50-269 Superseded Per Rev 8 to EDA-28 & Rev 7 to EDA-8
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DUKE POWER COMPANY

EMERGENCY DOSE ASSESSMENT MANUAL

February 25,1992

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CRISIS MANAGEMENT PLAN

IMPLEMENTING PROCEDURE

EDA - 2

"Off-Site Dose Projections for
Catawba Nuclear Station"

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Approved By

11/7/91
Date

Rev. 7
November 8, 1991

# DUKE POWER COMPANY
# CATAWBA NUCLEAR STATION
# OFFSITE DOSE PROJECTIONS

## 1.0 PURPOSE

To describe 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 HP/0/B/1000/10, Determination of Radiation Monitor Setpoints

2.2 HP/0/B/1009/06, Alternative Method for Determining Dose Rate Within the Reactor Building

2.3 HP/0/B/1009/14, Radiation Protection Actions Following an Uncontrolled Release of Liquid Radioactive Material

2.4 HP/0/B/1009/17, Unit 1 Post-Accident Containment Air Sampling System

2.5 HP/0/B/1009/21, Abnormal Unit Vent Sampling

2.6 CNS Technical Specification 3.6.1.2

2.7 Offsite Dose Calculation Manual (ODCM)

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

2.9 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"

2.10 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"

2.11 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"

2.12 Letter from F. G. Hudson, September 30, 1985, re: Release Rate Information for McGuire and Catawba Nuclear Station (File: CN-134.10)

2.13 Catawba Nuclear Station Class A Computer Model Validation (File: NUC-0306)

2.14 Letter from J. E. Thomas, May 19, 1987, File: CN-1346.05 and personal conversation with Frank Poley

2.15 Radioiodine and Particle Transmission Through Plant Vent Sampling Lines at Catawba Nuclear Station, prepared by SAIC, dated July 1989.

2.16 Letter from C.D. Ingram, June 7, 1989, re: Guidance for Off-site Protective Actions Containment Design Leak Rate Validation. File No.: CN-134.10

2.17 Letter from H.P. Smith, dated October 3, 1991, re: Radiation Monitor EMF-53 Response Correlation to a Steam Generator Tube Rupture

## 3.0 LIMITS AND PRECAUTIONS

3.1 This procedure is an alternative method of dose assessment to the Catawba Class A Atmospheric Dispersion Model computer code.

3.2 This procedure applies to releases made from Catawba 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, iodine whole body dose is not considered here.

3.4 This procedure considers all releases to be ground level releases and that meteorological data are 15 minute averages.

3.5 Once a zone has been added to the list of affected zones, 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 an evacuation recommendation is made.

## 4.0 PROCEDURE

### 4.1 Meteorology Assessment

4.1.1 Acquire the following information and record on the Dose Assessment Worksheet (Enclosure 5.1):

4.1.1.1 Lower tower wind speed (WS) in miles per hour.

4.1.1.1.1 Use upper tower wind speed if lower tower wind speed is not available.

4.1.1.2 Upper tower wind direction in degrees from North (North = 0).

4.1.1.2.1 Use lower tower wind direction if upper tower wind direction is not available.

4.1.1.2.2 If the wind speed or wind direction cannot be obtained from plant systems, obtain them from the National Weather Service (phone 704-359-8466). If the NWS information is unavailable, then obtain data from McGuire Nuclear Station Control Room (73 or 78, then 875, then ext. 4262, or 4263, or 4264).

4.1.1.3 Temperature gradient ($\Delta T$) in degrees centigrade.

4.1.1.4 Using Enclosure 5.2, record the stability class based on $\Delta T$.

4.1.1.4.1 If the temperature gradient is unknown, the following applies:

If between 1000 - 1600 hours, use stability class D;

If between 1600 - 1000 hours, use stability class G.

4.1.1.5 If necessary, use forecasted meteorological data for calculating doses due to changing meteorological conditions.

4.1.2 Determine the atmospheric dispersion parameter, $\overline{X/Q}$ (sec/m³), for .5, 2, 5 and 10 miles (record on Enclosure 5.1, page 2):

4.1.2.1 Use ΔT, determine the two hour relative concentration value ($C_H$) from Enclosure 5.2.

4.1.2.2 Convert the $C_H$ values to $\overline{X/Q}$:

$$\overline{X/Q} = \frac{C_H}{\overline{WS}}$$

4.1.3 Using Enclosure 5.3, circle on Enclosure 5.1, Page 2, the Protective Action Zones (PAZ), based on wind speed and wind direction.

4.1.4 Recheck meterological conditions approximately every 15 minutes to ensure that other zones have not been affected.

4.2 Source Term Assessment - Steam Relief Valve (Enclosure 5.4)

| | |
|---|---|
| NOTE: | If the steam line monitor on the affected line is unavailable and a tube rupture occurs coincident with loss of offsite power, use Enclosure 5.14 to determine source term ($SQ_{NG}$). |

4.2.1 Determine the Sub-Noble Gas Release Rates, $SQ_{NG}$ (Ci/sec), by the following method:

4.2.1.1 For Unit 1-EMF26, EMF27, EMF28 and EMF29 or for Unit 2-EMF10, EMF11, EMF12, EMF13:

$$SQ_{NG} = R/hr \times \frac{1}{VOPEN} \times LBM \times CF \frac{Ci}{lbm\ R/hr}$$

where:

| | | |
|---|---|---|
| R/hr | = | EMF26, EMF27, EMF28, EMF29, EMF10, EMF11, EMF12, EMF13 reading |
| VOPEN | = | time the valve is open in seconds |
| LBM | = | lbm released for the time the valve was open |
| CF | = | correction factor per Enclosure 5.5 |

4.2.2 Determine the Noble Gas Release Rate, $Q_{NG}$(Ci/sec):

$$Q_{NG} = SQ_{NG}(EMF26) + SQ_{NG}(EMF27) + SQ_{NG}(EMF28) + SQ_{NG}(EMF29)$$

4.2.3 Determine the Iodine release rate, $Q_I$(Ci/sec):

$$Q_I = Q_{NG} \times Irat$$

where:

Irat = ratio of I131 eqv./Xe133 eqv. from Enclosure 5.6.

4.2.4 Record $Q_{NG}$ and $Q_I$ on Enclosure 5.1, page 2.

4.3 Source Term Assessment - Containment (Enclosure 5.7)

4.3.1 Determine the Noble Gas Release Rate, $Q_{NG}$(Ci/sec) based on one of the following methods:

4.3.1.1 Based on an EMF reading, where;

$$Q_{NG} = EMF \times CF \times LR$$

where;

EMF = 39(L), if EMF39(L) <1E7 cpm and flowpath not isolated,
EMF = 39(H), if EMF39(L) is offscale and EMF39(H) > 100 cpm and flowpath not isolated,
EMF = 53A or 53B, if EMF39(H) is offscale. Use survey meter reading (Reference 2.2) if 53A and 53B are not available.

CF = correction factor per Enclosure 5.8.

LR = Leak Rate x BYPASS, Leak Rate, (ml/hr), by one of the following methods:

based on containment pressure: LR = RLR (from Enclosure 5.9)

based on an opening in containment: LR = OIC (from Enclosure 5.10)

based on design leak rate: LR = 4.18E6 (Reference 2.16)

BYPASS = Bypass leakage, default is 7% or 0.07 (Reference 2.6)

4.3.1.2 Based on PACS sample, where;

$Q_{NG}$ = PACS x CF x LR

where;

PACS = $\mu$Ci/ml (Reference 2.4)

CF = 2.78E-10 $\frac{\text{Ci hr}}{\text{sec } \mu\text{Ci}}$

LR = Leak rate, as determined in Step 4.3.1.1 above

4.3.2 Detemine the Iodine Release Rate, $Q_I$ (Ci/sec) based on one of the following methods:

4.3.2.1 Based on $Q_{NG}$;

$Q_I = Q_{NG}$ x Irat

where:

$Q_{NG}$ = Noble Gas Release Rate as determined in Step 4.3.1 above

Irat = ratio of I131 eqv./Xe 133 eqv. from Enclosure 5.6.

4.3.2.2 Based on EMF 40 (if flowpath is not isolated);

$$Q_I = \frac{\Delta CPM}{\Delta min} \times 9.82E\text{-}20 \frac{\text{Ci hr min}}{\text{sec ml cpm}} \times LR$$

where:

$\Delta$CPM = reading from EMF40 Delta Counts
$\Delta$min = the time interval for EMF40 observation (normally 15 minutes)

9.82E-20 = 4.0E-5 $\mu$Ci/cpm x .25 min/ft$^3$ (inverse of EMF flow rate) x 3.53-5 ft$^3$/ml x 1Ci/1E6 $\mu$Ci x 1 hr/3600 sec.

4.0E-5 = correlation factor for EMF40 from Reference 2.1.

LR = Leak rate, as determined in Step 4.3.1.1 above

4.3.2.3 Based on PACS sample;

$Q_I$ = PACS x CF x LR

where;

PACS = ($\mu$Ci/ml) (Reference 2.4)

CF = 2.78E-10 $\frac{\text{Ci hr}}{\text{sec } \mu\text{Ci}}$

LR = Leak rate as determined in Step 4.3.1.1 above

4.3.3 Record $Q_{NG}$ and $Q_I$ on Enclosure 5.1, page 2.

4.4 Source Term Assessment - Unit Vent (Enclosure 5.11)

4.4.1 Determine the Noble Gas Release Rate, $Q_{NG}$(Ci/sec) based on one of the following methods:

4.4.1.1 Based on as EMF reading, where;

$Q_{NG}$ = EMF x CF x CFM

where:

EMF = 36(L) if EMF36(L) < 1E7 cpm,
EMF = 36(H) if EMF36(L) is offscale and EMF36(H) > 100 cpm and compressor not tripped,
EMF = 54 if EMF36(H) is offscale or compressor tripped.
CF = correction factor per Enclosure 5.12
CFM = unit vent flow rate ($ft^3$/min)

4.4.1.2 Based on unit vent sample, where;
$Q_{NG}$ = Unit Vent Sample x CF x CFM

where:

Unit Vent Sample = ($\mu$Ci/ml) per Reference 2.5

$$CF = 4.72E\text{-}4 \ \frac{\text{Ci min ml}}{\text{sec ft}^3\ \mu\text{ci}}$$

CFM = unit vent flow rate ($ft^3$/min)

4.4.2 Determine the Iodine Release Rate, $Q_I$ (Ci/sec), based on one of the following methods:

4.4.2.1 Based on $Q_{NG}$;

$$Q_I = Q_{NG} \times \text{Irat}$$

where:

$Q_{NG}$ = Noble Gas Release Rate as determined in Step 4.4.1 above

Irat = ratio of I131 eqv./Xe133 eqv. from Enclosure 5.6.

4.4.2.2 Based on EMF 37 (if compressor not tripped);

$$\frac{\Delta CPM}{\Delta min} \times 1.33E\text{-}13 \ \frac{\text{Ci min min}}{\text{sec ft}^3\ \text{cpm}} \times CFM = Q_I$$

where:

$\Delta$CPM = reading from EMF37 Delta Counts
$\Delta$min = the time interval from EMF37 observation (normally 15 minutes)

1.33E-13 = 4.0E-5 $\mu$Ci/cpm x 0.1667 min/ft$^3$ (inverse of EMF flow rate) x 1Ci/1E6 $\mu$Ci x 1 min/60 sec. x 1.2

where:

4.0E-5 = correlation factor for EMF37 from Reference 2.1.

1.2 = inverse of iodine transmission factor (see Reference 2.15)

CFM = unit vent flow rate (ft$^3$/min)

4.4.2.3 Based on unit vent sample:

$$Q_I = \text{Unit vent sample} \times 4.72\text{E-}4 \ \frac{\text{Ci min ml}}{\text{sec ft}^3\ \mu\text{Ci}} \times \text{CFM}$$

where:

Unit vent sample = ($\mu$Ci/ml) (Reference 2.5)

CFM = unit vent flow rate (ft$^3$/min)

4.4.3 Record $Q_{NG}$ and $Q_I$ on Enclosure 5.1, page 2.

4.5 Dose Assessment (Enclosure 5.1 or Class A computer printout)

4.5.1 On Item 1, record if this information is for a drill or real emergency.

4.5.2 On Item 2, record which unit is affected.

4.5.3 On Item 9, record the reactor status.

4.5.3.1 If the reactor has not tripped, use the data sheet date/time as the time of reactor trip. On the computer printout, cross out the shutdown time/date and record the % Power from the data sheet.

4.5.4 On Item 10; determine release status by the following guidance criteria:

4.5.4.1 No Release - no potential release of activity generated by the event.

4.5.4.2 Potential Release - activity generated by the event that can potentially be released, but is not currently being released.

4.5.4.3 Release Within Normal Operating Limits - activity generated by the event currently or previously released within normal operating limits (less than 1.008E-2 mrem/hr whole body or less than 1.711E-1 mrem/hr child thyroid). Examples include containment pressure ≥ 1 psig with increased reactor building activity, S/G tube leak, increased unit vent activity and field team activity.

4.5.4.4 Release Above Normal Operating Limits - activity generated by the event currently or previously released above normal operating limits (greater than or equal 1.008E-2 mrem/hr whole body or greater than or equal 1.711E-1 mrem/hr child thyroid).

4.5.5 On Item 11, record what type of release has occurred.

4.5.6 On Item 12, record the noble gas and iodine release rates (curies per second) from all releases.

4.5.6.1 If whole body dose rates exceed 1.008E-2 mrem/hr or thyroid dose rates exceed 1.711E-1 mrem/hr, check above normal operating limits; otherwise, check below.

4.5.6.2 If available, record the highest iodine/xenon ratio.

4.5.7 On Item 13, record the dose rates and the integrated doses.

4.5.7.1 If new doses were calculated, check the NEW block.

4.5.7.2 The duration is the total time of previous releases plus the time estimated for the projected release.

4.5.7.3 The integrated dose (mrem) is the total dose from all releases plus the dose from the projected release.

4.5.7.4 If information is available contradicting the calculated doses, change the data to reflect the new values.

4.5.7.5 On Enclosure 5.1:

4.5.7.5.1 Determine the Projected Whole Body Dose Rate, DRwb (rem/hr), due to the noble gases for .5, 2, 5 and 10 miles:

$$DRwb = 33.6 \frac{rem\ m^3}{hr\ Ci} \times TQ_{NG} \times \overline{X/Q}$$

where:

33.6 is the adult whole body dose conversion factor from Reference 2.9 in $\frac{rem\ m^3}{hr\ Ci}$

4.5.7.5.2 Determine the Projected Whole Body Dose, Dwb(rem), due to noble gases for .5, 2, 5 and 10 miles:

$$Dwb = DRwb \times 2\ hr$$

where:

dose is integrated over 2 hour time period

4.5.7.5.3 Determine the Projected Thyroid Dose Rate, DRct (rem/hr), due to iodine for .5, 2, 5 and 10 miles:

$$DRct = \overline{X/Q} \times TQ_I \times 2.26E6 \frac{rem\ m^3}{hr\ Ci}$$

where:

2.26E6 is the child thyroid dose conversion factor from Reference 2.13 in $\frac{rem\ m^3}{hr\ Ci}$

4.5.7.5.4 Determine the Projected Thyroid Dose, Dct(rem), due to iodine for .5, 2, 5 and 10 miles:

Dct = DRct x 2 hr

where:

dose is integrated over 2 hour time period

4.5.8 List any whole body or child thyroid dose rate less than .0001 mrem/hr as "less than background" (where .0001 is an assumed value based on yearly effluent data).

4.5.9 On Item 14, record the meteorological data.

4.5.10 On Item 16, this section is for the TSC Dose Assessment Coordinator or the CMC off-Site Dose Assessment Director.

4.6 Protective Action Recommendations (Enclosure 5.1, Section 15 or Class A computer printout):

4.6.1 If the projected dose in a PAZ is < 1 rem whole body or <5 rem thyroid, then recommend no protective action (action A).

4.6.2 If the projected dose in a PAZ is 1 to 5 rem whole body or 5 to 25 rem thyroid, then recommend to consider evacuating pregnant women and children and shelter all other PAZs (actions OTHER and C).

4.6.3 If the projected dose in a PAZ is ≥ 5 rem whole body or ≥ 25 rem thyroid, then recommend evacuate everyone and shelter all other PAZs (actions C and B).

4.7 Emergency Classification (Enclosure 5.1)

4.7.1 Check the box indicating the emergency classification based upon the following.

4.7.2 If the dose rate at the site boundary is ≥ 5.0E-4 rem/hr whole body then recommend an Alert.

4.7.3 If the dose rate at the site boundary is ≥ .05 rem/hr whole body or ≥ .25 rem/hr thyroid, then recommend a Site Area Emergency.

4.7.4 If the dose rate at the site boundary is $\geq$ 1 rem/hr whole body or $\geq$ 5 rem/hr thyroid, then recommend a General Emergency.

## 5.0 ENCLOSURES

5.1 Meteorology Source Term and Dose Assessment Worksheet

5.2 Two-hour Relative Concentration Factors ($C_H$)

5.3 Protective Action Zones Determination

5.4 Source Term Assessment - Steam Relief Valves

5.5 EMF26, EMF27, EMF28, EMF29 or EMF10, EMF11, EMF12, EMF13 Noble Gas Correction Factor

5.6 I131 eqv./Xe 133 eqv. Ratio

5.7 Source Term Assessment - Containment

5.8 Containment Noble Gas Correction Factor

5.9 Containment Leakage Rate versus Pressure

5.10 Containment Leakage Rate versus Pressure and Size Opening

5.11 Source Term Assessment - Unit Vent

5.12 Unit Vent Noble Gas Correction Factor

5.13 Integrated Dose

5.14 Source Term Assessment - Steam Generator Tube Rupture Coincident with Loss of Offsite Power

# EMERGENCY NOTIFICATION

1. [A] THIS IS A DRILL [B] ACTUAL EMERGENCY [ ] INITIAL [ ] FOLLOW-UP* MESSAGE NUMBER _____

2. SITE: _____ UNIT: _____ REPORTED BY: _____

3. TRANSMITTAL TIME/DATE: _____ (Eastern) ___/___/___ (mm/dd/yy) CONFIRMATION PHONE NUMBER: _____

4. AUTHENTICATION (If Required): _____ (Number) _____ (Codeword)

5. EMERGENCY CLASSIFICATION:
   [A] NOTIFICATION OF UNUSUAL EVENT [B] ALERT [C] SITE AREA EMERGENCY [D] GENERAL EMERGENCY

6. [A] Emergency Declaration At: [B] Termination At: TIME/DATE: _____ (Eastern) ___/___/___ (mm/dd/yy) (If B, go to Item 16.)

7. EMERGENCY DESCRIPTION/REMARKS: _____

8. PLANT CONDITION: [A] IMPROVING [B] STABLE [C] DEGRADING

9. REACTOR STATUS: [A] SHUTDOWN: TIME/DATE: _____ (Eastern) ___/___/___ (mm/dd/yy) [B] _____ % POWER

10. EMERGENCY RELEASE(S):
    [A] NONE (Go to item 14.) [B] POTENTIAL (Go to item 14.) [C] IS OCCURRING [D] HAS OCCURRED

**11. TYPE OF RELEASE: [ ] ELEVATED [ ] GROUND LEVEL

[A] AIRBORNE: Started: _____ Time (Eastern) ___/___/___ Date Stopped: _____ Time (Eastern) ___/___/___ Date

[B] LIQUID: Started: _____ Time (Eastern) ___/___/___ Date Stopped: _____ Time (Eastern) ___/___/___ Date

**12. RELEASE MAGNITUDE: [ ] CURIES PER SEC. [ ] CURIES NORMAL OPERATING LIMITS: [ ] BELOW [ ] ABOVE

[A] NOBLE GASES _____ [B] IODINES _____

[C] IODINE/NOBLE GAS RATIO (If available) _____ [D] OTHER _____

**13. ESTIMATE OF PROJECTED OFFSITE DOSE: [ ] NEW [ ] UNCHANGED ESTIMATED DURATION: _____ HRS.

| | Wholebody DOSE RATE (mrem/hr) | Child Thyroid DOSE RATE (mrem/hr) | Wholebody DOSE (mrem) | Child Thyroid DOSE (mrem) |
|---|---|---|---|---|
| SITE BOUNDARY | | | | |
| 2 MILES | | | | |
| 5 MILES | | | | |
| 10 MILES | | | | |

**14. METEOROLOGICAL DATA: [A] WIND DIRECTION (from) _____ [B] SPEED (mph) _____

[C] STABILITY CLASS _____ [D] PRECIPITATION (type) _____

15. RECOMMENDED PROTECTIVE ACTIONS: (based on radiological conditions)
    [A] NO RECOMMENDED PROTECTIVE ACTIONS
    [B] EVACUATE _____
    [C] SHELTER IN-PLACE _____
    [D] OTHER _____

16. APPROVED BY: _____ (Name) _____ (Title) TIME/DATE: _____ (Eastern) ___/___/___ (mm/dd/yy)

* If items 8-14 have not changed, only items 1-7 and 15-16 are required to be completed.
**Information may not be available on initial notifications.

Form 34888 (R7-90)

NOTES: 1) For all evacuations, recommend that the remainder of the 10 mile emergency planning zone stay indoors.
2) Compare these recommendations with other groups' recommendations that the Emergency Coordinator/Recovery Manager reviews.

Projection based on data on ___/___/___ Time since trip_____hrs.

| Miles | .5 | 1 | 2 | 4 | 5 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| PAZ | A0 | B1 E1 | A1 C1 D1 F1 | B2 | A2 C2 D2 E2 F2 | F3 | A3 |

Total Source Term Assessment ☐ Current ☐ Hypothetical

| Steam Relief Encl. 5.4 | | Containment Encl. 5.7 | | Unit Vent Encl. 5.11 | | |
|---|---|---|---|---|---|---|
| _____ Ci/sec | + | _____ Ci/sec | + | _____ Ci/Sec | = | _____ Ci/Sec ($TQ_{NG}$) |
| _____ Ci/sec | + | _____ Ci/sec | + | _____ Ci/Sec | = | _____ Ci/Sec ($TQ_I$) |

Source Term Based on

1. LOCA
2. LOCA (charcoal)
3. Melted Core
4. Melted Core (charcoal)
5. Tube Rupture
6. New Fuel Accident (< 100 hrs old)
7. Old Fuel Accident (≥ 100 hrs old)
8. Waste Gas Decay Tank

Dose Assessment $H_c = \frac{\overline{X/Q}}{WS}$ $\Delta T$ = _____

<----< Adult whole body <----< >----> Child thyroid >---->

2 hr 2 hr

Dose = 2 x DRwb = 33.6 x $TQ_{NG}$ x $\overline{X/Q}$ x $TQ_I$ x 2.26E6 = DRct x 2 = Dose
(rem) (rem/hr) (Ci/sec) (sec/m³) (Ci/sec)(rem/hr) (rem)

| | | | Distance miles | | | | |
|---|---|---|---|---|---|---|---|
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | .5 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 2 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 5 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 10 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 1 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 4 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 7 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |
| _____ | =2 x _____ | = 33.6 x $TQ_{NG}$ | 8 | _____ | $TQ_I$ x 2.26E6 = | _____ x 2 = | _____ |

Review with Emergency Coordinator the recommended Emergency Classification.

☐ Recommend Alert
☐ Recommend Site Area Emergency
☐ Recommend General Emergency

DUKE POWER COMPANY
ENCLOSURE 5.2
TWO-HOUR RELATIVE CONCENTRATION FACTORS($C_H$)

| Temperature Gradient (C) | Stability Class | DISTANCE (miles) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | .5 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1) $\Delta T$ <0.6 | A | 1.4E-5 | 1.2E-6 | 5.9E-7 | 4.1E-7 | 3.2E-7 | 2.5E-7 | 2.0E-7 | 1.9E-7 | 1.8E-7 | 1.6E-7 | 1.5E-7 |
| 2) -0.6 $\leq\Delta$<-0.5 | C | 1.5E-4 | 4.5E-5 | 1.3E-5 | 6.3E-6 | 3.9E-6 | 2.7E-6 | 1.9E-6 | 1.4E-6 | 1.1E-6 | 8.3E-7 | 7.8E-7 |
| 3) -0.5 $\leq\Delta$<-0.2 | D | 3.8E-4 | 1.4E-4 | 4.9E-5 | 2.7E-5 | 1.7E-5 | 1.2E-5 | 9.2E-6 | 7.3E-6 | 6.0E-6 | 5.0E-6 | 4.3E-6 |
| 4) -0.2 $\leq\Delta$< +0.4 | E | 6.9E-4 | 2.5E-4 | 9.6E-5 | 5.5E-5 | 3.5E-5 | 2.5E-5 | 2.0E-5 | 1.6E-5 | 1.3E-5 | 1.1E-5 | 9.7E-6 |
| 5) +0.4 $\leq\Delta$< +1.2 | F | 1.1E-3 | 5.1E-4 | 2.0E-4 | 1.2E-4 | 8.2E-5 | 6.3E-5 | 5.1E-5 | 4.3E-5 | 3.8E-5 | 3.3E-5 | 3.0E-5 |
| 6) +1.2$\leq\Delta$ | G | 1.8E-3 | 1.1E-3 | 4.3E-4 | 2.7E-4 | 2.0E-4 | 1.7E-4 | 1.3E-4 | 1.2E-4 | 8.6E-5 | 7.8E-5 | 7.3E-5 |

NOTE: If $\Delta T$ is unavailable use: 1000-1600 hours — Use Stability Class D

1600-1000 hours — Use Stability Class G

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.3
PROTECTIVE ACTION ZONES DETERMINATION

Determine the affected zones (based on wind direction) from the table below and record on Enclosure 5.1.

NOTE: If wind speed is less than or equal to 5 mph, the affected zones for 0-5 miles shall be A0, A1, B1, C1, D1, E1, F1.

| Wind Direction (degrees from North) | PAZ's 0-5 miles | PAZ's 5-10 miles |
|---|---|---|
| 0.0 - 22 | A0, C1, D1 | C2, D2 |
| 22.1 - 73 | A0, C1, D1, E1 | C2, D2, E2, F2 |
| 73.1 - 108 | A0, C1, D1, E1, F1 | D2, E2, F2, F3 |
| 108.1 - 120 | A0, D1, E1, F1 | D2, E2, F2, F3 |
| 120.1 - 159 | A0, E1, F1 | D2, E2, F2, F3, A2 |
| 159.1 - 207 | A0, E1, F1, A1 | E2, F2, F3, A2, B2 |
| 207.1 - 247 | A0, F1, A1, B1 | F2, F3, A2, B2 |
| 247.1 - 265 | A0, A1, B1 | F3, A2, B2, A3, C2 |
| 265.1 - 298 | A0, A1, B1, C1 | A2, B2, A3, C2 |
| 298.1 - 338 | A0, B1, C1 | B2, A3, C2, D2 |
| 338.1 - 359.9 | A0, B1, C1, D1 | B2, C2, D2 |

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.4
SOURCE TERM ASSESSMENT - STEAM RELIEF VALVES

Report # _____

Reactor Trip _____/_____ (Date/Time) Projection based on data on _____/_____ (Date/Time)

Calculations based on _____Melted Core _____LOCA

NOBLE GAS

based on EMF26 or EMF10 $SG_{NG}$

_____ R/hr x $\left[\frac{1}{____\text{sec}}\right]$ x _____lbm x _____ $\frac{Ci}{lbm\ R/hr}$ (Encl. 5.5) = _____ $\frac{Ci}{sec}$

based on EMF27 or EMF11

_____ R/hr x $\left[\frac{1}{____\text{sec}}\right]$ x _____lbm x _____ $\frac{Ci}{lbm\ R/hr}$ (Encl. 5.5) = _____ $\frac{Ci}{sec}$

based on EMF28 or EMF12

_____ R/hr x $\left[\frac{1}{____\text{sec}}\right]$ x _____lbm x _____ $\frac{Ci}{lbm\ R/hr}$ (Encl. 5.5) = _____ $\frac{Ci}{sec}$

based on EMF29 or EMF13

_____ R/hr x $\left[\frac{1}{____\text{sec}}\right]$ x _____lbm x _____ $\frac{Ci}{lbm\ R/hr}$ (Encl. 5.5) = _____ $\frac{Ci}{sec}$

Total from all Steam Relief Valves, $Q_{NG}$ = _____ Ci/sec

IODINE

From all Steam Relief valves

$Q_{NG}$ x _____ I131 eqv./Xe 133 eqv. ratio (Encl. 5.6) = $Q_I$ _____ Ci/sec

☐ Emergency ☐ Drill Prepared by: _____

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.5
EMF26, EMF27, EMF28, EMF29 or
EMF10, EMF11, EMF12, EMF13 NOBLE GAS CORRECTION FACTOR

| Time Since Trip (hrs) | Correction Factor based on Melted Core or LOCA |
|---|---|
| $\geq 0$ | 3.622 |
| $\geq 2$ | 3.971 |
| $\geq 4$ | 4.041 |
| $\geq 8$ | 4.029 |
| $\geq 24$ | 3.332 |
| $\geq 48$ | 2.647 |
| $\geq 100$ | 2.438 |
| $\geq 250$ | 2.438 |
| $\geq 500$ | 2.438 |
| $\geq 720$ | 2.438 |

* units in $\frac{\text{Ci}}{\text{lbm R/hr}}$

* Enclosure 5.5 is the correlation factor per Reference 2.13 x

$$2.83E4 \frac{ml}{ft^3} \times .41 \frac{ft^3}{lbm} \times \frac{m^3}{1E6\ ml}$$

.41 = specific gravity of steam per Reference 2.13.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.6
I131 eqv./Xe133 eqv. RATIO

| Time Since Trip (hrs) | Ratio based on LOCA (Column 1) | Ratio based on Melted Core (Column 2) |
|---|---|---|
| ≥0 | 2.74E-3 | 2.24E-3 |
| ≥2 | 3.42E-3 | 9.66E-3 |
| ≥4 | 3.82E-3 | 1.59E-2 |
| ≥8 | 4.34E-3 | 2.85E-2 |
| ≥24 | 4.79E-3 | 7.52E-2 |
| ≥48 | 4.84E-3 | 1.11E-1 |
| ≥100 | 5.06E-3 | 1.33E-1 |
| ≥250 | 6.55E-3 | 1.80E-1 |
| ≥500 | 1.02E-2 | 2.90E-1 |
| ≥720 | 1.44E-2 | 4.33E-1 |

* Enclosure 5.6 is from Reference 2.13.

NOTE: For unit vent releases in which Irat is utilized to determine I-131 equiv. concentration, apply the appropriate correction from the table below:

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 1.44E-5
6. New fuel accident, use 2.217E-4 (< 100 hrs old)
7. Old fuel accident, use 7.217E-4 (≥ 100 hrs old)
8. Gas decay tank, assume no radioiodine released, only noble gases are considered to be released from gas tank, use 0.

NOTE: For steam releases in which Irat is utilized to determine I-131 equiv. concentration, apply the appropriate correction from the table below:

1. LOCA divide column 1 value by 100.
2. Core damage, divide column 2 value by 100.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.7
SOURCE TERM ASSESSMENT - CONTAINMENT

Report # _____

Reactor Trip _____/_____ Projection based on data on _____/_____
(Date/Time) (Date/Time)

Calculations based on _____Melted Core _____LOCA

Containment pressure _____psig

LR = _____ml/hr x BYPASS _____ (default = .07)

LR based on _____ Realistic Leak Rate
(check one)

____ 1" 2" 4" 6" 8" 12" 18" 34" diameter opening
(circle one) Personnel Hatch opening Equipment Hatch opening

____ Design Leak Rate (4.18E6)

NOBLE GAS_____
based on (check one)

☐ EMF39(L) if < 1E7 cpm ☐ EMF39(H) if > 100 cpm ☐ EMF53 if 39(H) is off scale

EMF CF LR $Q_{NG}$

_____ or $\frac{\text{cpm}}{\text{R/hr}}$ x _____ (Encl. 5.8) x _____ml/hr = _____ $\frac{\text{Ci}}{\text{sec}}$

(Note on Encl. 5.9)

based on
PACS sample

_____ $\mu$Ci/ml x 2.78E-10 $\frac{\text{Ci hr}}{\text{sec } \mu\text{Ci}}$ x _____ml/hr = _____ $\frac{\text{Ci}}{\text{sec}}$

IODINE_____
based on
$Q_{NG}$ $Q_I$

_____ $\frac{\text{Ci}}{\text{sec}}$ x _____ I131 eqv./Xe133 eqv. ratio (Encl. 5.6) = _____ $\frac{\text{Ci}}{\text{sec}}$

based on EMF40 LR

_____ $\frac{\Delta\text{CPM}}{\Delta\text{min}}$ x 9.82E-20 $\frac{\text{Ci hr min}}{\text{sec ml cpm}}$ x _____ml/hr = _____ $\frac{\text{Ci}}{\text{sec}}$

based on PACS sample

_____ $\frac{\mu\text{Ci}}{\text{ml}}$ x 2.78E-10 $\frac{\text{Ci hr}}{\text{sec } \mu\text{Ci}}$ x _____ml/hr = _____ $\frac{\text{Ci}}{\text{sec}}$

☐ Emergency ☐ Drill Prepared by: _____

DUKE POWER COMPANY
EDA-2
CATAWBA CONTAINMENT NOBLE GAS CORRECTION FACTOR

| Time Since Trip (hours) | EMF 39(L) based on | | EMF 39(H) based on | | EMF 53 based on | |
|---|---|---|---|---|---|---|
| | LOCA | Melted Core | LOCA | Melted Core | LOCA | Melted Core |
| ≥0 | 6.389E-18 | 6.672E-17 | 5.56E-14 | 1.429E-13 | 3.781E-10 | 1.190E-9 |
| ≥2 | 6.389E-18 | 4.448E-17 | 5.56E-14 | 1.003E-13 | 3.114E-10 | 5.894E-10 |
| ≥4 | 6.389E-18 | 3.058E-17 | 5.56E-14 | 1.232E-13 | 2.780E-10 | 4.726E-10 |
| ≥8 | 6.389E-18 | 2.113E-17 | 5.56E-14 | 1.195E-13 | 2.446E-10 | 3.392E-10 |
| ≥24 | 6.389E-18 | 1.112E-17 | 5.56E-14 | 7.339E-14 | 2.335E-10 | 1.890E-10 |
| ≥48 | 6.389E-18 | 1.056E-17 | 5.56E-14 | 6.060E-14 | 2.335E-10 | 1.668E-10 |
| ≥100 | 6.389E-18 | 1.390E-17 | 5.56E-14 | 5.699E-14 | 2.335E-10 | 1.612E-10 |
| ≥250 | 6.389E-18 | 1.446E-17 | 5.56E-14 | 5.588E-14 | 2.335E-10 | 1.557E-10 |
| ≥500 | 6.389E-18 | 9.730E-18 | 5.56E-14 | 5.560E-14 | 2.335E-10 | 1.251E-10 |
| ≥720 | 6.389E-18 | 6.394E-18 | 5.56E-14 | 5.560E-14 | 2.335E-10 | 1.056E-10 |
| | Units in $\frac{\text{Ci hr}}{\text{sec ml cpm}}$ | | Units in $\frac{\text{Ci hr}}{\text{sec ml cpm}}$ | | Units in $\frac{\text{Ci hr}}{\text{sec ml R/hr}}$ | |

Enclosure 5.8 is the correlation factor per Reference 2.13 x $\frac{\text{hr}}{3600\text{ sec}}$ x $\frac{\text{Ci}}{1\text{E6 }\mu\text{Ci}}$

NOTE: Reference 2.14.

If Time Since Trip is > 48 hours and EMF53A or EMF53B is less than or equal to 150 R/hr, add 150 R/hr to reading.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.9
CONTAINMENT LEAKAGE RATE VERSUS PRESSURE

| PSIG | ml/hr |
|---|---|
| ≥0 | *2.081E5 |
| ≥2 | 4.536E5 |
| ≥4 | 8.316E5 |
| ≥8 | 1.397E6 |
| ≥10 | 1.591E6 |
| ≥11 | 1.663E6 |
| ≥12 | 1.713E6 |
| ≥13 | 1.764E6 |
| ≥14 | 1.800E6 |
| ≥15 | 1.836E6 |

Enclosure 5.9 is the realistic leakage rate ($m^3$/sec) per Reference 2.12 x 1E6 ml/$m^3$ x 3600 sec/hr.

* 2.081E5 ml/hr is derived as follows:

$$2.081E5 \frac{ml}{hr} = 0.017 \ \%/day \times 3.4E\text{-}3 \ m^3 \frac{\text{-day}}{\%\text{-sec}} \times 1E6 \frac{ml}{m^3} \times 3600 \frac{sec}{hr}$$

where:

0.017 is determined from containment leakage rate vs pressure curve from Reference 2.13 for an assumed 1 psig. 3.4E-3 is from Reference 2.12.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.10
CONTAINMENT LEAKAGE RATE VERSUS PRESSURE AND SIZE OPENING

For 1" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 2.209E8 | >5.0 | 3.908E8 | >12.5 | 5.862E8 |
| >2.50 | 2.889E8 | >7.5 | 4.588E8 | >15.0 | 6.287E8 |
| >3.75 | 3.483E8 | >10.0 | 5.268E8 | | |

For 2" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 8.496E8 | >5.0 | 1.512E9 | >12.5 | 2.243E9 |
| >2.50 | 1.121E9 | >7.5 | 1.784E9 | >15.0 | 2.464E9 |
| >3.75 | 1.342E9 | >10.0 | 2.022E9 | | |

For 4" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 3.144E9 | >5.0 | 5.692E9 | >12.5 | 8.496E9 |
| >2.50 | 4.248E9 | >7.5 | 6.797E9 | >15.0 | 9.176E9 |
| >3.75 | 5.098E9 | >10.0 | 7.731E9 | | |

For 6" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 7.137E9 | >5.0 | 1.291E10 | >12.5 | 1.937E10 |
| >2.50 | 9.516E9 | >7.5 | 1.529E10 | >15.0 | 2.124E10 |
| >3.75 | 1.138E10 | >10.0 | 1.716E10 | | |

For 8" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 1.257E10 | >5.0 | 2.243E10 | >12.5 | 3.381E10 |
| >2.50 | 1.648E10 | >7.5 | 2.634E10 | >15.0 | 3.568E10 |
| >3.75 | 1.971E10 | >10.0 | 3.042E10 | | |

For 12" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 2.719E10 | >5.0 | 5.012E10 | >12.5 | 7.476E10 |
| >2.50 | 3.738E10 | >7.5 | 5.947E10 | >15.0 | 8.156E10 |
| >3.75 | 4.452E10 | >10.0 | 6.712E10 | | |

For 18" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 5.522E10 | >5.0 | 1.003E11 | >12.5 | 1.529E11 |
| >2.50 | 7.476E10 | >7.5 | 1.189E11 | >15.0 | 1.665E11 |
| >3.75 | 8.836E10 | >10.0 | 1.351E11 | | |

For 34" diameter opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 1.869E11 | >5.0 | 3.398E11 | >12.5 | 5.132E11 |
| >2.50 | 2.583E11 | >7.5 | 4.078E11 | >15.0 | 5.607E11 |
| >3.75 | 3.093E11 | >10.0 | 4.588E11 | | |

For Personnel Hatch opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 2.379E12 | >5.0 | 4.690E12 | >12.5 | 6.967E12 |
| >2.50 | 3.398E12 | >7.5 | 5.573E12 | >15.0 | 7.646E12 |
| >3.75 | 4.111E12 | >10.0 | 6.372E12 | | |

For Equipment Hatch opening

| PSIG | ml/hr | PSIG | ml/hr | PSIG | ml/hr |
|---|---|---|---|---|---|
| >1.25 | 1.121E13 | >5.0 | 2.022E13 | >12.5 | 3.059E13 |
| >2.50 | 1.478E13 | >7.5 | 2.379E13 | >15.0 | 3.398E13 |
| >3.75 | 1.767E13 | >10.0 | 2.719E13 | | |

* Enclosure 5.10 is the containment leakage for an opening size in standard cubic feet per min (scfm) x 2.83E4 ml/ft$^3$ x 60 min/hr.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.11
SOURCE TERM ASSESSMENT - UNIT VENT

Report # _____

Reactor Trip _____/_____ (Date/Time) Projection based on data on _____/_____ (Date/Time)

Calculations based on _____Melted Core _____LOCA

CFM = _____ ft³/min

NOBLE GAS _____

based on (check one)

☐ EMF36(L) if < 1E7 cpm ☐ EMF36(H) if > 100 cpm ☐ EMF54 if 36(H) is offscale

EMF CF CFM $Q_{NG}$

_____cpm or R/hr x _____ (Encl. 5.12) x _____ $\frac{ft^3}{min}$ = _____ $\frac{Ci}{sec}$

based on Unit Vent Sample

_____μCi/ml x 4.72E-4 $\frac{Ci\ min\ ml}{sec\ ft^3\ \mu Ci}$ x _____ $\frac{ft^3}{min}$ = _____ $\frac{Ci}{sec}$

IODINE _____

based on $Q_{NG}$ $Q_I$

_____ $\frac{Ci}{sec}$ x _____ I131 eqv./Xe133 eqv. ratio (Encl. 5.6) = _____ $\frac{Ci}{sec}$

based on EMF37 CFM

_____ $\frac{\Delta CPM}{\Delta min}$ x 1.33E-13 $\frac{Ci\ min\ min}{sec\ ft^3\ cpm}$ x _____ $\frac{ft^3}{min}$ = _____ $\frac{Ci}{sec}$

based on Unit Vent Sample

_____μCi/ml x 4.72E-4 $\frac{Ci\ min\ ml}{sec\ ft^3\ \mu Ci}$ x _____ $\frac{ft^3}{min}$ = _____ $\frac{Ci}{sec}$

☐ Emergency ☐ Drill Prepared by: _____

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.13
INTEGRATED DOSE

| Duration (hrs) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A0 | | | | | | | | | | |
| B1 | | | | | | | | | | |
| E1 | | | | | | | | | | |
| A1 | | | | | | | | | | |
| C1 | | | | | | | | | | |
| D1 | | | | | | | | | | |
| F1 | | | | | | | | | | |
| B2 | | | | | | | | | | |
| A2 | | | | | | | | | | |
| C2 | | | | | | | | | | |
| D2 | | | | | | | | | | |
| E2 | | | | | | | | | | |
| F2 | | | | | | | | | | |
| F3 | | | | | | | | | | |
| A3 | | | | | | | | | | |

Instructions:

1) Add the doses from previous releases to the projected release.

2) Add the times of releases to the time of the projected release.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-2
ENCLOSURE 5.14
SOURCE TERM ASSESSMENT - STEAM GENERATOR
TUBE RUPTURE COINCIDENT WITH LOSS OF OFFSITE POWER

NOBLE GAS

EMF53* CF** LRps dT Lbsmr*** VOPEN

Affected Steam Line Monitor _____

_____ x R/hr _____ $\frac{\mu Ci/ml}{R/hr}$ x _____ gpm x _____ min x $\frac{___ lbm}{2400\ lbm}$ / _____ secs

x 3.785E-3 = $Q_{NG}$ _____ Ci/sec

* If EMF53 < 5 R/hr, use 5 R/hr.

** Time Since Trip (hrs)

| | CF |
|---|---|
| 0 | 4115 |
| 1 | 2337 |
| 2 | 2740 |
| 4 | 3364 |
| 8 | 5142 |
| >12 | 7960 |

*** If Lbsmr > 2400 lbm, use 2400 lbm.

IODINE

$Q_{NG}$ x _____ I131 eqv./Xe-133 eqv. ratio (from table below) = $Q_I$ _____ Ci/sec

| Times Since Trip (hrs) | I131/Xe-131 ratio |
|---|---|
| 0 | 1.24E-6 |
| 1 | 4.00E-6 |
| 2 | 5.30E-6 |
| 4 | 7.65E-6 |
| 8 | 1.36E-5 |
| >12 | 2.07E-5 |

Prepared by: _____

where:

LRps = primary to secondary leak rate.

dT = time that primary to secondary leakage has lasted from the start of the leak to present.

Lbsmr = mass of steam released from the code safety valves or PORVs.

VOPEN = time the valve is open in seconds.

3.785E-5 = 1E-6 Ci/$\mu$Ci x 3.785E3 ml/gal

2400 = mass of steam in the faulted steam generator; conservative value is 2400 lbm (mass of steam from S/G nozzle to MSIV).

CRISIS MANAGEMENT PLAN

IMPLEMENTING PROCEDURE

EDA - 8

"Environmental Monitoring for Emergency Conditions for Catawba Nuclear Station"

R E Harris
Approved By

5/10/90
Date

Rev. 6
May 10, 1990

# ENVIRONMENTAL MONITORING FOR EMERGENCY CONDITIONS FOR CATAWBA NUCLEAR STATION

## 1.0 PURPOSE

To provide a method for identifying airborne plumes or liquid effluents, and obtaining field data indicative of the radiation exposure to the general public following a release of radioactive material.

## 2.0 REFERENCES

2.1 HP/0/B/1000/06 Emergency Equipment Functional Check and Inventory

2.2 HP/0/B/1001/23 Operation and Calibration: Quantum Portable MCA

2.3 HP/0/B/1002/12 Radiological Environmental Sample Collection

2.4 HP/0/B/1003/05 Operating and Calibration Procedure: Eberline Model PIC-6A Portable Ion Chamber

2.5 HP/0/B/1003/12 Operating and Calibration Procedure: Eberline Model E-520 Portable Beta-Gamma Geiger Counter

2.6 HP/0/B/1003/31 Operation and Calibration: Eberline Model E140N Portable Count Rate Meter

2.7 HP/0/B/1003/41 Operation and Calibration: Bicron Model RSO-50

2.8 HP/0/B/1009/09 Guidelines for Accident and Emergency Response

2.9 HP/0/B/1009/16 Distribution of Potassium Iodide Tablets in the Event of a Radioiodine Release

2.10 HP/0/B/1009/19 Emergency Radio System Operations, Maintenance and Communications

2.11 S.D. 3.8.4 Onsite Emergency Organization

2.12 NUREG-1210, J. A. Martin, T. J. McKenna et al., "Pilot Program: NRC Severe Reactor Accident Incident Response Training Manual," Vol. 2, "Severe Reactor Accident Overview," Vol. 3, "Response of Licensee and State and Local Officials," Vol 4, "Public Protective Action," February 1987.

## 3.0 LIMITS AND PRECAUTIONS

3.1 The Field Monitoring Teams (FMT) should park vehicles completely off the road when sampling and use vehicle emergency flashers while stopped.

3.2 Enclosure 5.1, SRWP 98 contains protective clothing, dosimetry, and respiratory equipment criteria for field monitoring. The Field Monitoring Coordinator (FMC) in either the Technical Support Center (TSC) or in the Crisis Management Center (CMC) can change these criteria depending upon conditions.

3.3 FMT members excluding Foxtrot should follow the protective guidance as listed on Enclosure 5.1.

3.4 Radiation surveys shall consist of gamma readings unless otherwise directed by FMC to perform beta surveys.

3.5 If the team members are expected to be exposed to I-131 in excess of 70 MPC ($6.1 \times 10^{-7}$ μCi/ml), the FMC will determine if each team member should ingest a tablet of potassium iodide per Reference 2.9.

3.6 While performing instrument surveys in the field, if any FMT except Foxtrot notes an instrument reading of $\geq$ 2 mR/hr, they shall retreat from the area to an area of < 2 mR/hr. The FMT shall report results to FMC and await further instructions. Foxtrot team shall use $\geq$ 50 mR/hr as action level.

3.7 Environmental sampling during emergency conditions shall not replace, but rather supplement normal environmental monitoring.

3.8 Minimum labeling requirements for all samples are as follows:

3.7.1 Date and time.

3.7.2 Location.

3.7.3 Volume of the sample (if applicable).

3.9 All FMTs shall repeat directions given by Radio Operator whenever possible, to ensure effective monitoring techniques. Also, survey results shall be repeated by Radio Operator whenever possible to ensure correct, accurate data transmission.

3.10 Each FMT shall maintain open radio communications with the FMC per Reference 2.9. If a radio becomes inoperable, telephone the following:

3.10.1 FMC in the TSC at 831-8182 (Lake Wylie/Charlotte).

3.10.2 Station PBX Operator at 831-3000 (Lake Wylie/Charlotte). 861-0331 (Gaston County), 324-3128 (Rock Hill/Fort Mill), and request ext. 5882 for FMC.

3.10.3 FMC in the CMC at (704) 382-0735/0736.

3.11 If any equipment becomes inoperable, notify the FMC.

3.12 Personnel not trained for emergency response may assist a trained Radiation Protection technician to do surveys and/or drive the vehicle. In the event that backup teams are provided from other stations, the FMC should ensure that at least one CNS FMT member is on each backup team.

3.13 Ensure that count rate portable survey instrumentation is on and audibly monitored during transport to all sampling locations.

3.14 When returning kits to the Emergency Kit Storage Room, perform an equipment inventory check using the Environmental Survey Kits List of Contents (Reference 2.1). Note deviations and forward to the Respiratory/Instrument Calibration Supervisor.

3.15 When returning kit(s) to the Radiation Protection Instrument Issue Area, perform an equipment inventory check using the Protected Area Survey Kit List of Contents (Reference 2.1). Note deviations and forward to the Respiratory/Instrument Calibration Supervisor.

3.16 Voluntary use of personal vehicles may be requested by FMC.

3.17 When operating any equipment in vans, ensure that engine is running when power inverter is ON.

3.18 When counting samples on the MCA, the dead time shall be <10% unless the FMC specifies otherwise. If the dose rate is >2 mR/hr, the dead time may be too high.

3.19 Specialized sampling (e.g. TLD, composites) shall be performed by the Applied Science Center personnel or by individuals qualified to reference 2.3.

3.20 Upon activation of the CMC, the FMC in the TSC will become an extension of the CMC organization and will direct the Field Monitoring Teams (FMTs) under the guidance of the CMC's FMC. The CMC FMC will monitor FMT communications and report field measurements to the CMC Dose Assessment Coordinator, as appropriate.

3.21 During a drill, include the statement, "this is a drill" with each radio transmission.

3.22 The field monitoring radio is an alternate means of providing emergency notification information to the states and counties. If needed, the state/county communications will take precedence over field monitoring communications. Field monitoring teams should maintain radio silence until these communications are completed.

## 4.0 PROCEDURE

### 4.1 Field Monitoring Team (FMT) Activation

4.1.1 Form as many qualified survey teams and sampling van teams as possible, based upon the number of personnel available and field monitoring required. Personnel not trained for Emergency Response may assist a qualified technician as driver or to perform surveys.

| Team Call Signs* | Number of Members | Transportation |
|---|---|---|
| Sample Van 1 | 2 | Emergency Van (#1620) |
| Sample Van 2 | 2 | Emergency Van (#1622) |
| Alpha | 2 | Land Vehicle |
| Bravo | 2 | Land Vehicle |
| Charlie | 2 | Land Vehicle |
| Delta | 2 | Land Vehicle |
| Foxtrot | 2 | (Onsite Team) |

*For any backup teams from other stations, precede the call sign by the station name (e.g. MNS Sample Van 1).

4.1.2 Depending on the team, use the suggested guidelines, (Enclosure 5.9, 5.10 or 5.11) as an initial response for performing duties.

4.2 Locating and Tracking the Plume

4.2.1 Unless otherwise directed by the FMC, the FMT's will generally be dispatched as follows:

Alpha, Bravo, Charlie, Delta - Perform gamma radiation surveys on the edges of the suspected area to determine plume boundaries, utilizing a station vehicle.

Foxtrot - Perform (on-site, near-site) gamma radiation surveys along the security area boundary fence, mobile or on foot, as directed.

Sample Van 1, 2 - Perform air sample and gamma radiation surveys and mobile analyses at or beyond the site boundary fence, utilizing an emergency van.

4.2.2 The FMC will direct FMT's to systematically survey the suspected areas in a continuous mode and to obtain air samples and gamma measurements as conditions warrant utilizing quadrants, major roads, and/or predetermined sampling locations.

4.2.2.1 Each quadrant consists of a four square mile area (two miles on each side). This area is then sub-divided into four sub-quadrants of one square mile each.

4.2.2.1.1 A quadrant on the EPZ Map will be identified by, 1) the letter depicting the column and 2) the number depicting the row (ex. H-12).

Note: The letter "I" has been omitted to eliminate possible confusion with the number (1).

4.2.2.1.2 A sub-quadrant will be described as either the upper left (UL), upper right (UR), lower left (LL), or lower right (LR).

4.2.2.2 Major roadways delineate major territories surrounding the plant. Either all or a portion of these sections would be expected to be affected to some degree by radioactivity released from the plant. Major roadways are therefore utilized to provide access to suspected regions (outer edges, leading edge(s), centerline) of the plume, as necessary.

4.2.2.2.1 Major roadways on the EPZ map are identified by numerical designations and responsibility level (federal, state, county or city) designations.

4.2.2.2.2 Selected roadways on the EPZ map are identified by a specific name, rather than a numerical responsibility designation.

4.2.2.3 Each predetermined sampling location is denoted by a (colored) dot on the map. The sampling point designator indicates the protective action zone the point is in and the mileage from the plant.

4.2.2.3.1 The FMC should use the points as landmarks when directing the teams.

4.2.2.3.2 The point locations can be read directly from the map or from the directions in Enclosure 5.4.

4.2.3 The FMC may use Enclosure 5.5 as a log to document instructions to the radio operator regarding FMT movement and utilization.

4.2.4 The radio operator shall use Enclosure 5.6 to log FMT movement and field data such as gamma surveys, air samples, and/or special samples.

4.2.5 The FMC shall periodically provide information to the FMTs on the emergency classification, wind speed, wind direction, zones affected and other pertinent information using Enclosure 5.7.

4.2.6 The FMC shall periodically check and track FMT members radiation exposures, using Enclosure 5.8.

4.2.7 At the assigned survey point, the FMT shall perform a general area gamma survey. This method should be used to locate center and width of plume.

4.2.7.1 Record date, time, location and dose rate (mr/hr) on the Field Monitoring Survey Data Sheet (Enclosure 5.6). Ensure accurate data prior to transmission to FMC.

4.2.8 Report all survey results (including background readings) to the FMC. If survey results are greater than background, take protective actions as necessary.

4.2.9 While enroute and at sampling locations, survey teams shall report the maximum radiation level to the FMC as directed.

4.2.10 Wait for further instructions from the FMC.

4.3 Special Sampling, as directed:

4.3.1 When sampling away from the emergency vehicles and no one is present to monitor the radio do the following:

4.3.1.1 For the emergency vans, ensure the exterior speaker is on and volume turned up. The switch is located near the radio monitor on the right side of the drivers seat.

4.3.1.2 For other Station vehicles or personnel vehicles, carry the portable radio to the sampling location.

4.3.2 All sampling immediately outside of the Auxiliary, Service and Turbine Buildings should be done by Team Foxtrot.

4.3.3 Take smears on stationary, horizontal surfaces (e.g. mail boxes, gas pumps). Do not take any on automobiles. Place them in separate plastic bags, label and retain for later analysis.

4.3.4 Count smears on E140N if background is low and record on Field Monitoring Survey Data Sheet (Enclosure 5.6). Call in results to FMC.

4.3.5 Collect air sample(s) as follows:

4.3.5.1 Insert silver zeolite cartridge with arrow pointing in.

4.3.5.2 Insert filter paper with smooth side facing out.

4.3.5.3 Calculate required sample time per Enclosure 5.2 (volume should be $\geq 10^6$ ml).

4.3.5.4 Turn the switch on the air sample power cord on.

4.3.5.5 When air sampling is complete, place the cartridge in a thin plastic bag (baggie) for analysis.

4.3.5.6 If you are in a low background area, analyze the sample per Enclosure 5.3 and record the Dose Equivalent Iodine results (mrem/hr).

4.3.5.7 Place filter in a separate plastic bag.

4.3.5.8 Seal the bag and label with; the date, time, sample location and sample volume; and retain for further analysis.

4.3.6 Collect water sample(s) as follows:

4.3.6.1 Use the bucket to collect approximately 1 gallon of water from the top surface layer of water.

4.3.6.2 Attach a rope to the sampler if the body of water being sampled may not be easily reached.

4.3.6.3 Pour the water sample into a cubitainer or some other appropriate container.

4.3.6.4 Seal the container and label with; the date, time and sample location; and retain for later analysis.

4.3.7 Collect broadleaf vegetation sample(s) as follows:

4.3.7.1 Estimate an approximate square meter plot of vegetation.

NOTE: Leaves in the shape of needles, i.e. pine or spruce needles, are not considered to be broad leaf vegetation.

4.3.7.2 Using shears or scissors, cut and collect the vegetation approximately one inch from the top.

4.3.7.3 Place the vegetation in a plastic sample bag.

4.3.7.4 Seal the bag and label with; the date, time and sample location; and retain for later analysis.

4.3.8 Collect soil sample(s) as follows:

4.3.8.1 Estimate an approximate square foot plot of exposed soil.

4.3.8.2 Use a small hand spade or another similar object to collect one inch depth of soil.

4.3.8.3 Place the sample into an appropriate container. Avoid filling with rocks or water.

4.3.8.4 Seal the container and label with; the date, time and sample location; and retain for later analysis.

4.4 Contamination Control Considerations

4.4.1 Don Anti-Cs inside the vehicle before leaving the vehicle.

4.4.2 Once a release has occurred, vehicle windows should be closed with ventilation off (unless filtration or recirculation is available on the ventilation) to minimize contamination until the plume area is identified. Depending on weather conditions (extreme heat or cold), this may not be possible.

4.5 Turnover

4.5.1 Each FMT shall be relieved as directed by the FMC.

4.5.2 Inform the relief FMT on the status of the following:

4.5.2.1 Radiation surveys and dose rates in the plume area.

4.5.2.2 Kit inventory consumed.

4.5.2.3 Equipment operating status.

4.5.2.4 Any sampling problems.

4.5.2.5 Plant status information.

4.5.3 Direct the relief FMT to don TLD's and pocket dosimetry and fill out dose cards.

4.5.4 Return all samples to the Emergency Kit Storage Room as directed by the FMC.

4.5.5 Turn in all data sheets to the FMC or his designee.

4.5.6 Following turnover, relieved FMT members shall report to a counting facility designated by the FMC for a post-job BBA, if required.

## 5.0 ENCLOSURES

5.1 SRWP #98

5.2 Sample Time Required For Minimum Sample Volume

5.3 Sample of MCA Operational Guidelines

5.4 Predetermined Sampling Locations

5.5 Sample of FMC Instruction Log

5.6 Sample of Field Monitoring Survey Data Sheet

5.7 Sample of Periodic Status Update for Field Monitoring Teams

5.8 Sample of Field Monitoring Team Radiation Exposure Record

5.9 Suggested Guidelines for Foxtrot Survey Team

5.10 Suggested Guidelines for Survey Teams

5.11 Suggested Guidelines for Sample Van Teams

Form 34537 (R1-86) Enclosure 5.1 EDA-8

# RADIATION WORK PERMIT

DUKE POWER COMPANY

Catawba NUCLEAR STATION

Date _____ Time _____ (S)RWP Number _____

Job Description Field Monitoring Team Emergency Response Activities

Location: Building/Unit N/A Room/Elevation N/A Area 10 mile EPZ

## SPECIAL INSTRUCTIONS/PRECAUTIONS

- [X] Notify FMC prior to start of work, or changing work locations.
- [X] Contact FMC for expected conditions during job.
- [X] Utilize RCZ/~~barricades/tape/signs~~/laundry bins/and Radioactive waste containers. #
- [ ] Health Physics approval required prior to sweeping, brushing, grinding, welding, or use of compressed air and solvents.
- [ ] Provide for adequate system drainage and provide absorbent material to pick up water.
- [ ] Lay down polyethylene and/or canvas to protect work surfaces and limit contamination.
- [ ] Set up local exhaust system with HEPA filter for proper ventilation.
- [X] Enter time in RCA/RCZ on Daily Exposure Time Record Card.
- [ ] Review area Radiological Status Sheet prior to entry.
- [X] Low dose-rate areas are identified ~~and posted~~
- [X] Personnel/tool/equipment monitoring required when leaving RCA/RCZ. #
- [ ] Housekeeping tour required before RWP termination.

**Refer to Comments Section for Additional Instructions/Information.**

| Health Physics Coverage Required | Radiation Monitoring Required | | ALARA Considerations |
|---|---|---|---|
| [X] Continuous | Type | X Radiation Level | [ ] Pre-Job Briefing |
| [ ] Intermittent | [ ] Alpha | * Contamination | [X] Post-Job Debriefing |
| [ ] Start of Work | [X] Beta | * Airborne Particulate | [ ] Tool List |
| [ ] Dose Controller | [X] Gamma | * Airborne Iodine | [ ] Temp. Shielding |
| [ ] _____ | [ ] Beta-Gamma | _____ Gaseous Activity | [X] Post-job BBA |
| | [ ] Neutron | *See survey and/or supplemental sheets for specific levels* | [ ] Additional Sheet |

***Notice: Each radiation worker is responsible for knowing their work area dose rates and the location of low dose-rate waiting areas. Each radiation worker is responsible for following the requirements of this RWP.***

Comments: * Information/direction provided by FMC

A: No core damage; no release occurring

B: No core damage; release occurring

C: Core damage; no release occurring

D: Core damage; release occurring

E: Sample Handling

# If the outside of the vehicle the contamination levels are ≥ 450 ccpm with a HP210 or E140N or as directed by FMC.

## PROTECTIVE CLOTHING AND EQUIPMENT REQUIRED

| Job Classification * Refer to Comments Section | A | B | C | D |
|---|---|---|---|---|
| [X] **Hood #** | | | | |
| Disposable | | | | |
| Cloth | | | | X |
| Wetsuit | | | | |
| [X] **Coveralls #** | | | | |
| Disposable | | | | |
| Cloth | | | | X |
| Wetsuit | | | | |
| [X] **Gloves #** | | | | |
| Cotton | | X | | X |
| Rubber | | X | | X |
| Surgical | | | | |
| Cotton Work | | | | |
| Heavy Rubber | | | | |
| Leather | | | | |
| [X] **Shoe Covers #** | | | | |
| Disposable | | X | | X |
| Cloth | | | | |
| Rubber | | X | | X |
| Heavy Rubber | | | | |
| [X] **Tape Required** | | | | X |
| [ ] **No Personal Outer Clothing** | | | | |
| [X] **Dosimetry** | | | | |
| Whole-Body TLD | X | X | X | X |
| Extremity TLD | | | | |
| Low Range Pocket Dosimeter | X | X | X | X |
| High Range Pocket Dosimeter | X | X | X | X |
| Extremity Pocket Dosimeter | | | | |
| Digital Alarming Dosimeter | | | | |
| [X] **Respiratory** | | | | |
| Full-Face Particulate | | * | | * |
| Air Line | | | | |
| SCBA | | | | |
| Air Supplied Suit/Hood | | | | |
| Potassium Tablet(KI) | | | | * |

SRWP _____ Approval Station Manager _____ Date/Time

RWP _____ Approval _____ Health Physics Title Date/Time

RWP _____ Terminated _____ Health Physics Title Date/Time

XC: ~~Supervisor/Worker~~ Health Physics ~~Change Room~~ ~~Job Location~~ _____

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.2
SAMPLE TIME REQUIRED FOR MINIMUM SAMPLE VOLUME

| FLOW RATE | | | MINIMUM REQUIRED SAMPLING TIME IN MINUTES |
|---|---|---|---|
| CFM | | LPM | |
| .5 | = | 14 | 71 |
| 1.0 | = | 28 | 36 |
| 1.5 | = | 42 | 24 |
| 2.0 | = | 56 | 18 |
| 2.5 | = | 70 | 15 |
| 3.0 | = | 84 | 12 |
| 3.5 | = | 99 | 11 |
| 4.0 | = | 113 | 9 |
| 4.5 | = | 127 | 8 |

NOTE: When estimating time required to get a minimum volume of $1 \times 10^6$ ml if flow rate for the air sampler in use is not on table, go to next <u>Lower</u> flow rate. The LPM are rounded off to the conservative side.

Example: Air Sampler flow rate = 106 LPM. Minimum time 11 minutes

5.3.1 System Set-Up Quantum Portable MCA Operational Guidelines

5.3.1.1 Verify that the Quantum system (#1 and #2) calibration date is within the last 15 months.

5.3.1.2 Both systems, as found, should be powered and the components, with exception of the Xtend computer and HP Printer, should be 'ON'.

5.3.1.3 Turn the Xtend computer 'ON' with small switch on black box. The system will automatically Boot and then display the AUTO MENU.

5.3.1.3.1 Select Option #2 SOURCE CHECK to verify that the system is functional.

5.3.1.3.2 If a spectrum appears on the screen, the system is functional.

5.3.1.3.3 If the system is not functional, notify FMC.

5.3.1.4 Turn OFF Computer.

5.3.1.5 Turn off toggle switch for High Voltage (HV) to detector.

5.3.1.6 Turn Bias knob down to ZERO.

5.3.1.7 Turn off POWER SWITCH on Front of ACEMATE Chassis.

5.3.1.8 Turn OFF switch at right back side of ACEMATE Chassis.

5.3.1.9 Disconnect the NaI Detector and transport to Sample Van.

5.3.1.10 Unplug power strip from wall outlet.

5.3.1.11 Transport Quantum system to Sample Van. Two people are required for safe transport of unit.

5.3.1.12 Place system unit on shelf in Van. Connect power cord from power strip to the Power Inverter located under the shelf.

5.3.1.13 Ensure that Van motor is running before switching the Inverter to the ON position.

5.3.1.14 Install the detector in the shield, then connect the signal and high voltage cables.

5.3.1.15 Turn on switch at back right side of ACEMATE chassis.

5.3.1.15.1 Turn on switch on the front right side of the ACEMATE chassis.

5.3.1.16 Verify that the Bias knob on the ACEMATE front panel is set to 0, then turn on the HV switch. The red "HV on" light should illuminate.

5.3.1.17 Apply a high voltage to detector.

5.3.1.17.1 Depress the select button below the LED display until the kv light illuminates.

5.3.1.17.2 Unlock the Bias knob and rotate clockwise until 80 appears in the knob's window.

5.3.1.17.3 Make fine adjustments with the Bias knob until .80 appears in the LED display.

5.3.1.18 Power up the Xtend computer. System will automatically boot and then display auto menu.

5.3.1.19 Energy Calibration and QC Check

5.3.1.19.1 Place the source on shelf 0 of the detector. Select Option #2 SOURCE CHECK, then strike a key when ready. Data acquisition will begin and the spectrum will be displayed.

5.3.1.19.2 When the acquisition is complete, the software will perform an energy calibration. Select option press #5 to view results of QC check.

5.3.1.19.3 The calibration and QC check is acceptable if the center channel of the Cs-137 661.65 keV peak is 165 ± 7 channels.

5.3.1.19.4 If the QC check is not acceptable, perform an Energy vs. Channel alignment by adjusting the Fine Gain knob.

5.3.1.19.4.1 If the peak is to the left of Channel 165, increase the Fine Gain by turning the knob clockwise.

5.3.1.19.4.2 If the peak is to the right of Channel 165, decrease the Fine Gain by turning the knob counterclockwise.

5.3.1.19.5 Report results of check to FMC.

5.3.1.20 Sample Analysis

5.3.1.20.1 Place the sample to be counted on the detector on shelf 0.

5.3.1.20.1.1 Place cartridge with the air flow air pointing away from the detection.

5.3.1.20.1.2 Place filter with recognizable (collection side toward the detector.

5.3.1.20.2 Press the number key to select count/analyze for cartridge or particulate sample.

5.3.1.20.3 Press the number key to select the desired count time and shelf.

5.3.1.20.3.1 Verify that dead time is <10%. If dead time is ≥10%, stop the acquisition using the ESCAPE key and move the sample to the next higher shelf.

5.3.1.20.3.2 Repeat Steps 5.8.1.20.2 and 5.8.1.20.3.1 until dead time is <10%. If dead time is still ≥10% when sample is placed on the highest shelf, report to FMC for instructions.

5.3.1.20.4 When the sample spectrum acquisition is complete, the analysis software will interactively query the operator for sample data. The data in parentheses is default data; if it is correct, make no entry and press the RETURN key. If the default data is not correct, enter the correct data in the same format as the default data.

5.3.1.20.4.1 The software will query for the MCA start date and time.

5.3.1.20.4.2 The software will query for the sample start date and time.

5.3.1.20.4.3 The software will query for the sample stop date and time.

5.3.1.20.4.4 The software will query for the sample volume.

5.3.1.20.4.5 The software will query for the sample units.

5.3.1.20.4.6 The software will query for the sample ID.

5.3.1.20.5 Select Option #7 RETURN TO MAIN MENU to return to the MAIN MENU, then select the appropriate TYPE RESULTS Option from the MAIN MENU to review the analysis report.

5.3.2 When returning the Quantum system to the storage location, leave the ACEMATE chassis in the ON position.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.4
PREDETERMINED SAMPLING LOCATIONS

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| AO | 1 | 1 | T,A,B | Hwy. 274-N for .5 miles, right on Liberty Hill Rd. for .4 miles to fork in road, right at fork for 1.1 miles to end of road (TLD CNS #200). |
| AO | 1 | 2 | | Hwy. 274-N for 2.2 miles, right on Lake Wylie Rd. (1099) for 2.2 miles to fork in road, right at fork onto Commodore Pl. for .2 miles, left on Tioga Rd. for .3 miles to end of road. |
| AO | 2 | 3 | | Hwy. 274-N for 2.2 miles, right on Lake Wylie Rd. (1099) for 2.2 miles to fork in road where pavement ends. |
| AO | 2 | 4 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 3 miles to fork in road, left at fork for .6 miles to end at Catawba Yacht Club. |
| AO | 1 | 5 | T,A,B | Left exiting Nuclear Production entrance on Concord Rd. for 1.2 miles, left on Old Concord Rd. for .3 miles, right on Acacia Rd. for .3 miles, left on Crepe Myrtle Rd. for .7 miles, left on Blue Bird Ln. for .1 miles to end (TLD CNS #201) |
| AO | 1 | 6 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 2.8 miles, left on Snug Harbor Rd. (1357) for .5 miles, right on Kalabash Rd. for .3 miles, right on Cozy Cove Rd. (1434) for .5 miles to end. |
| AO | 2 | 7 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 2.8 miles to the intersection of Snug Harbor Rd. (1357). |

*Sample types are the following:

T-TLD, A-Air, W-Water, M-Milk, S-Shoreline Sediment, B-Broadleaf Vegetation (these designations are used for specialized sampling).

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| A0 | 1 | 8 | T | Left exiting Nuclear Production entrance on Concord Rd. for 1.2 miles, left on Old Concord Rd. for .3 miles, right on Acacia Rd. for .3 miles, left on Crepe Myrtle Rd. Go .3 miles to first drive on right past Paradise Pl., TLD across road (TLD CNS #202). |
| A0 | 1 | 9 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles. right on Youngblood Rd. (1102) for 2.3 miles, left on Snug Harbor Rd. (1357) for 1.3 miles to end of road. |
| A0 | 2 | 10 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 2.8 miles, left on Snug Harbor Rd. (1357) for 1.3 miles, left on Crosshavens Dr. for .3 miles to end of road. |
| A0 | 1 | 11 | T | Left exiting Nuclear Production entrance on Concord Rd. for 1.2 miles, left on Old Concord Rd. for .3 miles, right on Acacia Rd. for .3 miles, left on Crepe Myrtle Rd. for .2 miles. TLD is on left in curve (TLD CNS #223). |
| A0 | 1 | 12 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 1.6 miles, left on McKee Rd. (1100) for 1.2 miles, right on Bankhead Rd. for 1.2 miles to end of road. |
| A0 | 2 | 13 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 1.6 miles, left on McKee Rd. (1100) for 1.2 miles, right on Bankhead Rd. for .4 miles to the intersection of Bessbrook Rd. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| A0 | 1 | 14 | T | Left exiting Nuclear Production entrance on Concord Rd. for 1.2 miles, left on Old Concord Rd. for .3 miles, right on Acacia Rd. for .2 miles. TLD is on right side of road (TLD CNS #224). |
| A0 | 1 | 15 | | Left exiting Nuclear Production entrance on Concord Rd. for 1.3 miles, left on Kingfisher Dr. for 1.8 miles to Commodore Yacht Club. |
| A0 | 1 | 16 | | Left exiting Nuclear Production entrance on Concord Rd. for 1.3 miles where pavement ends. |
| A0 | 1 | 17 | T | Left exiting Nuclear Production entrance on Concord Rd. for 1.1 miles to first transmission tower on left after bridge (TLD CNS #225). |
| A0 | 1 | 18 | | Left exiting Nuclear Production entrance on Concord Rd. for 1.7 miles, right on Sandlapper Rd. for .2 miles. Stop at transmission tower. |
| A0 | 2 | 19 | | Hwy. 274-S for 1.6 miles, left on Allison Creek Rd. (1081) for 3 miles to end of pavement. |
| A0 | 1 | 20 | T,B | Left exiting Nuclear Production entrance on Concord Rd. for .7 miles. TLD on left just past fence (TLD CNS #226). |
| A0 | 1 | 21 | | Hwy. 274-S for 1.6 miles, left on Allison Creek Rd. (1081) for 1.7 miles, left on Spratt Rd. to end. (Beware of dogs). |
| A0 | 2 | 22 | | Hwy. 274-S for 1.6 miles, left on Allison Creek Rd. (1081) for 1.6 miles to intersection of Bardale Rd. |
| A0 | 1 | 23 | T | Left exiting Nuclear Production entrance on Concord Rd. for .4 miles. TLD on left at beginning of guardrail posts (TLD CNS #204). |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| A0 | 1 | 24 | | Hwy. 274-S for 1.6 miles, left on Allison Creek Rd. (1081) for 1.7 miles, left at Spratt Rd. for .1 miles, left on Morrison Rd., right at first 2 forks then left at next fork to end for a total of .5 miles. |
| A0 | 2 | 25 | | Hwy. 274-S for 1.6 miles, left on Allison Creek Rd. (1081) for 1.7 miles to intersection of Spratt Rd. |
| A0 | 1 | 26 | T,A | Location at the base of Catawba Nuclear Station Meterological Tower (TLD CNS #205). |
| A0 | 1 | 27 | | Right exiting Nuclear Production entrance on Concord Rd. for .1 miles, left on Valelake Rd. for .1 miles to fork in road, left at fork for .5 miles to end of road. |
| A0 | 2 | 28 | | Hwy. 274-S for 1.6 miles, left on Allison Creek Rd. (1081) for 1 mile to intersection of Colina Rd. |
| A0 | 1 | 29 | T | Left exiting Nuclear Production entrance on Concord Rd. for .1 miles. TLD at Shady Shore Dr. on right corner of Bethel Community Clubhouse sign (TLD CNS #227). |
| A0 | 1 | 30 | | Right exiting Nuclear Production entrance on Concord Rd. for .1 miles, left on Valelake Rd. for .1 miles to fork in road, right at fork for .5 miles to end of road. |
| A0 | 2 | 31 | | Hwy. 274-S for 1.2 miles to the intersection of Campbell Rd. (80). |
| A0 | 1 | 32 | T | Right exiting Nuclear Production entrance on Concord Rd. for .1 miles. TLD is on right side of entrance to Valelake Rd. (TLD CNS #228). |
| A0 | 1 | 33 | | Right exiting Nuclear Production entrance on Concord Rd. for 1 mile, left on Pine Point Dr. for .5 miles. |
| A0 | 2 | 34 | | Hwy. 274-S for .7 miles to Big Allison Creek Bridge. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| AO | 1 | 35 | T | Right exiting Nuclear Production entrance on Concord Rd. for .4 miles. TLD on top of hill on right at the intersection of Catawba Nuclear Station Construction entrance (TLD CNS #206). |
| AO | 1 | 36 | | Right exiting Nuclear Production entrance on Concord Rd. for .9 miles. Stop at entrance to transmission lines. |
| AO | 2 | 37 | | Hwy. 274-N for .5 miles, left on Liberty Hill Rd. for .3 miles, left on Fremont Rd. for .2 miles to end of road. |
| AO | 1 | 38 | T | Go through Construction Maintenance Dept. (Central) Main Gate for approximately 50 ft., left on Alternate 1 for approximately 200 ft. to stop sign, left on gravel road for .1 miles, left into rebar yard for .7 miles on gravel road to end at chain link fence. Follow chain link fence in a northerly direction for approximately 300 yards. TLD is hanging on fence (TLD CNS #229). |
| AO | 1 | 39 | | Hwy. 274-N for .5 miles, right on Liberty Hill Rd. for .4 miles to fork in road, right at fork for .3 miles to third transmission tower on right. |
| AO | 2 | 40 | | Right exiting Nuclear Production entrance on Concord Rd. for 1.3 miles, right on Hwy. 274-N for 1 mile. |
| AO | 1 | 41 | T | Hwy. 274-N for .5 miles, right on Liberty Hill Rd. for .4 miles to fork in road, right at fork for .4 miles. TLD on fence on right (TLD CNS #207). |
| AO | 1 | 42 | | Hwy. 274-N for .5 miles, right on Liberty Hill Rd. for .4 miles to fork in road, right at fork for .8 miles to softball field entrance. |
| AO | 2 | 43 | | Hwy. 274-N for 2.2 miles, right on Lake Wylie Rd. (1099) for 1.9 miles, right on Beaver Creek Trail for .3 miles to end of road. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| A0 | 1 | 44 | T | Hwy. 274-N for .5 miles, right on Liberty Hill Rd. for .4 miles to fork in road, right at fork for 1 mile to large rock pile at fence. TLD is on fence (TLD CNS #222). |
| A0 | 1 | 45 | T | Left exiting Nuclear Production entrance on Concord Rd. for 1.2 miles, left on Old Concord Rd. for 1.4 miles to end of road. TLD is on fence on the left side (TLD CNS #203). |
| A0 | 1 | 46 | W,S | Left exiting Nuclear Production entrance on Concord Rd. for .7 miles. Turn left just after canal bridge. Go to pier (Water CNS #208). |
| A1 | 3 | 1 | | Hwy. 49-N for 4.8 miles to the N.C. side of Buster Boyd Bridge. |
| A1 | 4 | 2 | T | Hwy. 49-N for 6.5 miles to the intersection of Pleasant Hill Rd. (1109). TLD is on the transmission tower on left (TLD CNS #232). |
| A1 | 5 | 3 | | Hwy. 49-N for 7.8 miles to Steele Creek Volunteer Fire Department on right. |
| A1 | 4 | 4 | T | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for .6 miles, left on Zoar Rd. (1105) for .4 miles, right on Thomas Rd. (1104) for .1 miles. TLD is behind second house on right in pines (TLD CNS #233). |
| A1 | 5 | 5 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for .3 miles, left on Hamilton Rd. (1106) for .7 miles to the intersection of Hwy. 160. |
| A1 | 4 | 6 | W,S | Hwy. 49-N for 5.6 miles, left at Camp Steere sign after crossing Buster Boyd Bridge for .7 miles to end of road (Water CNS #215). |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| A2 | 10 | 1 | | Hwy. 49-N for 11.4 miles to Westinghouse Blvd. Go 1 mile past Westinghouse Blvd. to Roberts Systems 8500 on left. |
| A3 | 10 | 1 | | Hwy. 49-N for 10 miles, right on Carowinds Blvd. (1441) for 3 miles, left on Hwy. 51 for 2.1 miles to Sugar Creek Bridge. |
| B1 | 3 | 1 | T,A | Hwy. 49-N for 8 miles, right on Hwy. 160 for 2.8 miles, right on Gold Hill Rd. (98) at Tega Cay sign for 1.2 miles, right on gravel road into Duke Power Company substation (TLD CNS #212). |
| B1 | 2 | 2 | | Hwy. 49-N for 6.5 miles, right on Pleasant Hill Rd. (1109) for .5 miles, right on Youngblood Rd. (1102) for 1.6 miles, left on McKee Rd. (1100) for 1.2 miles, left on Bankhead Rd. for .4 miles, left on Bessbrook Rd. for .8 miles to end of road. |
| B1 | 4 | 3 | T | Hwy. 49-N for 8 miles, right on Hwy. 160 for 3.9 miles, right on Dam Rd. (99) for 1.9 miles to last gravel road on right in sharp curve before Lake Wylie Dam, left through fence for .2 miles to substation. TLD on right of inner substation (TLD CNS #235). |
| B1 | 2 | 4 | | Hwy. 49-N for 8 miles, right on Hwy. 160 for 2.8 miles, right on Gold Hill Rd. (98) at Tega Cay sign. Enter Tega Cay following Tega Cay Dr. for 2.6 miles, right on Windjammer Dr. for .6 miles to circle, right at circle for .2 miles, left on Kiwi Point for .2 miles to end of road. |
| B1 | 4 | 5 | W | Hwy. 49-N for 8 miles, right on Hwy. 160 for 3.9 miles, right on Dam Rd. (99) for 1.6 miles, left on Gray Rock Rd. (251) for .7 miles to Lake Wylie Dam. Walk through plant to upstream side of the dam (Water CNS #211). |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| B1 | 4 | 6 | | Hwy. 49-N for 8 miles, right on Hwy. 160 for 3.9 miles, right on Dam Rd. (99) for 1.6 miles, left on Gray Rock Rd. (251) for .7 miles to Lake Wylie Dam. Go to river access on downstream side of dam. |
| B2 | 8 | 1 | T | Hwy. 49-N for 10 miles, right on Carowinds Blvd. (1441) for 1.3 miles, left on Choate Circle for .3 miles. TLD is on the inside of fence left of the guardhouse (TLD CNS #246). |
| B2 | 4 | 2 | T | Hwy. 49-N for 8 miles, right on Hwy. 160 for 2.8 miles to the Home Federal Savings and Loan on left side of road. TLD on barbed wire fence approximately 50 yds. behind bank (TLD CNS #234). |
| B2 | 5 | 3 | | Hwy. 49-N for 8 miles, right on Hwy. 160 for 2.8 miles, left on Gold Hill Rd. (98) for 1 mile, stop at the intersection of Whitley Rd. |
| B2 | 10 | 4 | | Hwy. 49-N for 10 miles, right on Carowinds Blvd. (1441) for 3 miles, left on Hwy. 51 for 3 miles, right on Hwy. 521 (Polk St.) for 2.9 miles, right on Dorman Rd. for 1.1 miles, stop at the state line. |
| B2 | 5 | 5 | | Hwy. 49-N for 8 miles, right on Hwy. 160 for 5.6 miles, right on Sutton Rd. (49) for 1.1 miles to the intersection of Gray Rock Rd. (251). |
| B2 | 7 | 6 | T,W | Hwy. 49-N for 8 miles, right on Hwy. 160 for 7.1 miles, right on Lee St. for .1 miles, left on Self St. for approximately 100 yds. TLD at Fort Mill Municipal Water Supply on right behind Springs Mill (TLD CNS #247, Water CNS #213). |
| B2 | 10 | 7 | | Hwy. 49-N for 8 miles, right on Hwy. 160 for 10 miles through Fort Mill to the Sugar Creek Bridge. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| C1 | 3 | | S | Hwy 274-S, left on Mt. Gallant. Left at Boatshore Rd (CNS #210). |
| C1 | 4 | 1 | T | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 5.2 miles, left on India Hook Rd. (30) for .9 miles to the S.C. Wildlife Resources Dept. on left (TLD CNS #236). |
| C1 | 5 | 2 | | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 5.6 miles to Red Burketts Body Shop on right. |
| C1 | 4 | 3 | T | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 3 miles, right on Homestead Rd. (657) for 2.5 miles to end of road. TLD is straight across at intersection of Twin Lake Rd. (TLD CNS #237). |
| C1 | 5 | 4 | | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 3 miles, right on Homestead Rd. (657) for 2.5 miles to end of road. |
| C1 | 4 | 5 | T | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 1.3 miles, right on West Oak Dr. (962) for 1.2 miles to end at fork. TLD on left at fence (TLD CNS #238). |
| C1 | 5 | 6 | | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for 2.2 miles to fork in road, left at fork for .1 miles, S.C. National Guard Armory on left side of road. |
| C1 | 5 | 7 | | Hwy. 274-S for 5 miles to Carter Lumber Company. |
| C2 | 10 | 1 | | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for 2.2 miles to fork in road, left at fork on Celanese Rd. (50) for 8.2 miles to the intersection of Springdale Rd. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| C2 | 7 | 2 | W | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 8.5 miles to the intersection of Cherry Rd. Go to Rock Hill Municipal Water Supply across intersection on left (Water CNS #214). |
| C2 | 7 | 3 | T | Hwy. 274-S for 9.2 miles, right on Herlong Ave. for .3 miles to Piedmont Medical Center emergency entrance to back of hospital. TLD on fence at back right corner of Liquid Oxygen storage area (TLD CNS #248). |
| C2 | 10 | 4 | | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for 5.7 miles, right on Mt. Gallant Rd. (195) for 1.5 miles, right on Hwy. 21-121 Bypass for 2 miles to the Fast Fare on left at the intersection of Springsteen Rd. |
| C2 | 10 | 5 | T,A,B | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for 1.3 miles, right on Rawlinson Rd. (56) for 1.8 miles, left on Hwy. 5 for 1.6 miles, right on Heckle Blvd. (901) for 3.3 miles to end of road, left on Hwy. 72 for 1.2 miles, right on dirt road across from Wayne's Auto Service. Go .1 miles to Duke Power Company substation on left (TLD CNS #217). |
| C2 | 8 | 6 | T | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for 1.3 miles, right on Rawlinson Rd. (56) for 1.8 miles, left on Hwy. 5 for .5 miles to Rock Hill Career Development Center on right. TLD on transmission tower in front of building (TLD CNS #249). |
| C2 | 10 | 7 | | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for .1 miles, right on Adnah Church Rd. (81) for 2.9 miles, right on Hwy. 5 for .2 miles, left on Eastview Rd. (102) for 3.2 miles, right on Hwy. 322 for .1 miles, left on Falls Rd. for .9 miles to the intersection of Oak Park Rd. (103). |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| C2 | 7 | 8 | | Hwy. 274-S for 3.8 miles, left on Mt. Gallant Rd. (195) for 7.6 miles, left on Hwy. 161 for 1.1 miles, left on Hwy. 21 for .4 miles, left on Grier McGuire Rd. for .5 miles to end of road. |
| D1 | 5 | 1 | T | Hwy. 274-S for 5 miles to Carter Lumber Company. TLD on fence near gate (TLD CNS #239). |
| D1 | 4 | 2 | T | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 2.3 miles, left on Paraham Rd. (54) for 1.5 miles to transmission tower on right. TLD on power pole (TLD CNS #240). |
| D1 | 5 | 3 | | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 2.3 miles, left on Paraham Rd. (54) for .6 miles, right on Harper Rd. (815) for 1.4 miles to Allison Creek Bridge. |
| D1 | 5 | 4 | T | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 3 miles. TLD on left at beginning of fence (TLD CNS #241). |
| D1 | 6 | M | M | Hwy. 274-S for 5.1 miles, right on Hwy. 161 for 2.1 miles, left on Rd. 1080 for .5 miles to Pursley Dairy (CNS # 219). |
| D1 | 7 | M | M | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for .1 miles, right on Adnah Church Rd. (81) for 1.4 miles. Woods Dairy is on the left (CNS # 209). |
| D2 | 10 | 1 | | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for .1 miles, right on Adnah Church Rd. (81) for 2.9 miles, right on Hwy. 5 for .2 miles, left on Eastview Rd. (102) for 1 mile, right on Holland Rd. (157) for .7 miles, right on Turkey Farm Rd. (1172) for 1.2 miles, left on Russell Rd. (536) for .2 miles. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| D2 | 10 | 2 | | Hwy. 274-S for 5.1 miles, left on Hwy. 161 for .1 miles, right on Adnah Church Rd. (81) for 2.9 miles, right on Hwy. 5 for .3 miles, left on Billy Wilson Rd. (1451) for 2.2 miles, right on Turkey Farm Rd. (1172) for .8 miles, left on Benfield Rd. for .3 miles to Fishing Creek Bridge. |
| D2 | 10 | 3 | | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 3.4 miles, left on Hwy. 49-S for 5 miles. Stop at Pantry on left. |
| D2 | 10 | 4 | T | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 3.4 miles, left on Hwy. 49-S for 5.2 miles, left on North Congress St. (64) for .7 miles, left on Hwy. 5 for .2 miles to Duke Power Company Appliance Center on left. TLD on fence in back (TLD CNS #250). |
| D2 | 10 | 5 | | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 3.4 miles, left on Hwy. 49-S for 1.7 miles, right on Old Limestone Rd. (172) for 4.3 miles to end of road. |
| E1 | 5 | 1 | | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 3.4 miles to the intersection of Hwy. 49. |
| E1 | 5 | 2 | T | Hwy. 49-S for 3 miles, right on Paraham Rd. (54) for .7 miles to transmission tower on left after bridge (TLD CNS #242). |
| E1 | 5 | 3 | T | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 2.3 miles, left on Kingsburry Rd. (114) for .4 miles to transmission tower on left (TLD CNS #243). |
| E1 | 5 | 4 | | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 2.3 miles to the intersection of Kingsburry Rd. (114). |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| E2 | 5 | 1 | | Hwy. 274-S for 1.2 miles, right on Campbell Rd. (80) for 2.3 miles, right on Paraham Rd. (54) for .9 miles to the intersection of Dr. Nichols Rd. (819). |
| E2 | 10 | 2 | T | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 7.4 miles to Duke Power Company Appliance Center on left. TLD on fence in back of building (TLD CNS #251). |
| E2 | 10 | 3 | | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 7.3 miles to the Pantry on left at the intersection of Hwy. 321 (behind Pantry). |
| F1 | 4 | 1 | T | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 1.5 miles to Bethel School. TLD on side of small building in back (TLD CNS #244). |
| F1 | 5 | 2 | | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 1.5 miles, right on Bethel School Rd. (152) for 1 mile to the intersection of Holland Dr. |
| F1 | 4 | 3 | T | Hwy. 274-N for 3.4 miles, left on Glenvista Rd. to Crowders Creek boat landing. TLD to east of parking lot (TLD CNS #245). |
| F1 | 4 | 4 | T | Hwy. 274-N for 3.1 miles to River Hills Plantation rear entrance at Hamilton's Ferry Rd. TLD behind green building on right corner (TLD CNS #230). |
| F1 | 5 | 5 | | Hwy. 49-N for 2.9 miles to Sherer Memorial Presbyterian Church parking lot on left. |
| F1 | 4 | 6 | T | Hwy. 49-N for 4.1 miles to River Hills Plantation entrance guardhouse (TLD CNS #231). |
| F1 | 5 | 7 | | Hwy. 49-N for 3.6 miles, left on Montgomery Rd. for 1 mile. Stop in horseshoe curve near lake. |

| ZONE | RADIUS & (Miles) | No. | Sample Types* | DESCRIPTION |
|---|---|---|---|---|
| F2 | 10 | 1 | | Hwy. 274-N for 4.2 miles, left on Hwy. 557 for 2.2 miles, right on Ridge Rd. (27) for 5 miles to Bowling Green Presbyterian Church. |
| F2 | 5 | 2 | | Hwy. 274-N for 4.2 miles, left on Hwy. 557 for .6 miles to Pine Grove Baptist Church. |
| near F2 | 13 | M | M | Hwy. 274-N for 2.1 miles, left on Hwy. 55 for 9.5 miles through Clover S.C., right on Lloyd White Red. (148) for 2.3 miles, left on Crowders Creek Rd. (1103) for 1.3 miles, right on Sparrow Springs Rd. (1125) for .5 miles. Oates Dairy is on the left. (CNS #221) |
| F3 | 10 | 1 | | Hwy. 274-N for 4.2 miles, left on Hwy. 557 for .9 miles, right on Oakridge Rd. (435) at Bethel Fire Dept. for 5.4 miles to the intersection of Hwy. 274 (in N.C.) |
| F3 | 10 | 2 | | Hwy. 274-N for 5 miles, right on Pole Branch Rd. (279) for 5.8 miles to Friendship Baptist Church on left. |
| F3 | 10 | 3 | | Hwy. 274-N for 5 miles, right on Pole Branch Rd. (279) for 2.8 miles, right on Hwy. 273 for 3 miles to Allen Steam Plant Bridge. |
| near F3 | 14 | 4 | W | Hwy. 274-N for 5 miles, right on Pole Branch Rd. (279) for 2.8 miles, right on Hwy. 273 for 7.2 miles into Belmont, right on Catawba St. for .6 miles, left at next light for .2 miles to Belmont Municipal Water Supply (Water CNS #218). |

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.5
FMC INSTRUCTION LOG

Time_____

Team_____

Go From_____ To _____

Take Gamma [ ] Smear [ ]

DE I131 [ ] Water [ ]

Vegetation [ ] Soil [ ]

Beta [ ]

Other instructions: _____

_____

_____

Time_____

Team_____

Go From_____ To _____

Take Gamma [ ] Smear [ ]

DE I131 [ ] Water [ ]

Vegetation [ ] Soil [ ]

Beta [ ]

Other instructions: _____

_____

_____

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.6
FIELD MONITORING SURVEY DATA SHEET

Team_____

Location_____

Survey Time_____

Results [ ] Gamma _____mR/hr [ ] Smear_____ccpm

[ ] DE I131_____mrem/hr [ ] Water

[ ] Vegetation [ ] Soil

[ ] Beta_____mR/hr

Other instructions: _____

_____

_____

Team_____

Location_____

Survey Time_____

Results [ ] Gamma _____mR/hr [ ] Smear_____ccpm

[ ] DE I131_____mrem/hr [ ] Water

[ ] Vegetation [ ] Soil

[ ] Beta_____mR/hr

Other instructions: _____

_____

_____

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.7
PERIODIC STATUS UPDATE FOR FIELD MONITORING TEAMS

Time: _____ hours

Classification: _____

Wind Speed: _____mph

Wind Direction: from _____°

Zones Affected: _____

_____

Other: _____

_____

Time: _____ hours

Classification: _____

Wind Speed: _____mph

Wind Direction: from _____°

Zones Affected: _____

_____

Other: _____

_____

Time: _____ hours

Classification: _____

Wind Speed: _____mph

Wind Direction: from _____°

Zones Affected: _____

_____

Other: _____

_____

Time: _____ hours

Classification: _____

Wind Speed: _____mph

Wind Direction: from _____°

Zones Affected: _____

_____

Other: _____

_____

Time: _____ hours

Classification: _____

Wind Speed: _____mph

Wind Direction: from _____°

Zones Affected: _____

_____

Other: _____

_____

Time: _____ hours

Classification: _____

Wind Speed: _____mph

Wind Direction: from _____°

Zones Affected: _____

_____

Other: _____

_____

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.8
FIELD MONITORING TEAM RADIATION EXPOSURE RECORD

| TEAM NAME | S.V. 1 | | S.V. 2 | | ALPHA | | BRAVO | | CHARLIE | | DELTA | | FOXTROT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | | | |
| TLD # | | | | | | | | | | | | | | |
| Initial Dose | | | | | | | | | | | | | | |
| Subsequent Dose | | | | | | | | | | | | | | |
| Running Total | | | | | | | | | | | | | | |
| Subsequent Dose | | | | | | | | | | | | | | |
| Running Total | | | | | | | | | | | | | | |
| Subsequent Dose | | | | | | | | | | | | | | |
| Running Total | | | | | | | | | | | | | | |
| Subsequent Dose | | | | | | | | | | | | | | |
| Running Total | | | | | | | | | | | | | | |
| Subsequent Dose | | | | | | | | | | | | | | |
| Running Total | | | | | | | | | | | | | | |

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.9
SUGGESTED GUIDELINES FOR FOXTROT SURVEY TEAM

- Receive instructions from FMC, RPPM, or Supervisor
- Go to R/IC Calibration Lab
- Pick up Foxtrot Kit
  - Back Pack w/supplies
  - Instruments
  - Radio and antenna
  - Respirator w/GMRI canister (ensure proper fit size)
- Source Check Instruments
- Proceed to Material Access Portal (MAP) on 594'
- Don low and high range dosimetry, TLD and fill out dose card
- Dress in sack suit, hood, shoe covers, gloves
- Perform a radio communication check with FMC and inform the FMC you are ready for further instructions
- Begin Field Monitoring

  Note: If FMC does not mention respirator requirements, request this information.

  Note: Excess material, i.e. respirator, radios, instruments, not in use can be placed in the back pack.
- Upon completion:
  - Complete respirator blue cards
  - Replace sack suits, hoods, gloves, shoe covers with ones that have never been used.
  - Restore kit to original condition and location.
  - Post-job BBA, if required.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.10
SUGGESTED GUIDELINES FOR SURVEY TEAMS

- Receive direction from the FMC, RPPM, or Supervisor
- Get key to Emergency Kit Room from RP Key Box. At night, contact Security to open the exterior door to the emergency equipment room.
- Proceed to Emergency Kit room.
- Ensure the tamper seal on the Emergency Kit has not been broken and inventory any that have.
- Open Emergency Kit*
- Team members do the following:

<u>Team Member</u>

- Get key for available vehicle (If none available, use privately owned vehicle)
- Start vehicle

<u>Team Member</u>

- Perform a battery and source check for survey instruments. Turn the E140N Count Rate Meter on and continuously monitor the audible signal while locating and tracking the plume.
- Survey the area for higher than background radiation levels.
- Get portable radio ready and take both antennas
- Perform a radio communication check with FMC

- Don low and high range dosimetry, TLD and fill out dose card
- Inform the FMC you are ready for further instructions
- Move to field and begin monitoring
- Upon completion:
  - Complete respirator blue cards
  - Restore kit to original condition and location
  - Post-job BBA, if required

*Charlie and Delta teams should contact FMC for equipment acquisition.

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
EDA-8
ENCLOSURE 5.11
SUGGESTED GUIDELINES FOR SAMPLE VAN TEAMS

- Receive direction from the FMC, RPPM, or Supervisor
- Get key to Emergency Kit Room from RP Key Box. At night, contact Security to open the exterior door to the emergency kit room.
- Proceed to Emergency Kit Room
- Ensure the tamper seal on the Emergency Kit has not been broken and inventory any that have.
- Verify that MCA is functional by performing MCA source check per Enclosure 5.3.
- Open kit for respective van
- Team members do the following:

| Team Member | Team Member |
|---|---|
| - Get key for van from kit | - Perform a battery and source check for survey instruments. Turn the E140N Count Rate Meter on and continuously monitor the audible signal while locating and tracking the plume. |
| - Start van motor and air conditioner or heater to stabilize inside environment for MCA | - Survey the area for higher than background radiation levels. |
| - Check fuel in both tanks | - Get portable radios ready take both antennas |
| - Perform a radio communication check using van radio with FMC. | - Perform a radio communication check using portable radio with FMC |

- Power down MCA System
- Both members move the MCA to the van (ensure source and shelves are on Unit Tray)
  - Place switch on power inverter in van to ON.
  - Plug in MCA
  - Place detector in shield
- Power up MCA System
- Don low and high range dosimetry, TLD and fill out dose card.

- Inform the FMC you are ready for further instructions.
- Once in field, do Energy Calibration and Source Check on MCA and make adjustments as needed.
- Upon Completion:
  - Complete respirator blue cards
  - Restore kit to original condition and location
  - Post-job BBA, if required.