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TRANS INSTRUCTIONS

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CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EM-204B

OFF-SITE DOSE ASSESSMENT DURING RADIOLOGICAL EMERGENCIES (USER INSTRUCTIONS FOR RADDOSE-IV)

TABLE OF CONTENTS

1.0 PURPOSE

The RADDOSE-IV Computer model provides a method to evaluate the magnitude of a radiological release from CR-3, to track the plume, and to estimate offsite exposure. This procedure contains operating instructions for RADDOSE-IV and information to be used in developing program inputs.
[NOCS 00387, 00388, 00389, 01029, 01062, 01128, 01582, 01589, 01592, 05647 12210, 13040, 13140, 040188, 040771,]

2.0 REFERENCES

2.1 Developmental References

2.1.1 RADDOSE-IV Operator's Manual

2.1.2 RADDOSE-IV Detailed Design Manual

2.1.3 RADDOSE-IV Verification & Validation Manual

2.1.4 CR-3 Radiological Emergency Response Plan (RERP)

2.1.5 EM-202, Duties of Emergency Coordinator

2.1.6 Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA-400-R-92-001 Environmental Protection Agency (October, 1991).

2.1.7 Nuclear Regulatory Commission Response Technical Manual.

2.1.8 Final Safety Analysis Report.

2.1.9 Engineering Evaluation EEF-00-009, Rev. 1 – Radiation Monitor Response Factors

3.0 PERSONNEL INDOCTRINATION

3.1 Definitions

3.1.1 **Advection Step** - ("time step" or "step") The entry of a set of meteorological and source term data into RADDOSE-IV and performance of calculations.

3.1.2 **Core Melt** - deformation of fuel pellet configuration due to excessive core temperature releasing large quantities of gaseous and particulate fission products.

3.1.3 **Delta T** – a measurement of the difference in air temperature between two different elevations above ground level. The value provides a measure of the atmospheric stability.

3.1.4 **Depletion** - reduction of the concentration of the plume (i.e., deposition and dispersion).

3.1.5 **Deposition** - a means of puff depletion that deposits particulate radioactive material on the ground.

3.1.6 **Field** - the space provided on the monitor for one value on the meteorological and source term entry screens.

3.1.7 **Gas Gap Failure** - degradation of the protective cladding around the fuel pellets due to elevated core temperature releasing only radionuclides contained in the space between pellet and the cladding.

3.1.8 **Sea breeze Effect** - a wind circulation system produced when the land temperature is higher than the ocean temperature causing a lower level wind direction from sea to land.

3.1.9 **Sigma-Theta** - The standard deviation of a set of wind range measurements. The Sigma-Theta meter automatically calculates and displays the standard deviation of wind range for the previous 15 minutes.

3.1.10 **Stability Class** - a lettering system from A to G to designate certain atmospheric conditions which affect the dispersion of the plume. Class A indicates rapid dispersion (unstable conditions) and class G indicates slow dispersion (stable conditions).

3.2 Responsibilities

3.2.1 The Emergency Coordinator (EC) is responsible for ensuring the Dose Assessment Team is aware of plant conditions related to offsite dose projections.

3.2.2 The Dose Assessment Team is responsible for the implementation of this procedure.

3.3 Limits & Precautions

3.3.1 Protective Action Guideline doses from the Environmental Protection Agency are 1 REM TEDE and 5 REM Thyroid at the site boundary (0.83 miles) or beyond. EM-202 Enclosure 1 specifies conditions in which site boundary dose or dose rate may require declaration of a Site Area Emergency or General Emergency.

3.3.2 The RADDOSE-IV model has several switches (options) that may be set during program startup which affect the method the model uses to calculate doses. The calculation switches have been pre-set, but further details are available in the Operator's Manual, Section 2.3.1.

3.3.3 Detailed instructions, notes, and cautions are provided on various screens depending on input and parameters.

3.3.4 Doses calculated by RADDOSE-IV are approximately two times the doses calculated by the NRC's RASCAL model. To perform a reasonable comparison, inputs to both models must match as closely as possible (i.e., isotopic distribution, Ci/sec, meteorological data, exposure location, and exposure duration).

3.3.5 In a station blackout, the following instrumentation is available:

- RM-Gs 1, 3, 5, 7, 9, 11, 25, 26, 27, 28, 29, 30.
- RM-Ls 2, 7.
- Primary Meteorological Tower local (at the tower) readouts only.
- RM-A1, RM-A2 meters and detectors powered, but pumps are NOT available (may be useful in detecting changes to area radiation levels).

3.3.6 Recorder AH-32-FIR Channel D indicates total Reactor Building stack flow and is the correct flow to use when using RM-A1 as the RADDOSE-IV release method. AH-294-FT measures Reactor Building purge flow rate only and does NOT include make up flow.

3.3.7 As of January, 2003, RADDOSE-IV software has been placed on the hard drives of all standard desktop computers. Running RADDOSE-IV on any standard desktop computer will store files on that computer and will no longer over-write other RADDOSE-IV runs in progress as was the case when the software resided on the server. There are still two versions of the code installed: RADDOSE-IV – TSC and RADDOSE-IV – EOF, but these two versions are independent and either may be selected. It is recommended, however, that each facility run their respective versions.

4.0 INSTRUCTIONS

The following task hierarchy is used to perform dose assessment with RADDOSE-IV:

Program Startup (section 4.2)
- Log on
- Select begin new or continue previous incident

Data Input (section 4.3)
- Accident Scenario Definition (trip/release times, etc.)
- Meteorological Data Entry
- Source Term Data Entry for Noble Gas and Iodine
  - selection of accident type
  - determining core damage
  - selection of release method
    - automatic Ci/sec calculations or
    - worksheets for manual Ci/sec calculations

Data Output (section 4.4)
- Adjusting Projections with User-Defined Locations
- Obtaining and Reviewing Printouts
- Performing a Forecast
- Correcting a Step

4.1 Communications

4.1.1 LIFT the receiver of the Dose Assessment Ringdown Telephone to establish communications among the TSC and EOF Dose Assessment Teams (DATs) and the Dose Assessment Communicator in the Control Room monitoring radiological and meteorological data. [NOCS 00387]

4.1.2 IF the Dose Assessment Ringdown telephone is inoperable,
THEN REFER TO Enclosure 2 for instruction on establishing a conference call on the conventional telephone.

4.1.3 REQUEST the Dose Assessment Communicator in the Control Room SCAN the monitors and provide all abnormal readings (especially effluent monitors).

4.1.4 IF it is suspected that the RM-A1/A2 low range monitor will reach off scale,
THEN REQUEST the Accident Assessment Ringdown Communicator in the Control Room to have the Superintendent Shift Operations direct operators to switch the low/medium/high valve controller to the "AUTO" position.

4.2 Program Startup

4.2.1 IF the dose assessment computer fails,
THEN CONSIDER the following alternatives:

- o Use another computer with the standard desktop.
- o OBTAIN dose projection data from the other facility (TSC or EOF) as appropriate.
- o USE EM-204(A) as backup dose assessment.
- o INSTALL (by contacting NIT personnel) RADDOSE-IV on another computer. REFER TO Enclosure 3 for program installation instructions.

NOTE

RADDOSE-IV is available on any computer with the standard desktop. The TSC and EOF dose assessment computers have an icon installed on the desktop. At the TSC, the icon will initiate the RADDOSE-IV – TSC version and in the EOF, the icon will initiate the RADDOSE-IV – EOF version. On other computers, the program is located at Start, Programs, (Emergency Preparedness or Regulatory Affairs), CR3, RADDOSE-IV EOF or RADDOSE-IV TSC.

NOTE

RADDOSE-IV will not restart if closed by using the 'X' in the upper-right corner. Always close out of RADDOSE-IV by using the RADDOSE-IV Exit Menu.

4.2.2 LOG ON to computer using your OT number and password.

4.2.3 START RADDOSE-IV by double clicking on the RADDOSE-IV icon on the desktop or accessing through Start Programs.

4.2.4 ACKNOWLEDGE Current Switch Settings (options for decay and depletion calculations, etc.).

4.2.5 From the Startup Menu, SELECT either:

- o Begin New Incident - This selection erases previously stored data and displays the Accident Definition Screen.

or

- o Continue Previous Incident - This selection recalls all entries and calculations for the previous incident and allows continuation.

4.2.6 IF previous incident data has been stored on a diskette(s),
THEN REFER TO Enclosure 6 for loading instructions.

4.3 Data Input

4.3.1 Accident Scenario Definition Screen

ENTER the following information:

- o Trip/decay start date
- o Trip/decay start time
- o Release date
- o Release time
- o Time step (normally 30 minute increments)
- o Sea breeze effects (normally "ON")
- o Operator's initials

4.3.2 OBTAIN Meteorological data and radiological data from the Control Room or by using the plant computer. REFER TO Enclosure 4 for plant computer instructions. [NOCS 00387]

4.3.3 RECORD input data on Enclosure 5, Input Data Sheet for RADDOSE-IV if desirable.

4.3.4 Meteorological Data Input Screen

4.3.4.1 USE the following priority when collecting wind speed, wind direction and outside air temperature:

1. 33' Primary Tower
2. 175' Primary Tower
3. 33' Alternate Tower (only source for Sigma-Theta, precipitation rate).

4.3.4.2 IF Sigma-Theta is NOT available,
THEN USE Delta T or the wind range to establish the stability class.
REFER to Enclosure 7, Alternate Methods for Determining Meteorological Data, for use of wind range.

4.3.4.3 IF Control Room instrumentation is used to obtain meteorological data,
THEN ENSURE that values for wind speed, average wind direction, and wind range are determined using the average of the previous 15 minutes as displayed on the appropriate recorder.

4.3.4.4 From the Main Menu, SELECT "Enter/Edit Meteorological Data."

4.3.4.5 ENTER the following data. REFER TO Enclosure 7 if NOT available from the plant computer or the Control Room:

- o Wind speed (meters/second, 15-minute average)
- o Wind direction from (degrees, 15-minute average)
- o Sigma-Theta **or**
- o Delta T (degrees F) **or**
- o Stability class (entered directly, see Enclosure 7)
- o Outside air temperature (degrees F)
- o Precipitation rate (inches/15 minutes)

4.3.4.6 IF there has NOT been any recorded rainfall,
THEN ENTER a "0" for "precipitation rate."

NOTE

This feature could be used to enter data for several steps at one time (e.g., from release start time to present time).

4.3.4.7 After all the meteorological data for the current step have been entered, ADD another step by PRESSING the [Insert] key if desirable.

4.3.4.8 PRESS the Down Arrow key and the Up Arrow key to move between the steps.

4.3.4.9 After all the meteorological data have been entered, PRESS the [F9] key to accept and continue.

4.3.5 Source Term Data Entry Screen

NOTE

Enclosure 1 provides reference source terms for dose assessment.

4.3.5.1 From the Main Menu, SELECT "Enter/Edit Source Term Data."

4.3.5.2 DETERMINE the appropriate Accident Type and GO TO the indicated section.

4.3.5.3 - Loss of Coolant Accident (LOCAN, LOCAG, LOCAC)
4.3.5.4 - Fuel Handling Accident (FHA)
4.3.5.5 - Waste Gas Decay Tank Rupture (WGDTR)
4.3.5.6 - Steam Generator Tube Rupture (SGTRN, SGTRG, SGTRC)

4.3.5.3 **Loss of Coolant Accident:**

NOTE
Offsite doses for LOCAN (no fuel damage) are NOT likely to exceed 1 REM TEDE or 5 REM Thyroid.

1. SELECT and ENTER the appropriate LOCA Accident Type based on the status of the core. REFER TO Enclosure 8.

   LOCAN - no fuel damage, normal RCS
   LOCAG - gas gap failure
   LOCAC - core melt

2. SELECT and ENTER one of the following Release Methods for Noble Gas (NG MTHD) and Iodine (I MTHD) based on the information available. REFER TO Enclosure 9 for more information on Release Methods:

   RMA1 - ENTER RM-A1 cpm and Reactor Building vent CFM from recorder AH-32-FIR Channel D. USE for LOCA inside the Reactor Building with a purge in progress. This method is available for NG or I, but it is NOT recommended for I. REFER TO Enclosure 9.

   RMA2 - ENTER RM-A2 cpm (NG and/or I) and Auxiliary Building vent CFM. USE for LOCA inside the Auxiliary Building (e.g., Letdown leak, Spent Fuel Cooling leak) or LOCA inside the Reactor Building with leak into the Auxiliary Building (e.g., penetration failure). This method is available for NG or I, but it is NOT recommended for I. REFER TO Enclosure 9.

   CONC - ENTER µCi/cc (NG and/or I) and release point CFM. Reactor Building concentrations may be obtained from RM-A6, PASS, grab samples. Auxiliary Building concentrations may be obtained from RM-A3, RM-A4, RM-A7, RM-A8, PASS, grab samples. USE the Radiation Monitor Sensitivity Curve Log to convert these monitor readings to µCi/cc.

   EFFL - ENTER isotopic µCi/cc (NG and I) and release point CFM. OBTAIN isotopic concentrations from PASS, analysis of grab sample.

   DRECT - ENTER calculated Ci/sec (NG and/or I). Calculated values may be obtained via Enclosure 10 Worksheets.

   DEFLT - Program supplies default Ci/sec.

   RATIO - This method should NOT be used for the first time step, as that would use default ratios that are likely NOT the best estimate for actual conditions. USE Enclosure 10 Worksheet 6 to determine an I/NG ratio and calculate a Ci/sec release rate for DRECT input. Once an iodine to noble gas ratio has been established, and there is no reason to believe it has changed, then this method may be chosen in subsequent steps. This will enter the iodine release rate based on the same NG/I ratio from the previous step. REASSESS the ratio using Worksheet 6 for decay or changes in plant conditions (e.g., RB spray, filters).

3. GO TO Section 4.3.5.7.

4.3.5.4 **Fuel Handling Accident:**

1. ENTER FHA as the Accident Type.

2. SELECT and ENTER one of the following Release Methods for Noble Gas (NG MTHD) and Iodine (I MTHD) based on the information available. REFER TO Enclosure 9 for more information on Release Methods.

   RMA1 - ENTER RM-A1 cpm and Reactor Building vent CFM from recorder AH-32-FIR Channel D. USE for FHA inside the Reactor Building with a purge in progress. This method is available for NG or I, but it is NOT recommended for I. REFER TO Enclosure 9.

   RMA2 - ENTER RM-A2 cpm and Auxiliary Building vent CFM. USE for FHA in the Auxiliary Building. This method is available for NG or I, but it is NOT recommended for I. REFER TO Enclosure 9.

   CONC - ENTER μCi/cc (NG and/or I) and release point CFM. Reactor Building concentrations may be obtained from RM-A6, PASS, grab samples. Auxiliary Building concentrations may be obtained from RM-A4, RM-A8, PASS, grab samples. USE the Radiation Monitor Sensitivity Curve Log to convert these monitor readings to μCi/cc.

   EFFL - ENTER isotopic μCi/cc (NG and I) and release point CFM. OBTAIN isotopic concentrations from PASS, analysis of grab sample.

   DRECT - ENTER calculated Ci/sec (NG and/or I). Calculated values may be obtained via Enclosure 10 Worksheets.

   DEFLT - Program supplies default Ci/sec.

3. GO TO Section 4.3.5.7.

4.3.5.5 **Waste Gas Decay Tank Rupture:**

NOTE
Offsite doses for a WGDTR are NOT likely to exceed 1 REM TEDE or 5 REM Thyroid.

1. ENTER WGDTR as the Accident Type.

2. SELECT and ENTER one of the following Release Methods for Noble Gas (NG MTHD) and Iodine (I MTHD) based on the information available. REFER TO Enclosure 9 for more information on Release Methods:

   RMA2 - ENTER RM-A2 cpm and Auxiliary Building vent CFM. This method is available for NG or I, but it is NOT recommended for I. REFER TO Enclosure 9.

   CONC - ENTER µCi/cc (NG and/or I) and release point CFM. Concentrations may be obtained from RM-A8, RM-A11, PASS, grab samples. USE the Radiation Monitor Sensitivity Curve Log to convert these monitor readings to µCi/cc.

   EFFL - ENTER isotopic µCi/cc (NG and I) and release point CFM. OBTAIN isotopic concentrations from PASS, analysis of grab sample.

   DRECT - ENTER calculated Ci/sec (NG and/or I). Calculated values may be obtained via Enclosure 10 Worksheets.

   DEFLT - Program supplies default Ci/sec.

3. GO TO Section 4.3.5.7.

4.3.5.6 **Steam Generator Tube Rupture:**

NOTE
Offsite doses for a SGTRN (no fuel damage) are NOT likely to exceed 1 REM TEDE or 5 REM Thyroid.

1. SELECT and ENTER the appropriate SGTR Accident Type based on the status of the core. REFER TO Enclosure 8.

   SGTRN - no fuel damage, normal RCS
   SGTRG - gas gap failure
   SGTRC - core melt

2. REFER TO Enclosure 10 Worksheet 4 or 5 for calculating source terms. Worksheet 4 contains background information on operational mitigation strategy.

3. SELECT and ENTER one of the following Release Methods for Noble Gas (NG MTHD) and Iodine (I MTHD) based on the information available.

   RMA2 - ENTER RM-A2 cpm and Auxiliary Building vent CFM. USE when the affected generator is steaming to the condenser. This method is available for NG or I, but it is NOT recommended for I. REFER TO Enclosure 9.

   DRECT - ENTER calculated Ci/sec (NG and/or I). Calculated values may be obtained from Enclosure 10 Worksheets.

   CONC - ENTER µCi/cc (NG and/or I) and release point CFM. Concentrations may be obtained from RM-A4, RM-A12, PASS, and grab samples. USE the Radiation Monitor Sensitivity Curve Log to convert these monitor readings to µCi/cc.

   EFFL - ENTER isotopic µCi/cc (NG and I) and release point CFM. OBTAIN isotopic concentrations from PASS, analysis of grab sample.

   DEFLT - Program supplies default Ci/sec.

4.3.5.7 IF multiple accidents or multiple release points for the same accident are to be entered, THEN REFER TO Enclosure 11 for specific instructions.

4.3.5.8 After all the source term data for the current step have been entered, ADD another step by PRESSING the [Insert] key and FOLLOWING instructions beginning at Section 4.3.5.2, if desirable.

4.3.5.9 IF more steps are added,
THEN PRESS the [Tab] key to move forward or the [Shift][Tab] keys to move backward.

4.3.5.10 After all source term data have been entered, PRESS the [F9] key to accept and continue.

4.3.5.11 From the Main Menu, SELECT "Perform Calculations" (NOT required on first step).

4.3.5.12 REVIEW the plume map and dose rates displayed after the calculations are complete and PRESS any key to continue.

4.3.5.13 To view or print results, SELECT "Output Menu" from the Main Menu.

4.3.5.14 To perform a forecast, REFER TO Section 4.4.5.

4.3.5.15 IF more steps have been entered,
AND it is desirable to complete all calculations before printing. THEN SELECT "Continue with Calculations" from the Main Menu.

4.3.5.16 After the plume map for each step is displayed, CONTINUE to SELECT "Continue with Calculations" until all steps have been calculated.

4.3.5.17 From the Main Menu, SELECT "Output Menu."

4.4 Data Output

4.4.1 Dose Rates at User-entered Locations

NOTE

Plume centerline dose rates are automatically calculated at 0.83, 2, 5, and 10 miles. Dose rates can be calculated at user-entered locations. Dose rates at user-enter locations will appear in the printed reports.

4.4.1.1 SELECT "Display PLUME CENTERLINE Dose Rates" from the Output Menu.

4.4.1.2 ENTER the Ring Distance in miles (distance from the plant) and the Direction in degrees (or "M" for plume centerline maximum).

4.4.1.3 PRESS [F9] to calculate.

4.4.1.4 REPEAT as necessary, PRESS [Esc] when finished.

4.4.2 Displayed Reports

4.4.2.1 To display maps or the tabular results of dose, dose rates, and/or deposition calculations, SELECT any of the "Display" options listed on the Output Menu.

4.4.3 Printed Reports

4.4.3.1 From the Output Menu, SELECT "Go to Report Menu."

NOTE

In order to print RADDOSE-IV from the TSC and EOF dose assessment computers, each Dose Assessment Team member must first map the printer to LPT1 on each computer. This is a one-time requirement. Nuclear Information Technology can assist.

The Dose/Dose Rate Report, the Deposition Report, and the Complete Report contain detailed tabular results of calculations. In most cases, the "Summary Report" will be sufficient.

4.4.3.2 From the Report Menu, SELECT the "Summary Report" which includes the following:

- o Header Page
- o 10 mile Map
- o Maximum dose rates for 0.83, 2, 5, and 10 mile distances, dose rates at any user selected points, and dose rates and accumulated doses at special receptors.
- o A flag to consider Protective Action Recommendations (PARs), if needed.

4.4.3.3 REVIEW the following information on the Header Page:

- o Trip/decay start date and time
- o Release date and time
- o Projection number (step)
- o List of program switches (e.g., source decay, etc.)
- o Meteorological data including mixing height
- o Source term data
- o Release rates for Noble Gas, Iodine, and particulates
- o Cumulative release data
- o Isotope % abundance

4.4.3.4 After the printout is complete, SELECT "Return to Output Menu" from the Report Options Menu.

NOTE

If data for one or more steps have been entered but NOT calculated, the program will automatically begin the next step calculation and display the plume map as in Section 4.3.5.12. If no more data have been entered, the cycle of data entry, calculation, and reporting starts again as in Section 4.3.4.

4.4.4 From the Output Menu, SELECT "Continue With Calculations."

4.4.5 Performing a Forecast

NOTE

After at least one step has been calculated, the Forecast option is available. This option can be used to project dose information and plume position two or more hours into the future based one set of meteorological and source term inputs. Doses will be calculated for the Forecast period only.

4.4.5.1 From the Main Menu, SELECT "Performing a Forecast."

4.4.5.2 ENTER meteorological and source term inputs to be used for the forecast period as described in Sections 4.3.4 and 4.3.5.

4.4.5.3 ENTER the forecast period in multiples of two hours (e.g., 2, 4, 6, 8 hours, etc.).

4.4.5.4 PRESS the [F9] key to accept and continue.

NOTE

On the 10 mile EPZ map displayed after a forecast calculation, the dose units are mREM accumulated during the forecast period NOT mR/hr. However, the printed report is in mR/hr.

4.4.5 5 DISPLAY or PRINT the forecast results just as with a real-time (normal) step if needed.

4.4.6 Before performing the next step after the forecast, REVIEW the meteorological and source term data and CORRECT as necessary as described in Sections 4.3.4 and 4.3.5.

4.4.7 Comparison with Field Data

4.4.7.1 COMPARE field measurements received from the Offsite Radiation Monitoring Team with calculated values (i.e., Noble Gas/Iodine ratios, dose rates, dose, etc.) obtained from RADDOSE-IV.

4.4.7.2 IF calculated values seem inconsistent with field team data,
THEN REFER TO EM-219 section 4.5.

4.4.8 Correcting and Recalculating a Step

4.4.8.1 IF incorrect data are discovered for a previous step,
THEN REFER TO Enclosure 12 for correction/recalculation instructions.

4.5 Protective Actions Recommendation

4.5.1 IF dose projections equal or exceed 1 REM TEDE or 5 REM Thyroid at the site boundary (0.83 miles),
THEN NOTIFY the facility lead (EC or EOF Director).

4.6 Documentation

4.6.1 FORWARD all documentation created in the TSC to the Radiation Controls Coordinator and in the EOF to the Radiation Controls Manager for review as time permits.

4.6.2 TRANSMIT the documentation to Document Services under EM-204(B).

ENCLOSURE 1

Site Boundary (0.83 miles) Dose Estimate Credibility Evaluation

Dose rate estimates may be compared with estimates in this table as a credibility check, however, actual dose rates could vary by orders of magnitude depending on plant conditions. Source terms were calculated using Enclosures 10 Worksheets

Monitor Reading or Accident Type	Type of Estimate	DDE mR/hr	Thyroid mR/hr	TEDE mR/hr	Gas Ci/sec	Iodine Ci/sec
RM-A1 Gas at 100K cpm	LOCAN	2.6	2.3	2.8	9.5E-2	3.2E-4 [1]
	FHA	0.3	0.7	0.3	9.5E-2	4.7E-6 [2]
RM-A1Mid-Range at 1 mR/hr	LOCAN	19	18	21	0.705	2.4E-3 [1]
	FHA	1.9	5.4	2.1	0.705	3.5E-5 [2]
RM-A2 Gas at 100K cpm	LOCAN	3.1	2.8	3.4	0.114	3.8E-4 [1]
	SGTRN	3.1	0	3.1	0.114	3.8E-7 [3]
	FHA	0.3	0.9	0.3	0.114	5.7E-6 [2]
	WGDTR	0.3	0.1	0.3	0.114	5.6E-7 [4]
RM-A2 Mid-Range at 1 mR/hr	LOCAN	52	47	57	1.9	6.3E-3 [1]
	SGTRN	52	0.1	52	1.9	6.3E-6 [3]
	FHA	5	14	5.6	1.9	9.5E-5 [2]
	WGDTR	5	1.6	5.1	1.9	9.5E-6 [4]
RM-G25/28 at 1mR/hr [2]	SGTRN	0.2	1.7	0.3	0.03	0.002 [5]
SGTRN 100 gpm P>S	RCS activity [6]	1	30	4	4.4E-3	4.4E-3
RM-G29/30 at 10 R/hr [7]	LOCAN	0	0.6	0.1	1.2E-4	8.2E-5
	FHA	0	12	0.5	1.2E-4	8.2E-5
LOCAN No Core Damage	RD4 Default	0	0	0	1.0E-5	1.0E-7
LOCAG Clad Failure	RD4 Default	30	220	40	0.7	0.01
LOCAC Fuel Melting	RD4 Default	560	1800	690	14	0.086
WGDTR[4]	RD4 Default	14	7	14	5.4	4.2E-5
FHA	RD4 Default	180	1000	220	68	6.7E-3
SGTRN No Core Damage [5]	RD4 Default	3	120	14	0.016	0.016
SGTRG Clad Failure [5]	RD4 Default	6.5E4	3.9E6	3.0E5	1100	180
SGTRC Fuel Melt [5]	RD4 Default	1.0E6	3.0E7	3.1E6	2.2E4	1400

Standard Assumptions:
RADDOSE-IV model, no holdup time, E stability class, 1 m/sec wind, 80° F ambient temperature, rain 0 inches/15 minutes
RM-A1: slope=2 489E7, cfm=50,000, RM-A2 slope=6 454E7, cfm=156,000 low-range or 100,000 cfm mid-range
Other Assumption Notes:
[1] Base I/NG Ratio=1, Iodine DFs: Partitioning=5, Plateout=3, Filters=20
[2] Base I/NG Ratio=1E-3, DFs: Filters=20
[3] Base I/NG Ratio=1, DFs Partitioning=5, Plateout=3, SGTR to condenser=1000, Filters=20
[4] Base I/NG Ratio=1E-4, DFs Filters=20
[5] Base I/NG Ratio=1, Iodine DFs· Partitioning=5, Plateout=3
[6] RCS Total NG=1.0 μCi/gm, Total Iodine=1.0 μCi/gm; ADV release
[7 NG spray off factor=0 007, Iodine spray off factor=.005, Design Basis Leakage of 3 5 cfm

CONFERENCE CALL INSTRUCTIONS

Communications should first be established between the Dose Assessment Communicator in the Control Room (providing met and rad monitor information) and the TSC Dose Assessment Team (DAT). Once the EOF DAT is established, it should be tied into the conference call as soon as possible. (A conference call can be initiated by any of the parties using the appropriate phone numbers.)

Dose assessment phone extensions are listed in the Emergency Facility Telephone Directory.

1. The Dose Assessment Communicator to the Control Room should establish communication with the TSC DAT.

2. Hookflash * (receive a stutter dial tone), then dial the EOF DAT extension.

3. Hookflash, and receive the feature dial tone.

4. Dial access code 4 to establish the conference.

5. If the extension at the EOF CANNOT be reached, hookflash again and communication with the TSC will be re-established.

*A hookflash is quickly depressing and releasing the connection button.

INSTALLING RADDOSE-IV

It should no longer be necessary to install the software as RADDOSE-IV is available on the Standard Desktop. If installation is necessary, a portable diskette reader will be needed and Nuclear Information Technology support may be necessary especially to setup printing from non-dose assessment computers.

1.0 The program is contained on one 3 1/2" 1.4 MB diskette marked "FPC RADDOSE-IV, Version 2.0" stored in TSC procedure cabinet with EM-204 (B) or in the EOF Dose Assessment Cabinet.

2.0 If Directory "RD4V2" already exists, go to 2.3.

2.1 Create a directory called "RD4V2" on drive C and make this the current directory. Type the following lines in the DOS Command Prompt window:

```
C:
CD\
MD\RD4V2
CD\RD4V2
```

2.2 If Directory "RD4V2" has just been created, go to 3.0.

2.3 If this directory already exists, delete all files by typing:

```
CD\RD4V2
DEL *.*
Y
```

3.0 Insert the RADDOSE-IV disk into drive A.

4.0 Run the installation program by typing "A:FPCINST."

5.0 Prompts are provided for the type printer to be used.

6.0 When installation is complete, a prompt will confirm the model is correctly installed.

7.0 There are additional data files on disk that must be copied manually. Leave disk inserted and type the following at the prompt:

```
COPY A:\DF\*.*
```

8.0 To start the program, type "FPC" at the DOS prompt.

DATA FROM THE PLANT COMPUTER [NOCS 40188]

This Enclosure contains four methods for obtaining data from the plant computer. Select the most appropriate method. NOT all methods may be available. Data can also be obtained directly from the Control Room.

DYNAMIC DATA EXCHANGE SPREADSHEET - Live data from radiation monitors and meteorological instruments displayed in an Excel spreadsheet.

1. Double-click on the PICS icon.

2. Access Control Client box :
   a. In the "Choose a system" box, Select CR3 PPCS.
   b. In the User Name box, type either tsc or eof.
   c. In the Password box, type either tsc or eof.
   d. Click LogOn.

3. Minimize the PICS Access Control Client window.

4. In Windows Explorer, go to the c:\PICS\RtdbDde directory and double- click on RtdbDde.exe file. When the hourglass disappears (takes < 1 second), go to the next step.

5. Start Excel.

6. Open the file c:\My Documents\Dde\RADMET.xls

7. Click Yes to update all linked information.

SPDS DISPLAYS – Live operational data, graphs, and selected radiation monitors.

1. Double-click on the PICS icon.

2. Access Control Client box :
   a. In the "Choose a system" box, Select CR3 PPCS.
   b. In the User Name box, type either tsc or eof.
   c. In the Password box, type either tsc or eof.
   d. Click LogOn.

3. In the PICS Access Control Client window, double-click on the SPDS Display icon.

4. When the SPDS graphic screen is displayed, press the "A" key to display the Alpha pages. Page 7 of 8 displays RM-G29/30, RM-A6, RM-L1, RM-A1 low-range, RM-A2 low-range, RM-A12, RM-Gs25-28, RM-L2, RM-L7, RM-G1, RM-A5.

PICS ARCHIVE RETRIEVAL – Data from any point recorded in the PICS Real Time Database downloaded per the user specifications of point selection, time selection, and time intervals.

1. Double-click on the PICS icon.

2. Access Control Client box :
   a. In the "Choose a system" box, Select CR3 PPCS.
   b. In the User Name box, type either tsc or eof.
   c. In the Password box, type either tsc or eof.
   d. Click LogOn.

3. In the PICS Access Control Client window, double-click on the Retrieval icon.

4. In the PDRSrtrv box, select File, New Retrieval.

5. On the Simple Retrieval Query Form:
   a. Enter start and stop times of desired data.
   b. Select Fixed Width Text.
   c. Enter file name and path for output file.
   d. Enter Snapshot interval (time between data points).
   e. Highlight point to read and click Select. Repeat as needed.
   f. Add point EVI-1 to the point selection list.
   g. Click Submit.

6. Start Excel.

7. Open the output file from 5.c above.

8. In the Text Import Wizard box:
   a. Select Fixed Width.
   b. Click Finish.

REDAS USE FOR DOSE ASSESSMENT

NOTE

There are tentative plans to eliminate REDAS in the near future.

I. LOGGING ON THE NETWORK

Dose assessment team members log on using your OT number and password.

II. REDAS ACCESS & INITIAL SET-UP

1. From the Desktop menu, double click on the REDAS icon.
2. REDAS Network Accessor box is displayed, click on **OK**.
3. Select **Request**, then **Request Group**.
4. Verify that Standard Group, Sort By Name, and ASCII Tabular File Format have been selected.
5. Specify Start & End Dates & Times. To change parameters, click on the box, then enter dates/times. Specify at least one hour.

III. SELECTING REDAS GROUPS & DOWNLOADING

The order in which groups are selected is NOT important.

Group Names:

AA_ENG	Engineering Instruments
AA_MET	Meteorological Instruments
AA_RADAL	Air and Liquid Radiation Monitors
AA_RADG	General Area Radiation Monitors

1. Click on **AA_ENG.**
2. Verify Frequency is 15 minutes and Average box is checked.
3. Click on **OK.** All download parameters will be displayed in a "Group Confirmation" window. If data are correct, click on **Yes.** Otherwise, click on **No** to return to previous screen.
4. Downloading will start, and should take less than 1 minute. While downloading is taking place, the "Data Request Status" window will be active.
5. When downloading is complete, the "REDAS-NIS" window will be displayed. Note the file name and location.
6. Click on **OK** in the "REDAS-NIS" screen.
7. Select **Request**, then **Request Group.**
8. Click on **AA_MET.**
9. Verify Frequency is 15 minutes and Average box is checked.
10. Click on **OK** to accept download settings.
11. Verify settings in "Group Confirmation" window. Click on **Yes** to accept & begin download.
12. When downloading is complete, the "REDAS-NIS" window will be displayed. Note the file name and location.
13. Click on **OK** in the "REDAS-NIS" screen.
14. Select **Request**, then **Request Group.**
15. Click on **AA-RADAL.**
16. Verify Frequency is 15 minutes and Average box is checked.
17. Click on **OK** to accept download settings.
18. Verify settings in "Group Confirmation" window. Click on Yes to accept & begin download.
19. When downloading is complete, the "REDAS-NIS" window will be displayed. Note the file name and location.
20. Click on **OK** in the "REDAS-NIS" screen.
21. Select **Request**, then **Request Group.**
22. Click on **AA_RADG.**
23. Verify Frequency is 15 minutes and Average box is checked.
24. Click on **OK** to accept download settings.
25. Verify settings in "Group Confirmation" window. Click on **Yes** to accept & begin download.
26. When downloading is complete, the "REDAS-NIS" window will be displayed. Note the file name and location.
27. Click on **OK** in the "REDAS-NIS" screen.

28. Start Excel.

29. Open the output file recorded earlier (normally C:\My Documents\Aa_eng.txt, etc.).

30. Text Import Wizard Step 1 of 3:
In the Original Data Type, select Delimited then click Next.

31. Text Import Wizard Step 2 of 3:
In the Delimiters, select Comma then click Next.

32. Text Import Wizard Step 3 of 3:
In the Column data format, select General then click Finish.

METEOROLOGICAL INPUT SHEET FOR RADDOSE-IV

DATE/TIME OF TRIP:_____ DATE/TIME OF RELEASE:_____

Sources listed by priority – enter number of source data used in each column heading

1. 33ft Primary Tower
2. 175ft Primary Tower
3. 33ft Alternate Tower
4. Other_____

METEOROLOGICAL DATA

ADVECTION STEP	DATE	DATA TIME	WIND SPEED m/sec	WIND DIRECTION DEGREES	Sigma Theta DEGREES or WIND RANGE DEGREES Or Delta T (Deg F)	STABILITY CLASS	AMBIENT TEMPERATURE DEGREES F	RAIN INCHES Per 15 min

RADIOLOGICAL DATA SHEET FOR RADDOSE-IV

ACCIDENT TYPES

LOCAN - Loss of Coolant Accident, Normal RCS
LOCAG - Loss of Coolant Accident, Gas Gap Failure
LOCAC - Loss of Coolant Accident, Core Melt
FHA - Fuel Handling Accident
SGTRN - Steam Generator Tube Rupture, Normal RCS
SGTRG - Steam Generator Tube Rupture, Gas Gap Failure
SGTRC - Steam Generator Tube Rupture, Core Melt
WGDTR - Waste Gas Decay Tank Rupture

RELEASE METHODS

RMA1 - RM-A1 Monitor (cpm)
RMA2 - RM-A2 Monitor (cpm)
CONC - Concentration/Flowrate (µCi/cc)
EFFL - Effluent Isotope Inventory (µCi/cc)
DRECT - Direct Input (Ci/sec)
DEFLT - Default Release Rate (Ci/sec)
RATIO - Iodine based on Noble Gas

SOURCE TERM DATA

ADVECTION STEP	DATE	DATA TIME	ACCIDENT TYPE	SCFM	NOBLE GAS METHOD	GAS MONITOR CPM	*GAS µCi/CC or Ci/sec*	IODINE METHOD	IODINE MONITOR CPM	IODINE µCi/cc or Ci/sec*

* If the Method is DRECT or DEFLT, enter Ci/sec in the Gas µCi/cc and/or the Iodine µCi/cc columns and mark the values with an *.

COPYING RADDOSE-IV DATA FILES

Computers provided in the January, 2003 computer upgrade no longer have diskette drives. Contact Nuclear Information Technology for assistance with this enclosure.

1.0 To copy an incident from the hard disk to formatted floppy diskettes, select "SAVE DATA TO DISK" from the startup menu. This may require several diskettes.

1.1 Insert a diskette in drive A when prompted. Label each diskette with the files it contains (e.g., MET and Source Data), so the files can be restored correctly to the hard disk later. Any files on the diskette will be overwritten.

2.0 To copy an incident from diskettes to the hard disk, type "RETRIEVE" from the C:\RD4V2\> prompt.

2.1 Insert the diskettes into drive A when prompted. Any files on the hard disk with the same name will be overwritten.

ALTERNATE METHODS FOR DETERMINING METEOROLOGICAL DATA

1. Wind direction, wind speed, and wind range can be estimated by observing cooling tower vapor, flags, fossil stack smoke, etc.

2. Stability class can be estimated using wind range if a wind direction recorder is available. Wind range is the difference (in degrees) between the highest and lowest wind direction tracing on the recorder for a 15 minute period. Use this difference and the following table to determine stability class. DO NOT ENTER WIND RANGE INTO THE SIGMA-THETA FIELD.

WIND RANGE DEGREES	STABILITY CLASS
≥135	A (disperses rapidly)
134 to 105	B
104 to 75	C
74 to 45	D
44 to 23	E
22 to 13	F
≤12	G (disperses slowly)

3. Enter the stability class into the CLS field of the Meteorological Data Input screen

4. Wind direction is determined by estimating the average value of the tracing for a 15 minute period.

5. Meteorological data may also be obtained from the following, however, non-local backup sources may NOT be representative.

   Primary Backup - FAA Flight Service Station in Gainesville, FL.
   Secondary Backup - Tampa Weather Service in Ruskin, FL.

DETERMINING CORE DAMAGE

This enclosure lists three methods of selecting accident type based on the level of core damage. Each method has advantages and disadvantages. Use the most appropriate method (or combination) to predict the level of core damage.

BASED ON RM-G29 AND RM-G30:

This method can be performed quickly, but requires a breach of the Reactor Coolant System. The monitor readings assume thorough mixing of the Reactor Building atmosphere which may take several hours. Earlier readings will likely be higher (conservative).

Obtain RM-G29 and RM-G30 readings. Ignore spikes and estimate the sustained monitor reading. Use this value with the following data to determine accident type.

RM-G29/30 R/HR	ACCIDENT TYPE
<100	LOCAN
100 - 25000 WITH RB SPRAY	LOCAG
100 - 75000 WITHOUT RB SPRAY	LOCAG
>25000 WITH RB SPRAY	LOCAC
>75000 WITHOUT RB SPRAY	LOCAC

BASED ON IODINE RATIOS

This method requires a gamma isotopic of a grab sample and hence may take several hours.

Analyze a liquid or gas sample representative of the post-accident source term. Determine the ratio of I-131 to Total Iodine.

I-131/Total Iodine < 0.05 – Assume LOCAN or SGTRN
I-131/Total Iodine ≥ 0.05 – Assume LOCAG or SGTRG

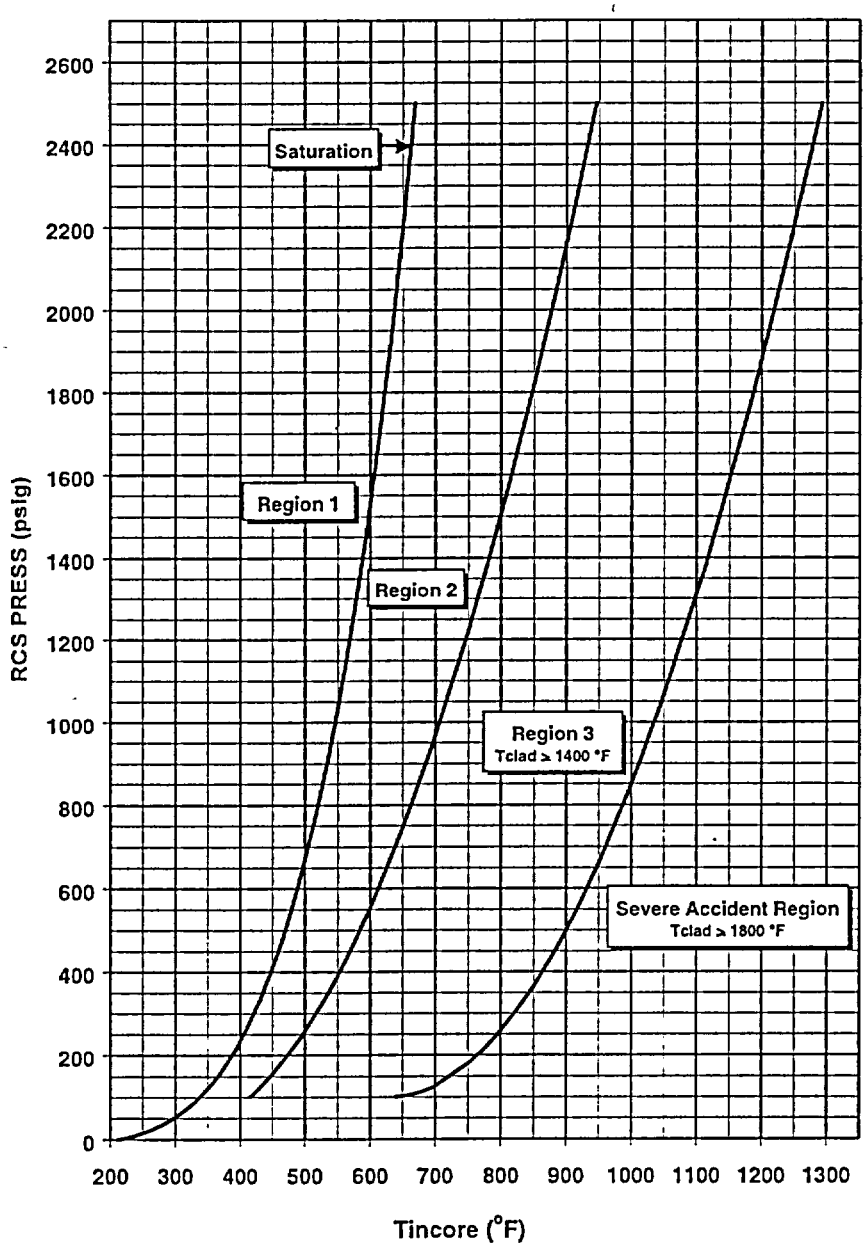
There is no way to distinguish between a gap release and a core melt release using iodine ratios.

DETERMINING CORE DAMAGE

BASED ON RCS PRESSURE AND TEMPERATURE:

This method can be performed quickly but will NOT indicate mechanically-induced core damage. The intersection of pressure from the Y axis and temperature from the X axis is the level of core damage. (Regions are from the Inadequate Core Cooling procedure used by Operations.)

Regions 1 and 2 indicate no fuel damage (normal RCS activity).
Region 3 indicates possible gas gap failure.
Severe Accident Region indicates possible core melt.



NOBLE GAS AND IODINE - METHODS DESCRIPTIONS

1. RM-A1 or RM-A2 – Low Range Effluent monitor cpm/Flowrate:

   This method may be used if there are releases from the Reactor Building being monitored by RM-A1 or releases from the Auxiliary Building being monitor by RM-A2. It can only be used if the low range gas channel is in service and is still on scale.

   The user must enter a specific RM-A1 monitor reading in cpm and a flow rate in SCFM in the Reactor Building vent or a specific RM-A2 monitor reading in cpm and a flow rate in SCFM in the Auxiliary Building vent. The release rate in Ci/sec is then calculated and displayed on the screen. It may be used for Noble Gas and/or Iodine. If the iodine filter has NOT been changed, the filter µCi for the previous step is subtracted from the current value. On the first step, the model assumes previous filter µCi is zero.

   This method is NOT recommended for Iodine due to the effect noble gases and particulates will have on the Iodine channel reading. It is recommended that the use of a Noble Gas release rate and Worksheet 6 of Enclosure 10 be used to determine the Iodine release rate, which can then be entered via the DRECT method.

2. CONC - Concentration/Flowrate

   The user must enter µCi/cc from a grab sample or an estimated µCi/cc and a flowrate measurement or estimate (in SCFM) at the release point. It may be used for Noble Gas and/or Iodine. If this method is used for Iodine, the program asks if the concentration is I-131 only. If I-131 only, the program adds other Iodine isotopes in appropriate ratios. The release rate in Ci/sec is then calculated and displayed on the screen.

3. EFFL - Effluent Isotope Entry

   The Isotope Screen is displayed and the user must enter isotopic concentrations in µCi/cc from a grab sample or other source. Press the [Enter] key to input the concentration and to move to the next isotope. At least one noble gas and one iodine isotope must be entered. The release rate in Ci/sec is then displayed on the screen. Once a distribution has been entered, the program will retain it until a new distribution is entered or until the accident type is re-entered.

4. DRECT - Direct Input

   The user must enter a calculated release rate in Ci/sec for Noble Gas and/or Iodine. Enclosure 10 includes worksheets for calculating the release rate from the following sources:
   Worksheet 1: Low, mid, and high range readings on RM-A1
   Worksheet 2: Low, mid, and high range readings on RM-A2
   Worksheet 3: Containment Releases based on RM-G29/30
   Worksheet 4: SGTR releases from condenser (RM-A2) or from ADV/MSSV based on RCS activity
   Worksheet 5: SGTR releases from ADV/MSSV based on RM-G25/28
   Worksheet 6: Iodine release rates based on the Noble Gas release rate and Iodine to Noble Gas ratios and recommended Iodine decontamination factors
   Worksheet 7: Noble Gas release rate based on an onsite plume measurement

5. DEFLT - Default

   The program enters the default value in Ci/sec for a particular accident type. It may be used for Noble Gas and/or Iodine. Default values should be used only as a last resort to calculate an upper limit dose rate. Results may be many orders of magnitude in error.

6. RATIO - Ratio of Noble Gas to Iodine (LOCA ONLY)

   This method is NOT recommended for the first time step as it will enter default ratios that may NOT be representative of current conditions. Enclosure 10 Worksheet 6 should be used to calculate an Iodine release rate if sample or monitor readings are unavailable or unreliable. For subsequent time steps, if there is no reason to believe the NG/I ratio has changed, then this method can be used to have RADDOSE-IV enter the Iodine release rate based on the ratio from the previous time step. The ratio should be periodically reassessed using Worksheet 6 due to radioactive decay or changes in plant conditions such as RB spray, ventilation filters, or condenser availability.

RELEASE RATE WORKSHEETS

This Enclosure contains worksheets for calculating the release rate in Ci/sec from the sources listed below. Worksheet data, assumptions and calculations should be verified by a second person.

Worksheet 1: Noble Gas Release Rate From RB Purge Exhaust Duct Based on RM-A1
(Low, mid, and high range readings on RM-A1)

Worksheet 2: Noble Gas Release Rate From AB/FH Exhaust Duct
(Low, mid, and high range readings on RM-A2)

Worksheet 3: Noble Gas/Iodine Release Rate From Containment Based on RM-G29/30

Worksheet 4: SGTR Release Rates From Condenser Based on RM-A2 or From MSSV/ADV Based on RCS Activity

Worksheet 5: SGTR Release Rates From MSSVs/ADVs Based on RM-G25 or RM-G28

Worksheet 6: Iodine Release Rate Based on Iodine/Noble Gas Ratios
(I/NG ratio and recommended Iodine decontamination factors)

Worksheet 7: Noble Gas Release Rate Based on Onsite Plume Measurement
(Uses release elevation, wind speed, and decay time to covert plume dose rate to release rate)

Worksheet 1
Noble Gas Release Rate from RB Purge Exhaust Duct Based on RM-A1

INPUT DATA			
A. Rx Shutdown: Date:		Time:	
B. Met/Rad Data: Date:		Time:	
C. Advection Step Time Period:	From:		To:
D. RM-A1 Low Range Gas Reading: or			cpm
E. RM-A1 Mid Range Gas Reading: or			mR/hr
F. RM-A1 High Range Gas Reading:			mR/hr
G. RB Exhaust Flow - from AH-32-FIR channel D or 50,000 cfm default:			cfm
RELEASE RATE ESTIMATE			
H. Time since Rx Shutdown (B-A)			hours

I. Enter or circle conversion factor:

Low Range Gas - from Calib. Curve: Slope = _____; Inverse of slope → _____ µCi/cc per cpm

or 1.7E-8 µCi/cc per cpm default →

Mid or High Range Gas

	µCi/cc per mR/hr	
	Mid	High
From 0 to 4 hours post Rx shutdown:	0.03	9.0
From 4 to 24 hours post Rx shutdown:	0.06	16
For ≥ 24 hours post Rx shutdown:	0.13	34

Release Rate = _____ x _____ x _____ x 4.7E-4* = _____
Ci/sec D, E, or F G I Ci/sec

* 4.7E-4 = 472 cc/sec per cfm x 1E-6 Ci/µCi

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

Worksheet 2
Noble Gas Release Rate from AB/FH Exhaust Duct Based on RM-A2

INPUT DATA			
A. Rx Shutdown Date:		Time:	
B. Met/Rad Data: Date:		Time:	
C. Advection Step Time Period:	From:		To:
D. RM-A2 Low Range Gas Reading: or			cpm
E. RM-A2 Mid Range Gas Reading: or			mR/hr
F. RM-A2 High Range Gas Reading:			mR/hr
G. AB Exhaust Flow - from AH-32-FIR channel C or 156,000 cfm default:			cfm
RELEASE RATE ESTIMATE			
H. Time since Rx shutdown (B-A)			hours

I. Enter or circle conversion factor:

Low Range Gas - from Calib. Curve
Slope = _____ ; Inverse of slope →
Or 1.7E-8 µCi/cc per cpm default →

	µCi/cc per cpm
	µCi/cc per mR/hr

Mid or High Range Gas

	µCi/cc per mR/hr Mid	High
From 0 to 4 hours post Rx shutdown:	0.04	9.0
From 4 to 24 hours post Rx shutdown:	0.07	16
For ≥ 24 hours post Rx shutdown:	0.13	34

Release Rate = _____ x _____ x _____ x 4.7E-4* = _____
Ci/sec (D, E, or F) (G) (I) Ci/sec

* 4.7E-4 = 472 cc/sec per cfm x 1E-6 Ci/µCi

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

Worksheet 3
Noble Gas/Iodine Release Rate from Containment Based on RM-G29/G30

INPUT DATA			
A. Release Date:		Time:	
B. Advection Step Time Period	From:		To:
C. *RM-G29 Reading: or			R/hr
D. *RM-G30 Reading:			R/hr
E. RB Pressure:			psig
F. Estimated RB hole size:			in^2
G. RB Sprays: Circle one:	ON OFF		
RELEASE RATE ESTIMATE			
H. Circle Noble Gas Factor:	Sprays On - 0.02 µCi/cc per R/hr Sprays Off - 0.007 µCi/cc per R/hr		
I. Circle Iodine Factor:	Sprays On - 0.0006 µCi/cc per R/hr Sprays Off - 0.005 µCi/cc per R/hr		
J. Flow =	$145 \times \left(\frac{\_\_\_\_\_}{E}\ psig\right)^{1/2} \times \frac{\_\_\_\_\_}{F}\ in^2 = \frac{\_\_\_\_\_}{J}$ CFM***		
K. Noble Gas Release Rate	$\frac{\_\_\_\_\_}{C \text{ or } D^*}$ R/hr x $\frac{\_\_\_\_\_}{H}$ $\frac{\mu Ci/cc}{R/hr}$ x $\frac{\_\_\_\_\_}{J}$ CFM x 4.7E-4** = _____ Ci/sec		
L. Iodine Release Rate	$\frac{\_\_\_\_\_}{C \text{ or } D^*}$ R/hr x $\frac{\_\_\_\_\_}{I}$ $\frac{\mu Ci/cc}{R/hr}$ x $\frac{\_\_\_\_\_}{J}$ CFM x 4.7E-4** = _____ Ci/sec		

Notes: * - The lowest of the two RM-G readings is the preferred reading.
** - 4.7E-4 = 472 cc/sec per CFM x 1E-6 Ci/µCi
*** - If for a projected RB purge, directly enter the projected purge CFM
If for a "What if" the RB inventory is all released in 1 hr, enter 3E4 CFM

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

Worksheet 4 (Page 1 of 2)
Steam Generator Tube Rupture Release Rates
From Condenser Based on RM-A2 or From MSSV/ADV Based on RCS Activity

Instructions: Determine whether the leaking OTSG is steaming to the condenser or to the atmosphere during the release period. Then refer to the appropriate section below to develop source terms (additional info next page). Periodic steam releases through the Main Steam Safety Valves may occur immediately after a reactor trip. The Control Room Dose Assessment Communicator may be able to track times the valves are open. Computer points W354, W355, RECL114, RECL115 track ADVs percent open. Downloading intervals of 1 minute or less over the period of the time step may be useful in determining minutes that the ADVs are open.

I. **LEAKING OTSG STEAMING TO THE CONDENSER** (Also use with normal intermittent releases from MSSV's. Refer to section II for continuous releases from the ADV's/MSSV's.)

NOBLE GAS:

- Use RMA2 Release Method for RM-A2 low-range or Worksheet 2 and the DRECT method for the mid or high range.
- Enter RM-A2 low-range monitor cpm or mid or high-range Ci/sec and the Auxiliary Building Vent CFM.

IODINE:

- If there are Iodine channel indications that appear reasonable, use RMA2 Release Method.
- Enter RM-A2 Iodine channel cpm and the Auxiliary Building Vent CFM.
- If the Iodine channel is off-scale, or considered unreliable, use the I/NG ratio in Enclosure 13 to calculate Ci/sec and enter using the DRECT Release Method.

II. **LEAKING OTSG STEAMING TO THE ATMOSPHERE CONTINUOUSLY**

A. If releases are via the ADV's and RM-G25/28 are available and on-scale, then use Worksheet 5 to estimate the release rate of noble gases and Worksheet 6 to determine the iodine release rate. Enter using the DRECT method. (The monitors will probably NOT detect normal reactor coolant.)

B. Use the following equations if there are no releases from the ADV's or RM-G25/28 are unavailable or NOT on-scale or the release is via the MSSV's. The release rate equals the primary-to-secondary Ci/sec. Enter using the DRECT method.

NOBLE GAS:

- Ci/sec = (_____µCi/cc NG in RCS) (_____gpm P→S Leak Rate) (6.3E-5) (_____ fraction of time there are releases directly to atmosphere)

IODINE:

- Ci/sec = (_____µCi/cc Total I in RCS) (_____gpm P→S Leak Rate) (6.3E-5) (____ fraction of time there are releases directly to atmosphere)

Performed by: _____ Date/Time _____

Verified by: _____ Date/Time _____

Worksheet 4 (Page 2 of 2)
Steam Generator Tube Rupture Release Rates
From Condenser Based on RM-A2 or From MSSV/ADV Based on RCS Activity

BACKGROUND INFORMATION:

Emergency Operating Procedures direct operators to continue to use both steam generators for RCS cooling until mode 5 is reached unless specific parameters are exceeded. These parameters are part of the Tube Rupture Alternate Control Criteria (TRACC) and involve RCS activity, BWST level, and OTSG level. If the condenser is available (vacuum established), steam will be directed there. Noble gases will be discharged from the condenser through the Auxiliary Building Ventilation and RM-A2. If the condenser is NOT available, steam will be discharged through the Atmospheric Dump Valves.

ADDITIONAL INFORMATION

- RM-G26 and RM-G27 are N-16 monitors calibrated to read in gallons per day at 100% power.
- It is assumed that all noble gas activity leaking into the OTSG will be released via the AB stack (RM-A2), MSSVs/ADVs, or EFP-2.
- If core integrity is maintained, activity is based on the most recent RCS activity. RM-L1 may be used to scale this value as transients cause spikes in RCS activity.
- 1 gpm = 63 cc/s
- Maximum Leak Rate = 400 gpm (for one tube)
- Default Flow Rate through stuck open MSSV/ADV = 3E7 cc/sec = 6E4 cfm

DERIVATION OF CONSTANTS USED IN THE SOURCE TERM EQUATIONS

$$6.3E-5 = \left[\frac{1Ci}{1E6\mu Ci} \times \frac{3780\ cc}{1\ Gal} \times \frac{1\ min}{60\ sec} \right]$$

Worksheet 5
SGTR Noble Gas Release Rate from Main Steam Safeties or ADV's Based on RM-G25 or RM-G28

INPUT DATA			
A. Rx Shutdown Date:		Time:	
B. Met/Rad Data: Date:		Time:	
C. Advection Time Period:	From:		To:
D. RM-G25 Reading: or		mR/hr - monitors A OTSG ADV line	
E. RM-G28 Reading:		mR/hr - monitors B OTSG ADV line	
F. Number of ADV/Safeties open on affected SG (1 - 9):			
G. Fraction of time releases in progress on affected OTSG (0 - 1):			

RELEASE RATE ESTIMATE		
H. Time since RX Shutdown (B – A):		hours
I. Circle conversion factor:		
From 0 to 4 hours post Rx shutdown:	0.03 µCi/cc per mR/hr	
From 4 to 12 hours post Rx shutdown:	0.1 µCi/cc per mR/hr	
For ≥ 12 hours post Rx shutdown:	0.3 µCi/cc per mR/hr	

Release Rate = _____ (D or E) x _____ (F) x _____ (G) x _____ (I) x 30* = _____ Ci/sec

* 30 = Estimated flow of 3E7 cc/sec per open valve x 1E-6 Ci/µCi

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

Worksheet 6
Iodine Release Rate
Based on Iodine/Noble Gas Ratio

INPUT DATA		
Advection Time Period:	From:	To:
Assumed Release Path from source (e.g., RCS) to release point:		
A. Noble Gas Release Rate:		Ci/sec

RELEASE RATE ESTIMATE

B. Base Iodine/Noble Gas Ratio (circle the most appropriate value)

1.	FHA (ratio at pool/cavity water surface)	1E-3
2.	WGDTR (ratio at tank release)	1E-4
3.	LOCAN/SGTRN (0-3 hours post shutdown)	1
4.	LOCAN/SGTRN (>3 hrs post shutdown)	10
5.	LOCAG/SGTRG (released from fuel)	0.5
6.	LOCAC/SGTRC (released from fuel)	0.2

C. Iodine Decontamination Factors (DF) - Enter DF for each removal mechanism that exists and multiply together to obtain Total DF:

Partitioning (LOCA's/SGTR's: from water flashing): Default DF = 5	_____
Plateout (LOCA's/SGTR's in containment or OTSG): Default DF = 3	X _____
RB Sprays: Default DF = 10 for 0-2 hrs or 100 for >2 hrs of spray time	X _____
SGTR Release via condenser: Default DF = 1000	X _____
RB/AB Exhaust filters: Default DF = 20	X _____
TOTAL DF:	Total = _____

D. Total Iodine Release Rate:

I Release Rate = _____ (A) X _____ (B) ÷ _____ (C) = _____ Ci/sec

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

Worksheet 7
Noble Gas Release Rate
Based on Onsite Plume Measurement

NOTE: This method assumes reasonable assurance that measured dose rates represent near maximum plume concentrations.

Date of Measurement: _____ Time of measurement: _____

_____ x _____ x _____ x _____ = _____

Measured Dose Rate (mR/hr)*	Conv. Factor	Wind Speed (m/sec)	Decay Corr.	Noble Gas Release Rate (Ci/sec)

0.18 for Elevated ** Release (e.g. - ADV)

0.03 for Ground Release

Time Since Rx Shutdown	Corr. Factor
0 hr	1
1 hr	2
2 hr	4
4 hr	6
≥8 hr	10

* Measured dose rate is the maximum closed window reading found while traversing the plume within 400 meters of the release point.

** Elevated factor based on assumed effective release height of 400 ft. This requires a thermal buoyant plume such as from the ADV's. A release from the RB/AB vent would lie somewhere between the 2 factors and would depend on the ratio of the wind speed to the vent exit velocity. For conservatism use the ground factor for a vent release. Factors are based on RASCAL-3.0.1 runs.

Completed by: _____ Date/Time: _____

Verified by: _____ Date/Time: _____

INSTRUCTIONS FOR ENTERING MULTIPLE ACCIDENTS AND RELEASE POINTS

Source terms from three different release points (from one or more accidents) may be entered in each step. Multiple release points could be associated with the same accident (e.g., from RM-A2 and safety relief valves during SGTR) or multiple accidents could cause releases from different points (e.g., LOCA from Containment and WGDTR from RM-A2).

1.0 Entering Multiple Accidents

1.1 After all source term data on line 1 of the current step have been entered, press the down arrow key to move to line 2.

1.2 Press [F2] to access the Accident Menu.

1.3 Select another accident and press [ENTER].

1.4 Enter all source term data for the new accident.

1.5 If a release terminates, enter "NONE" in the Accident Type field.

1.6 Up to three different accidents may be entered in the current step. When all data are correct, press [F9].

2.0 Entering Multiple Release Points for the Same Accident

2.1 After all source term data on line 1 of the current step have been entered, press the down arrow key to move to line 2.

2.2 Press [F2] to access the Accident Menu.

2.3 To enter another release point, select the same accident type again and press [ENTER].

2.4 Enter all source term data for the new release point.

2.5 If a release terminates, enter "NONE" in the Accident Type field.

2.6 Up to three separate release points may be entered in the current step. When all data are correct, press [F9].

INSTRUCTIONS FOR CORRECTING AND RECALCULATING A TIME STEP

To correct an error in a previous time step, it is necessary to return to both the meteorological data screen and the source term data screen. To recalculate the time step, perform the following:

1. From the Main Menu, select "Enter Meteorological Data," even if all data are correct.
2. If all meteorological data are correct, press [F9]. Go to 6 below.
3. Use the Up Arrow Key to return to the incorrect time step.
4. Use the Right and Left Arrow Keys to return to the incorrect data.
5. Re-enter the data, press [F9].
6. From the Main Menu, select "Enter Source Term Data," even if all source term data are correct.
7. If all source term data are correct, press [F9]. Go to number 11 below.
8. Use the [Shift][Tab] keys to return to the incorrect time step.
9. Use the Right and Left Arrow Keys and/or the Up and Down Arrow Keys to return to the incorrect data. (Use the Up and down Arrow Keys to access multiple accidents within the time step.)
10. Re-enter the data and press [F9].
11. RADDOSE-IV may have added a new time step to both the meteorological and source term data screens by copying the data from the last calculated time step. Ensure this new data are correct then press [F9]. If the data for the new time step are NOT available yet, it can be corrected when obtained.
12. From the Main Menu, select "Perform Calculations." The program will now recalculate the incorrect time step and display the plume map.
13. It is necessary to recalculate all time steps after the error. Reprint reports as necessary and continue to select "Perform Calculations" or "Continue with calculations" until program returns to the current time step.

Revision 32 Summary; April, 2003

TOC	Corrected page number error.
3.3.5	Moved RM-A1/A2 bullet to the bottom of the list since they are the exception in the list of monitors available in a station blackout. They won't have representative sample flow, but could be used for detecting changes in area radiation levels.
3.3.7	Noted that with the January, 2003 computer upgrade, RADDOSE-IV software was moved from the server to the hard drives of all standard desktop computers and that the over-writing problem no longer exists.
4.0	Added a hierarchy for performing dose assessment using RADDOSE-IV
4.2 Note	Corrected file path. As of the procedure issue date, plans were in place to change the location on the Start Menu from Regulatory Affairs to Emergency Preparedness, but the implementation date was not set so both paths were listed.
4.1.1	Moved action word to the beginning of the sentence.
4.1.4	Arranged in logic statement format.
4.2.1	In the note for this step, replaced "reboot" with "restart." The notes were moved to precede 4.2.2.
4.2.2	Deleted information about generic logins associated with the previous standard desktop.
4.2.3	Added option of starting RADDOSE-IV using the Start Menu.
4.3.1-4.3.3	Rearranged steps so obtaining and recording met data immediately precedes input. (NCR 84286) Deleted NOCS number 00387 from new 4.3.2 because this is covered in 4.1.1 and Enclosure 4 has a different NOCS number which was confusing.
4.3.4.5	Moved second action to immediately following first action.
4.3.5.2	Replaced "proceed" with "GO TO."
4.3.5.3 4.3.5.4 4.3.5.5 4.3.5.6	Under the CONC release method description, deleted RM-A1/A2 mid and high ranges because there are Enclosure 10 worksheets for those monitors that calculate Ci/sec. Also added to use the Radiation Monitor Sensitivity Curve Log to convert other RM-A monitors cpm to concentration. Added that RMA1 and RMA2 release methods are not recommended for Iodine. Added to the RATIO method that the NG/I ratio should be reassessed due to decay or changes in plant conditions. Capitalized action words and took action words out of parentheses.
4.4.3.2 note	Added that in order to print RADDOSE-IV from the TSC and EOF dose assessment computers, each Dose Assessment Team member must first map the printer to LPT1 on each computer.
4.4.3.4	Added "Return to" to reflect the actual option wording displayed on screen.
4.4.5.1	Swapped with 4.4.5.2 to reflect the actual order the program displays.
4.4.7	Re-labeled as "Comparison with Field Team Data."
4.4.7.3	Changed to 4.4.8 to separate correction of a step from the comparison with field data.
Encl 1	Revised Enclosure to combine dose info from former enclosures 1 and 10 and the Accident Consequences wall chart. (NCR 61613)
4.5.1	For projections exceeding PAGs, added to notify the "facility lead (EC or EOF Director)".
Encl 2	Changed reference location for dose assessment phone extensions to the Emergency Facility Telephone Directory.
Encl 3	Added note that software installation should no longer be necessary because RADDOSE-IV is now on the Standard Desktop.
Encl 4	Corrected file path (NCR 84286). Added that running RtdbDde.exe happens quickly. Added to REDAS download instructions to record the output file name and corrected the default file path given as a example.
Encl 6	Added that computers no longer have diskette drives and to contact NIT for assistance saving and retrieving RADDOSE-IV files.
Encl 8	Re-titled this enclosure "Determining Core Damage" because it's more descriptive of the action. Clarified that RM-G29/30 method does not prohibit use before the RB atmosphere is thoroughly mixed.
Encl 9	Add more information about release methods.
Encl 10	Combined source term calculation worksheets from former enclosures 10, 11, 13, 15 into new enclosure 10 and provided at worksheet index page (NCR 61613). Worksheets 1 and 2: Listed AH-32-FIR as the source of RB and AB exhaust flows and inserted line on which to record slope. Worksheet 4: Designated section I for releases through the condenser even with normal intermittent MSSV releases. Section II for continuous steaming to the atmosphere was broken into two parts. Part A is used when RM-G25/28 are on-scale. This would require releases via the ADVs and would likely require fuel damage. Part B is used when G25/28 are not available such as with normal reactor coolant or with a stuck MSSV. Background information was moved to the second page and signatures were moved to the first page. Also noted that the Control Room Dose Assessment Communicator

	may be able to track time the MSSVs are open. Worksheet 6 Made release rate equation term labels consistent with other worksheets.
Encl 11, 12	Renumbered former Enclosures 12 and 14.
Throughout	Capitalized and underlined negative word "not" to comply with old Writer's Guide and make consistent with other EPIPs.