = total iodine release rate, determined in Step 4.3.2.1.

X/Q = same as above, under 4.3.1.2.

2.26E6 = child thyroid dose conversion factor in $\frac{rem\text{-}m^3}{hr\text{-}Ci}$ (per Reference 2.10).

2 = same as above, under 4.3.1.2.

4.3.2.2.1 Record D_T on Enclosure 5.3.

4.3.3 Recommend protective action as follows:

4.3.3.1 Compare doses calculated in Steps 4.3.1.2 and 4.3.2.2 to guidelines provided on Enclosure 5.4.

4.3.3.2 Record the results of comparison in 4.3.3.1 on Enclosure 5.3.

4.3.3.3 Make the following recommendations to the Dose Assessment Coordinator if the dose rates described are achieved in the field and have not been previously calculated:

4.3.3.3.1 Recommend an Alert if the dose rate at the site boundary $\geq$ 5.0E-4 $\frac{REM}{hr}$ whole body.

4.3.3.3.2 Recommend a Site Area Emergency if the dose rate at the site boundary $\geq$ 0.05 $\frac{REM}{hr}$ whole body or $\geq$ 0.25 $\frac{REM}{hr}$ thyroid and these dose rates persist for 30 minutes.

4.3.3.3.3 Recommend a Site Area Emergency if the dose rate at the site boundary $\geq$ 0.5 $\frac{REM}{hr}$ whole body or $\geq$ 2.5 $\frac{REM}{hr}$ thyroid, and these dose rates persist for 2 minutes.

4.3.3.3.4 Recommend a General Emergency if the dose rate at the site boundary $\geq$ 1 $\frac{REM}{hr}$ whole body or $\geq$ 5 $\frac{REM}{hr}$ thyroid.

5.0 Enclosures

5.1 Oconee Meteorology, 1 Page, 5/88

5.2 Oconee Two-Hour Relative Concentration Factors (CH), 1 Page, 5/88

5.3 Oconee Warning Message: Nuclear Facility to State/Local Government, 2 Pages, 5/88

5.4 Oconee Protective Action Zones Determinations, 2 Pages, 9/87

5.5 Oconee Source Term Assessment-Steam Relief Valves, 1 Page, 9/87

5.6 Oconee I-131 Equivalent/Xe-133 Equivalent Ratio, 1 Page, 5/88

5.7 Oconee Source Term Assessment-Containment, 1 Page, 9/87

5.8 Oconee Containment Noble Gas Correction Factor, 1 Page, 5/88

5.9 Oconee Containment Leakage Rate, 1 Page, 5/88

5.10 Oconee Source Term Assessment-Unit Vent, 1 Page, 9/87

5.11 Oconee Unit Vent Noble Gas Correction Factor, 1 Page, 5/88

OCONEE METEOROLOGY

EDA-4

Unit _____ Report # _____

Date/Time of Rx trip _____/_____

Prepared By: _____

METEOROLOGICAL DATA

(All data is 15 min average except NWS.)
National Weather Service (NWS) phone number is (803) 877-6998.

1000 to 1600 hrs.

- wind speed sources 1) lower; 2) river; 3) upper x 05; 4) NWS x 0.5
- wind direction sources 1) upper; 2) lower; 3) river; 4) NWS
- ΔT°C sources 1) tower; 2) Assume -0.26°C

1600 to 1000 hrs.

- **River Wind 210° - 70°**
  - wind speed 1) lower; 2) upper x 0.5; 3) Assume 1 mph
  - wind direction 1) upper; 2) lower; 3) assume 0-360°
  - ΔT°C 1) tower; 2) Assume > +2.0
- **River wind * 70° - 210° or not available**
  - wind speed 1) Assume 1 mph
  - wind direction 1) Assume 0-360°
  - ΔT°C 1) Assume > +2.0

* Based on experiment

-Time
_____
- wind speed
_____mph
- wind direction
_____°
- ΔT°C
_____°C
- Stability Class
_____

ΔT°C	Stability Class
<-0.95	A
-0.95 to -0.86	B
-0.85 to -0.76	C
-0.75 to -0.26	D
-0.25 to +0.74	E
+0.75 to +2.0	F
> +2.0	G

*Conversion formulas for the meteorological data obtained from the NWS are:

(1.15) x (knots) = mph

(1.8 x °C) + 32 = °F

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

DUKE POWER COMPANY
OCONEE WARNING MESSAGE: NUCLEAR FACILITY TO STATE/LOCAL GOVERNMENT
EDA-4

Report #_____ Reviewed by:_____ Date:_____
Dose Report By:_____ ___Real Emergency
based on data from:_____(date/time) ___Exercise Message

1. Plant Status: OCONEE NUCLEAR STATION; Unit ____; Emergency Class _____
Reactor(a)____ is tripped/(b)____ was tripped at (Time):_____
Plant is at: (a) _____% power (c) _____hot shutdown (or hot standby)
(b) _____cold shutdown (d) _____cooling down
Prognosis is: (a) _____stable (c) _____degrading
(b) _____improving (d) _____unknown
2. Emergency actions underway at the facility include: _____
_____
3. Onsite support needed from offsite organizations:_____
_____

****

4. Dose Projection Data
Wind Speed: _____mph Wind Direction _____° (from) ΔT _____ °C
Stability Class: A, B, C, D, E, F, G Release Type: Ground
Weighted Dose Conversion Factor: (a) 33.6 R/hr/Ci/m^3 (whole body)
(b) 2.2E6 R/hr/Ci/m^3 (child thyroid)
Release Rate:

Stm Relief		Contain.		Vent		Total Ci/sec	
Q_{NG} _____	+	Q_{NG} _____	+	Q_{NG} _____	=	_____	TQ_{NG} (N.G. Eq. Ci/sec)
Q_I _____	+	Q_I _____	+	Q_I _____	=	_____	TQ_I (I. Eq. Ci/sec)

5. The type of actual or projected release is:
_____ (a) airborne _____ (d) other _____
_____ (b) waterborne _____ (e) No release is in progress or expected
_____ (c) surface spill at this time
6. Release (a) _____ will begin at _____/(b) _____ began at _____
7. The estimated duration of the release is _____ hours.
8. The source and description of the release _____
_____

9. Dose Projections: *Whole Body*

Mile	TQ_{NG}	x $\frac{CH}{Wind\ Speed}$	x	33.6 =	$D_{RWB}\frac{REM}{hr}$	x	2 =	D_{WB} REM
				33.6 =				
				33.6 =				
				33.6 =				
				33.6 =				

Child Thyroid

Mile	TQ_I	x $\frac{CH}{Wind\ Speed}$	x	2.26E6 =	$D_{RTHY}\frac{REM}{hr}$	x	2 =	D_{THY} REM
				2.26E6 =				
				2.26E6 =				
				2.26E6 =				
				2.26E6 =				

DUKE POWER COMPANY
OCONEE WARNING MESSAGE: NUCLEAR FACILITY TO STATE/LOCAL GOVERNMENT
EDA-4

10. Field Data

Time	Location	Distance from Plant	Direction from Plant	Whole Body*	Thyroid*

*Indicate units data is given in.

****

Protective Action Recommendations:

_____(a) No protective action is recommended at this time

_____(b) People living in zones _____ remain indoors with the doors and windows closed, turn off air conditioners and other ventilation, monitor EBS stations.

_____(c) People living in zones _____ evacuate their homes and businesses and go to a designated shelter.

_____(d) Pregnant women and children in zones _____ evacuate and go to a designated shelter.

_____(e) Other recommendations: _____

Miles	1	2	5	10
PAZ	AO	AO	A1,B1,C1,D1,E1,F1	A2,B2,C2,D2,E2,F2

Previous protective actions recommended:
_____(a) None

_____(b) & (d) Evacuate pregnant women and children; shelter remaining people. Zones _____

_____(c) Evacuate all people. Zones _____

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 $\geq$ 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 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 (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 (A1 through F1, A2 through F2).

Wind Direction	Protective Action Zones
14°-27°	C1, C2, D1, D2, E1, E2
27°-42°	C1, D1, D2, E1, E2
42°-66°	D1, D2, E1, E2
66°-85°	D1, D2, E1, E2, F2
85°-104°	D1, D2, E1, E2, F1, F2
104°-129°	E1, E2, F1, F2
129°-156°	A1, A2, E1, E2, F1, F2
156°-175°	A1, A2, E1, F1, F2
175°-181°	A1, A2, F1, F2
181°-219°	A1, A2, B1, B2, F1, F2
219°-255°	A1, A2, B1, B2
255°-271°	A1, A2, B1, B2, C1, C2
271°-297°	B1, B2, C1, C2
297°-312°	B1, B2, C1, C2, D2
312°-345°	B1, B2, C1, C2, D1, D2
345°-14°	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

OCONEE SOURCE TERM ASSESSMENT-STEAM RELIEF VALVES
EDA-4

Unit(s) 1 2 3 (circle one)

Report # _____

Reactor Trip _____/_____ (date / time)

Projections based on data on _____ (date/time)

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

Noble Gas based on RIA-16 and 17

(RIA-16 $\frac{mR}{hr}$ +RIA-17 $\frac{mR}{hr}$) x 2.24 = Q_{NG} $\frac{Ci}{sec}$
(_____ $\frac{mR}{hr}$ + _____ $\frac{mR}{hr}$) x 2.24 = _____

Iodine based on I-131 equiv./Xe-133 equiv. ratio, Encl.5.6

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

Prepared by: _____

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 $\frac{R}{hr}$	X	CF $\frac{Ci - hr}{sec\text{-}ml\text{-}R/hr}$ (Encl. 5.8)	X	LR $\frac{ml}{hr}$	=	Q_{NG} $\frac{Ci}{sec}$
_____	X	_____	X	_____	=	_____

Based on PAG sample

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

Iodine
Based on Irat

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

Based on PAG sample

Conc. $\frac{\mu Ci}{ml}$	x	2.78E-10 $\frac{Ci\text{-}hr}{sec\text{-}\mu Ci}$	x	LR $\frac{ml}{hr}$	= Q_I	$\frac{Ci}{sec}$
_____	x	2.78E-10	x	_____	=	_____

Prepared By: _____

OCONEE CONTAINMENT NOBLE GAS CORRECTION FACTOR

EDA-4

Based on RIA-57 and 58

Time Since Trip (hrs)	Correlation Factor* Based On LOCA	Core Melt
0	5.17E-11	1.57E-10
2	4.31E-11	1.07E-10
4	3.86E-11	1.04E-10
8	3.36E-11	9.11E-11
24	2.81E-11	6.64E-11
48	2.63E-11	5.42E-11
100	2.55E-11	4.47E-11
250	2.58E-11	4.50E-11
500	2.74E-11	5.22E-11
720	2.94E-11	5.92E-11

Based on Survey Instrument

Time Since Trip (hrs)	Correlation Factor** Based On LOCA	Core Melt
0.1 to 0.5	1.71E-5	5.32E-5
>0.5 to 1.0	1.95E-5	6.05E-5
>1.0 to 1.5	2.18E-5	6.78E-5
>1.5 to 2.0	1.93E-5	3.28E-5
>2.0 to 2.5	2.09E-5	3.56E-5
>2.5 to 3.0	2.25E-5	3.83E-5
>3.0 to 4.0	2.21E-5	3.69E-5
>4.0 to 5.0	2.50E-5	4.18E-5
>5.0 to 6.0	2.65E-5	4.43E-5
>6.0 to 7.0	2.94E-5	4.92E-5
>7.0 to 8.0	2.86E-5	3.94E-5
>8.0 to 9.0	3.12E-5	4.30E-5
>9.0 to 10	3.38E-5	4.65E-5
> 10 to 15	4.68E-5	6.44E-5
> 15 to 20	6.76E-5	9.31E-5
> 20 to 25	8.32E-5	7.34E-5
> 25 to 30	1.11E-4	9.79E-5
> 30 to 35	1.50E-4	1.33E-4
> 35 to 40	1.96E-4	1.73E-4
> 40 to 45	2.54E-4	2.24E-4
> 45 to 50	3.18E-4	2.44E-4
> 50 to 60	5.45E-4	4.18E-4
> 60 to 70	7.26E-4	5.57E-4
> 70 to 80	1.18E-3	9.05E-4
> 80 to 90	1.70E-3	1.31E-3
> 90 to 100	3.30E-3	2.04E-3

* Units in $\frac{\text{Ci-hr}}{\text{sec-ml-R/hr}}$; correlation factors per Reference 2.10 x hr/3600 sec x Ci/1E6μCi

**Units in $\frac{\text{Ci-hr}}{\text{sec-ml-R/hr}}$

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^3/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 volumn per hour. In an accident, these leak rates could not exist for more than a few minutes.

OCONEE SOURCE TERM ASSESSMENT-UNIT VENT
EDA-4

Unit(s) 1 2 3 Report # _____

Reactor Trip _____/_____ (date / time) Projections based on: _____/_____ (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 $\frac{Ci\text{-}min\text{-}ml}{sec\text{-}ft^3\text{-}\mu Ci}$	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 $\frac{Ci\text{-}min\text{-}ml}{sec\text{-}ft^3\text{-}\mu Ci}$	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	4.717E-11	2.170E-07	1.472E-03
2	4.528E-11	1.698E-07	6.651E-04
4	3.868E-11	2.311E-07	5.990E-04
8	2.736E-11	2.406E-07	4.358E-04
24	1.509E-11	1.509E-07	2.476E-04
48	1.179E-11	1.274E-07	2.113E-04
100	1.085E-11	1.226E-07	2.071E-04
250	1.132E-11	1.179E-07	1.943E-04
500	9.905E-12	1.179E-07	1.613E-04
720	7.075E-12	1.179E-07	1.340E-04

Other Accidents	RIA-45	RIA-46	RIA-56
LOCA	7.075E-12	1.179E-07	1.340E-04
LOCA thru Filter	7.075E-12	1.179E-07	1.340E-04
Tube Rupture	7.075E-12	1.179E-07	1.340E-04
Old Fuel	7.075E-12	1.179E-07	1.340E-04
New Fuel	1.085E-11	1.226E-07	2.071E-04
Gas Tank	7.075E-12	1.179E-07	1.340E-04

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

Correlation factors per Reference 2.10 x 2.832E4 ml/ft x min/60 sec x m /1E6 ml