CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2

REVISED PLANT EMERGENCY PROCEDURES

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* Partial instructions or modifications.

CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

UNIT 0

INITIAL DOSE PROJECTIONS

PLANT EMERGENCY PROCEDURE: PEP-03.4.1

VOLUME XIII

Rev. 005

Recommended By: _____ Date: 6/7/83
Director - Administrative Support

Approved By: _____ Date: 6-7-83
General Manager
for

dj

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3.5 Determine Source Term

3.5.1 If the stack high range radiation monitor is indicating a release, perform the following steps:

3.5.1.1 Read the actual activity (µCi/cc) from 2-D12-RR-4599, channel 1, 2, or 3.

3.5.1.2 Read flow meter for the specific release point (SCF/min).

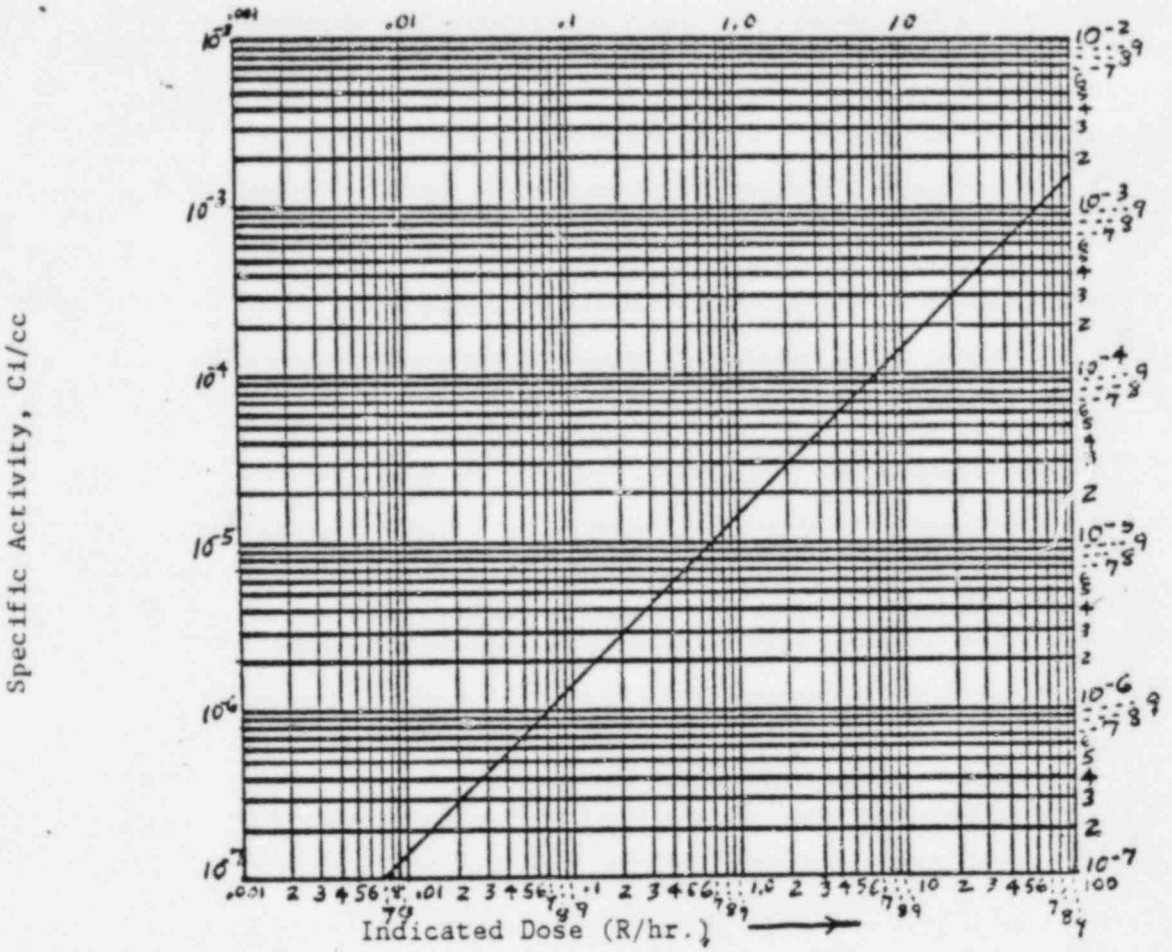
3.5.1.3 For WHOLE BODY DOSE PROJECTION, calculate total release in curies/second = specific activity (µCi/cc) x flow rate (SCF/min) x 28,300 (cc/SCF) x 10^{-6} (Ci/µCi) x 0.0167 (min/sec).

OR

3.5.1.4 For THYROID DOSE PROJECTION, calculate total release in curies/second = specific activity (µCi/cc) x flow rate (SCF/min) x 28,300 (cc/SCF) x 10^{-6} (Ci/µCi) x 0.0167 (min/sec) x (0.15).

3.5.1.5 Record results of either 3.5.1.3 or 3.5.1.4 in column 5 of Exhibit 3.4.1-1.

3.5.2 If the Turbine Building High Range Radiation Monitors are indicating a release, refer to the figure below.



Source Term Calculation From Unit No. 1 and/or Unit No. 2 Turbine Building Vent

3.5.2.1 Read the actual specific activity (Ci/cc) from the graph as a function of the dose rate (R/hr.) indicated on the meter.

3.5.2.2 Read the flow meter for the specific release point (SCF/min).

3.5.2.3 For WHOLE BODY DOSE PROJECTION, calculate total release in curies/second = specific activity (Ci/cc) x flow rate (SCF/min) x 28,300 (cc/SCF) x 0.0167 (min/sec).

OR

3.5.2.4 For THYROID DOSE PROJECTION, calculate total release in curies/second = specific activity (Ci/cc) x flow rate (SCF/min) x 28,300 (cc/SCF) x 0.0167 (min/sec) x .15.

3.5.2.5 Record the results of either 3.5.2.3 or 3.5.2.4 in column 5 of Exhibit 3.4.1-1.

3.5.3 If the gaseous effluent monitors for the Stack or the Turbine Building Vents are not indicating a release, refer to PEP-03.6.1 to calculate a source term based on one of the other low range effluent monitors. Record the appropriate source term in column 5 of Exhibit 3.4.1-1.

3.6 Determine Dose Conversion Factor

3.6.1 Use Table 3.4.1-3 to determine the Whole Body or Thyroid Dose Conversion Factor (DCF). Record the appropriate DCF in column 6 of Exhibit 3.4.1-1.

TABLE 3.4.1-3

DOSE CONVERSION FACTORS (Rem/hr)/(Ci/m^3)

Accident Condition	Whole Body	Thyroid
Unknown/unidentified	287	7.49E+5
Major damage to fuel cladding	287	7.49E+5
RCS leaks or steam line leaks but no major cladding failure	133	1.25E+6
Accidental discharge of waste gas	45	2.06E+6
Fuel handling accident	19	2.94E+6

3.7 To obtain the projected dose at the property boundary, multiply column 4 x column 5 x column 6 = column 7. Record the product in column 7 of Exhibit 3.4.1-1.

NOTE: If the release was via the stack (elevated), maximum radiological exposures could occur beyond the property boundary depending on stability class. Step 3.8 projects doses at distances beyond the property boundary for both elevated and ground level releases.

3.8 Determine Extrapolation Factor

3.8.1 If the release is from the stack, use Table 3.4.1-4. (If not, go to Step 3.8.3.) Read across the appropriate row based on distance from the plant to the extrapolation factor under the atmospheric stability class determined in Step 3.3.

NOTE: With an elevated release, maximum radiological exposures may occur beyond the property boundary depending on stability class. The following table indicates the downwind distance where maximum exposures are likely to occur as the result of an elevated release.

Stability Class	Downwind Distance
A	0.27 miles (0.43 km)
B	0.45 miles (0.72 km)
C	0.76 miles (1.22 km)(Property Boundary)
D	1.8 miles (2.9 km)
E	3.5 miles (5.6 km)
F	9 miles (14.5 km)
G	33 miles (53 km)

TABLE 3.4.1-4

EXTRAPOLATION FACTOR FOR ESTIMATING DOSES BEYOND
BSEP PROPERTY BOUNDARY (4,000 ft.)
ELEVATED RELEASE

DISTANCE FROM PLANT		EXTRAPOLATION FACTORS BY ATMOSPHERIC STABILITY CLASS						
Miles	km	A	B	C	D	E	F	G
1	1.6	4.2 E-1	6.6 E-1	9.2 E-1	2.1	8.4 E+0	2.3 E+2	4.2 E+5
2	3.2	5.2 E-2	1.9 E-1	3.8 E-1	3.4	6.7 E+1	8.8 E+4	8.5 E+11
3	4.8	1.6 E-2	8.4 E-2	2.0 E-1	2.8	8.7 E+1	3.3 E+5	3.4 E+13
4	6.4	6.5 E-3	4.7 E-2	1.2 E-1	2.2	8.6 E+1	5.8 E+5	1.8 E+14
5	8.0	3.4 E-3	3.1 E-2	8.2 E-2	1.8	8.0 E+1	7.3 E+5	4.6 E+14
6	9.7	2.0 E-3	2.1 E-2	5.9 E-2	1.4	7.3 E+1	8.1 E+5	8.4 E+14
7	11.3	1.2 E-3	1.5 E-2	4.5 E-2	1.2	6.6 E+1	8.8 E+5	1.3 E+15
8	12.9	8.2 E-4	1.2 E-2	3.6 E-2	1.0	6.0 E+1	8.8 E+5	1.6 E+15
9	14.5	5.8 E-4	9.4 E-3	2.8 E-2	8.6 E-1	5.5 E+1	8.8 E+5	2.2 E+15
10	16.1	4.3 E-4	7.6 E-3	2.4 E-2	7.6 E-1	4.9 E+1	8.8 E+5	2.5 E+15

3.8.2 Record the selected extrapolation factor in column 8 of Exhibit 3.4.1-1.

3.8.3 If the release is not from the stack, use Table 3.4.1-5. Read across the appropriate row based on distance from the plant to the extrapolation factor under the atmospheric stability class determined in Step 3.3.

TABLE 3.4.1-5

EXTRAPOLATION FACTOR FOR ESTIMATING DOSES BEYOND BSEP PROPERTY BOUNDARY (4,000 ft.) GROUND LEVEL RELEASE

DISTANCE FROM PLANT		EXTRAPOLATION FACTORS BY ATMOSPHERIC STABILITY CLASS						
Miles	km	A	B	C	D	E	F	G
1	1.6	4.3 E-1	5.8 E-1	6.1 E-1	6.4 E-1	6.3 E-1	6.5 E-1	6.5 E-1
2	3.2	5.3 E-2	1.5 E-1	1.7 E-1	2.2 E-1	2.3 E-1	2.3 E-1	2.4 E-1
3	4.8	1.6 E-2	6.5 E-2	8.4 E-2	1.2 E-1	1.3 E-1	1.3 E-1	1.4 E-1
4	6.4	6.5 E-3	3.7 E-2	4.8 E-2	7.8 E-2	8.4 E-2	9.3 E-2	1.0 E-1
5	8.0	3.4 E-3	2.4 E-2	3.2 E-2	5.6 E-2	6.3 E-2	7.0 E-2	7.6 E-2
6	9.7	2.0 E-3	1.6 E-2	2.4 E-2	4.2 E-2	4.9 E-2	5.6 E-2	6.1 E-2
7	11.3	1.2 E-3	1.2 E-2	1.8 E-2	3.4 E-2	4.0 E-2	4.4 E-2	5.0 E-2
8	12.9	8.2 E-4	9.1 E-3	1.4 E-2	2.8 E-2	3.4 E-2	3.7 E-2	4.3 E-2
9	14.5	5.8 E-4	7.3 E-3	1.2 E-2	2.3 E-2	2.9 E-2	3.3 E-2	3.8 E-2
10	16.1	4.3 E-4	5.9 E-3	9.4 E-3	2.0 E-2	2.5 E-2	2.8 E-2	3.3 E-2

3.8.4 Record selected extrapolation factor in column 8 of Exhibit 3.4.1-1.

3.9 To obtain projected dose at points beyond the property boundary, multiply column 7 x column 8 = column 9. Record the product in column 9 of Exhibit 3.4.1-1. Indicate the distance from the property boundary the projected dose represents.

3.10 Report the projected doses to the Site Emergency Coordinator or Radiological Control Director.

3.11 Repeat this procedure whenever source term or meteorological conditions change or as directed.

CAROLINA POWER & LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT

UNIT 0

RELEASE ESTIMATES BASED UPON STACK/VENT READINGS

PLANT EMERGENCY PROCEDURE: PEP-03.6.1

VOLUME XIII

Rev. 003

Recommended By: _____ Date: 6/7/83
Director - Administrative Support

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General Manager
for

dj

LIST OF EFFECTIVE PAGES

PEP-03.6.1

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1.0 Responsible Individual and Objectives

The Radiological Control Director is responsible to the Site Emergency Coordinator for determining the magnitude and rate of radioactive release to the environment. The Radiological Control Director may delegate the calculational aspects of this procedure to the Dose Projection Coordinator.

2.0 Scope and Applicability

This procedure shall be implemented by the Site Emergency Coordinator, or by the Radiological Control Director, whenever a radiological release through an identifiable release point is suspected, including any Site or General Emergency. The only apparatus required is a scientific calculator.

3.0 Actions and Limitations

NOTE: The detector response (μCi/cc of radioactivity per counts per minute or mr/hr) will depend on the specific isotopic mixture being released at various times. Grab samples must be taken, analyzed and evaluated by use of PEP-3.6.3, "Interpretation of Liquid and Gaseous Samples," to provide an exact relationship; however, the predetermined relationship used in this procedure should be sufficiently accurate to guide initial emergency response actions and assessments.

List of EXHIBITS:

3.6.1-1	Source Term Calculation from Plant Stack Monitors
3.6.1-2	Source Term Calculation from #1 RX Gas (1-CAC-AQH-1264-3)
3.6.1-3	Source Term Calculation from #1 Turbine Gas (1-VA-AQH-3215-3)
3.6.1-4	Source Term Calculation from #2 Rx Gas (2-CAC-AQH-1264-3)
3.6.1-5	Source Term Calculation from #2 Turbine Gas (2-VA-AQH-3215-3)
3.6.1-6	Source Term Calculation from #1 and/or #2 Turbine Building Vent (High Range)
3.6.1-7	$\bar{E}\gamma$ -Time 0 to 72 Hours After Reactor Shutdown

3.1 Depending upon alarming channel(s), use appropriate EXHIBIT (EXHIBIT 3.6.1-1 through EXHIBIT 3.6.1-6) to calculate the release source term.

Note: If the time duration of the release is unknown, assume 60 minutes and perform this procedure as directed by the Radiological Control Director.

If only one channel is alarming or reading abnormally high, the source term determined on the appropriate EXHIBIT is the total. If two monitors are measuring the same source term, use the average reading of the two.

3.2 If multiple radiation monitors are alarming, (and not monitoring the same point) calculate the individual source terms and sum them to obtain the total source term.

3.3 Report the source term to the Radiological Control Director (Radiological Control Manager after the Emergency Operations Facility is activated) for use in appropriate dose projection procedure from PEP-Section 3.4.

3.4 Stack monitor 2-D12-RR-4600 reads directly in µCi/sec when flow instrument loop 2-VA-FT-3359 is operational. No calculations are required for source term determination with these instruments operational.

EXHIBIT 3.6.1-1

SOURCE TERM CALCULATION FROM STACK MONITORS				
TIME	METER[1] READING (µCi/cc)	FLOW[2] (CFM)	EFFICIENCY[3] FACTOR µCi/sec / CFM-sec	RELEASE[4] RATE (µCi/sec)

[1] Monitor selects most accurate operational channel, either low, mid, or high range.

[2] If not available, use sum of design flows for systems exhausting to stack:

Steam Jet Air Ejectors (A & B)	300 SCFM ea.
Rad Waste Bldg. Vent (2 fans)	23,100 SCFM ea.
Purge Fans (2 fans)	7,200 SCFM ea.
Standby Gas (per train - 2 trains)	3,500 SCFM ea.

[3] The efficiency factor is channel item 011, accessible at display 2-D12-RM-235.

[4] Release Rate = µCi/cc x cfm x 472
Release rate is read in µCi/sec directly from D12-RR-4600 when 2-VA-FT3359 flow instrument loop is operational.

EXHIBIT 3.6.1-2

SOURCE TERM CALCULATION FROM #1 Rx GAS (1-CAC-AQH-1264-3)				
TIME	METER READING (cpm)	FLOW[1] (cfm)	EFFICIENCY[2] FACTOR	RELEASE[3] RATE (uCi/sec)

(1) If not available use 43,200 cfm per discharge fan times the number of fans operating.

(2) The efficiency factors posted on the front panel of the stack, reactor buildings monitors. If not posted, these values can be obtained from E&RC File 13324, or use 8.6E-6.

(3) Release Rate = cpm X cfm X Efficiency Factor

EXHIBIT 3.6.1-3

SOURCE TERM CALCULATION FROM #1 TURBINE GAS (1-VA-AQH-3215-3) (LOW RANGE)				
TIME	METER READING (cpm)	FLOW[1] (cfm)	EFFICIENCY[2] FACTOR	RELEASE[3] RATE (µCi/sec)

(1) If not available use 15,000 cfm.

(2) The efficiency factors posted on the front panel of the stack, reactor buildings monitors. If not posted, these values can be obtained from RC&T File 13324, or use 1.24E-5.

(3) Release Rate = cpm X cfm X Efficiency Factor

EXHIBIT 3.6.1-4

SOURCE TERM CALCULATION FROM #2 Rx GAS (2-CAC-AQH-1264-3)				
TIME	METER READING (cpm)	FLOW[1] (cfm)	EFFICIENCY[2] FACTOR	RELEASE[3] RATE (uCi/sec)

(1) If not available use 43,200 cfm per discharge fan times the number of fans operating.

(2) The efficiency factors posted on the front panel of the stack, reactor buildings monitors. If not posted, these values can be obtained from RC&T File 13324, or use 9.26E-6.

(3) Release Rate = cpm X cfm X Efficiency Factor

EXHIBIT 3.6.1-5

SOURCE TERM CALCULATION FROM #2 TURBINE GAS (2-VA-AQH-3215-3) (LOW RANGE)				
TIME	METER READING (cpm)	FLOW[1] (cfm)	EFFICIENCY[2] FACTOR	RELEASE[3] RATE (µCi/sec)

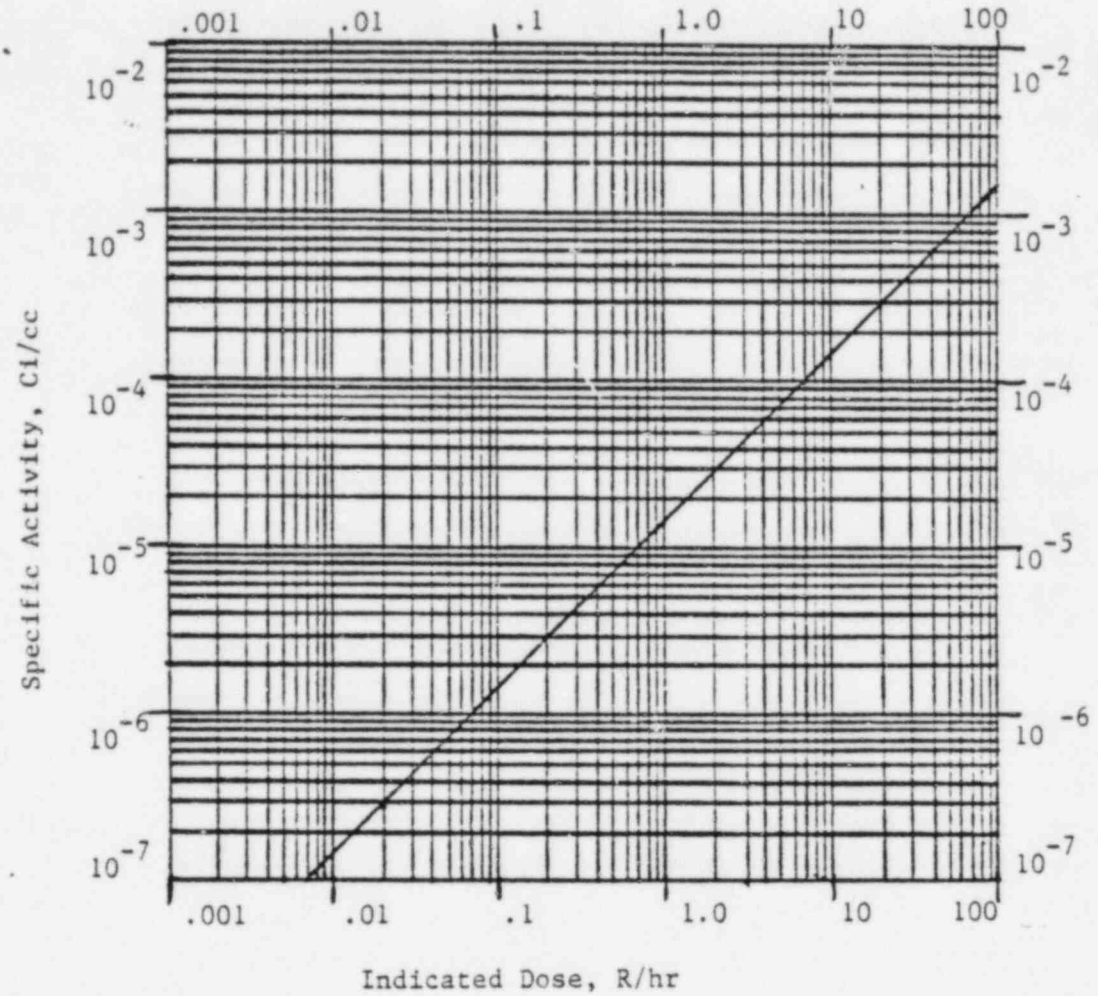
(1) If not available, use 15,000 cfm.

(2) The efficiency factors posted on the front panel of the stack, reactor buildings monitors. If not posted, these values can be obtained from RC&T File 13324, or use 1.11E-5.

(3) Release Rate = cpm X cfm X Efficiency Factor

EXHIBIT 3.6.1-6

Source Term Calculation from Unit No. 1 and/or Unit No. 2
Turbine Building Vent (High Range)



TEMPORARY GASEOUS EFFLUENT RADIATION MONITORS

To determine total release activity (curies/sec) from a Turbine Building vent:

1. Read the "actual specific activity (curies/cc)" from the graph as a function of the dose rate (R/hr) indicated on the meter.

2. Read flowmeter for the specific release point (SCFM).

3. Calculate Total Release (Ci/sec) = Specific Activity (Ci/cc) x Flow Rate (SCFM) x 28300 (cc/SCF) x .0167 (min/sec)

Graph parameters based on the projected isotopic distribution 30 minutes after a TMI-based accident. Reference: PM-79-296.

EXHIBIT 3.6.1-7

$\bar{E}_\gamma$ - TIME 0 TO 72 HOURS AFTER REACTOR SHUT DOWN

TIME	$\bar{E}_\gamma$
0	0.720
.5	0.680
1.0	0.520
1.5	0.480
2.0	0.370
2.5	0.390
3.0	0.380
3.5	0.360
4.0	0.320
4.5	0.300
5.0	0.280
6.5	0.230
8.0	0.200
10.0	0.170
12.5	0.130
15.0	0.140
24.0	0.096
48.0	0.040
72.0	0.048