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Offsite Radiological Dose Protection

Revision 3

Effective Date: 1-19-00

SAFETY RELATED

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1.0 PURPOSE

The purpose of this procedure is to provide guidance and clarification in the event of emergencies involving actual or potential radioactive releases from the Pilgrim Nuclear Power Station (PNPS) for the operation of the emergency dose assessment computer program 'DAPAR' version 2.

2.0 SOURCE DOCUMENTS

2.1 EP-PP-01, "PNPS Emergency Plan"

2.2 EPA 400-R-92-001, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents", October, 1991.

2.3 NRC I.E. Information Notice No. 83-28: "Criteria for Protective Action Recommendations for General Emergencies", May 4, 1983.

2.4 SAND 77-1725, "Public Protection Strategies for Potential Nuclear Reactor Accidents - Sheltering Concepts with Existing Public and Private Structures."

2.5 EP File 1.6.4 "DAPAR Version 2.0 Computer Application Verification, Validation and Documentation".

3.0 DEFINITIONS

3.1 Core Melt Sequence - A situation in which the core is uncovered and there is no means for restoring coolant to the core. Without coolant, overheating and melting of the fuel will occur.

3.2 Dose Commitment - The dose that will be accumulated by a specific organ over a specified period following uptake.

3.3 Evacuation Exposure Period - The period during which those being evacuated are exposed to the radioactive plume.

3.4 Gap Release Sequence - A situation in which the core is overheated and/or uncovered and there is no rapid means for restoring coolant to the core. Without cooling, overheating and failure of the fuel cladding will occur.

3.5 MEMA/OEP - Massachusetts Emergency Management Association/Office of Emergency Preparedness.

3.6 MDPH - Massachusetts Department of Public Health.

3.7 Offsite - The area outside the Owner Controlled Area.

3.8 Projected Exposure Time - That period of time in which the offsite population will be exposed to radiation as a result of an airborne radioactive release.

3.9 Planning Zone(s) - Two zones that are established around all nuclear power stations in which predetermined protective action plans are needed.

3.9.1 The first zone, the Emergency Planning Zone (EPZ), has an approximate radius of 10 miles for plume exposure pathway.

3.9.2 The second zone, the Ingestion Pathway Zone (IPZ), has an approximate radius of 50 miles for food ingestion exposure pathway.

3.10 Sheltering Dose - That dose received if the individual were to remain on the first floor within a wood framed shelter having ventilation control (that is, door, windows and ventilation shut) during the passage of the plume.

4.0 RESPONSIBILITIES

4.1 The Emergency Director is responsible for recommending protective actions to offsite agencies (MEMA/OEP, State Police, EPZ and host communities) to protect the health and safety of the general public.

4.2 The Emergency Offsite Manager, following discussions with the Offsite Radiological Supervisor, is responsible for recommending offsite protective actions to the Emergency Director.

4.3 The Shift Control Room Engineer is responsible for:

4.3.1 Advising the Operations Shift Superintendent on matters of offsite dose assessment and protective action recommendations.

4.3.2 Performance of all dose assessment activities prior to activation of the Emergency Operations Facility.

4.4 The Offsite Radiological Supervisor is responsible for:

4.4.1 Directing and monitoring all offsite dose assessment activities.

4.4.2 Evaluating the results provided by the DAPAR computer program and adjusting or modifying these results if he/she believes that they do not provide an appropriate or reasonably accurate assessment of offsite dose consequences.

4.4.3 Determining the need for offsite actions to protect the health and safety of the general public and providing these recommendations to the Emergency Offsite Manager for review.

4.5 The Dose Assessment Engineer is responsible for:

4.5.1 Obtaining the necessary information from status boards and other sources to execute this program and to promptly report the results to the Offsite Radiological Supervisor.

4.5.2 Immediately reporting significant changes in either input data or results to the Offsite Radiological Supervisor.

4.5.3 Performing dose projections whenever significant changes occur in meteorological, radiological, or plant conditions.

5.0 PROCEDURE

'DAPAR' Version 2.0 is a window based application designed to operate within the Microsoft Access program environment. Application operation and system requirements are dictated by Microsoft Windows protocols. This procedure is not required nor intended to be used as a step-by-step guide while operating 'DAPAR'; however, the user must be familiar with basic computer operations within the Microsoft Windows environment in order to utilize this application.

5.1 Application Start-Up

5.1.1 Verify the monitor is on. If it is not, start the monitor.

5.1.2 Verify the printer is connected to the computer and is turned on. If it is not, connect and start the printer.

5.1.3 Verify that a mouse or other type of pointing device is connected to the computer. If there is not, connect the mouse to the computer.

5.1.4 Verify that the keyboard is connected to the computer. If it is not, connect the keyboard to the computer.

5.1.5 Remove any floppy disks inserted in the "A" drive.

5.1.6 If the computer is off, turn the computer on. After the initial diagnostic checks the Windows NT Ctrl+Alt+Delete to logon window will appear. Push Ctrl+Alt+Delete. The User Logon window will appear. Push "OK", this will open the Windows NT Desktop. DAPAR can now be started by double clicking the mouse on the DAPAR v2.0 icon.

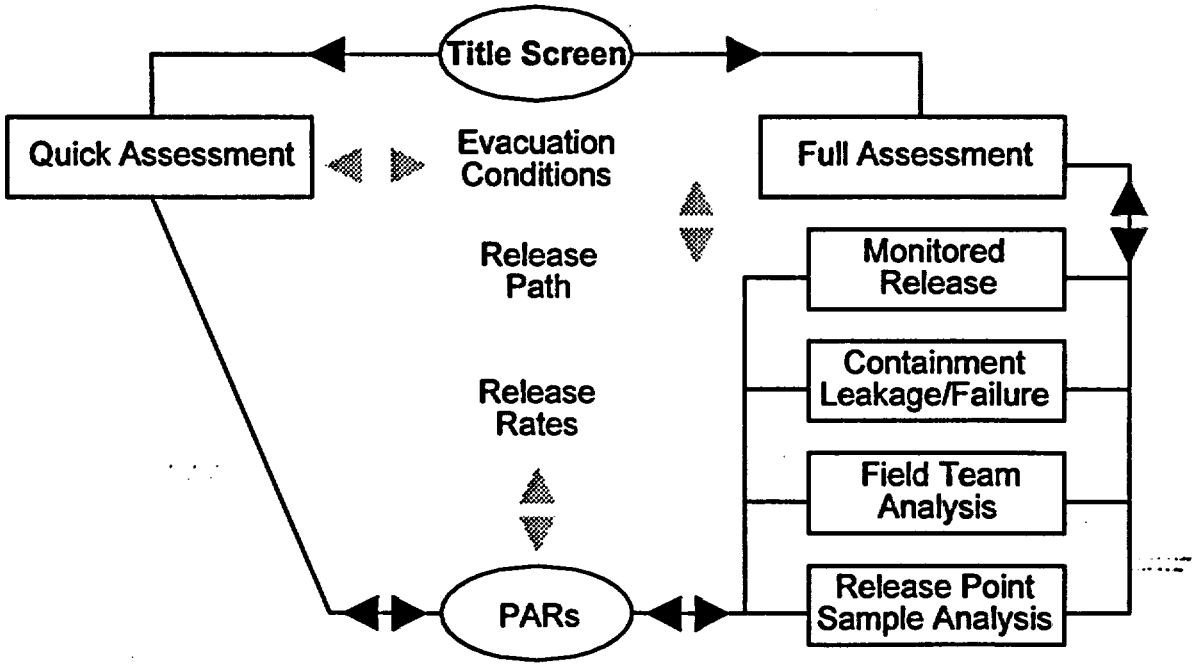
5.1.7 If the computer is on and DAPAR is not running, or another program is being run, quit or switch to the Windows desktop window. DAPAR can be started by double clicking the mouse on the DAPAR v2.0 icon.

5.1.8 If the program is still not operating or the computer does not start up as described above, notify the appropriate supervisor. Use another dose assessment computer or any PC with Microsoft Access and a back-up application disk or proceed to Section 5.8 until the problem is resolved.

5.2 Title Screen

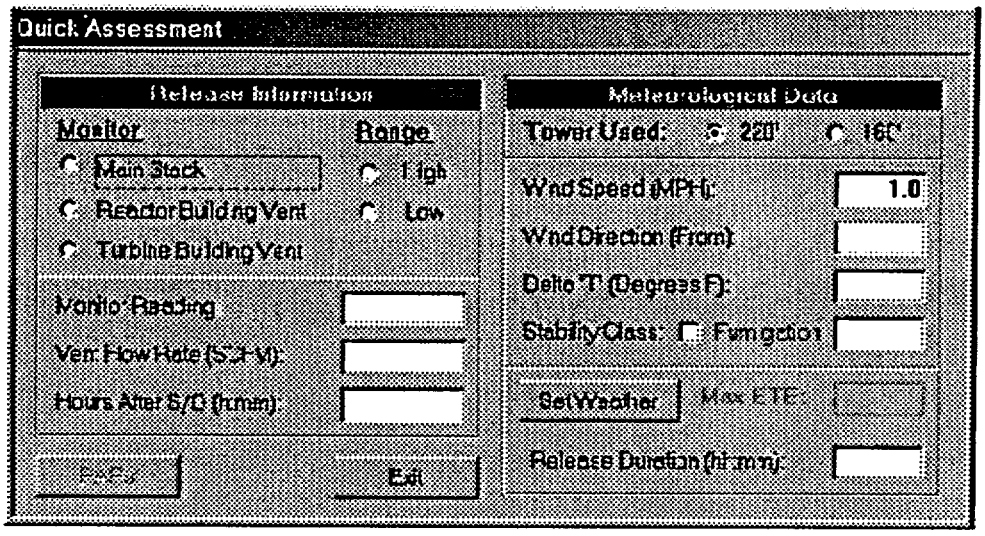
The title screen shows the application version and directs program flow to the desired assessment method. The 'Full Assessment' option is designed for use by a qualified dose assessment engineer. Four methods of dose assessment are available; monitored release, containment leakage/failure, field team analysis, and release point sample analysis. In the case of 'Full Assessment', multiple assessments can be performed simultaneously during a session. The 'Quick Assessment' option is designed for use in the Control Room. Assessment is performed from effluent information related to a monitored release using design basis accident (LOCA) default values. Once an assessment option is selected, the introduction screen cannot be recalled without quitting the application and beginning a new session. A basic program flow diagram is illustrated below.

DAPAR Input Window Flow Diagram



5.3 Quick Assessment

Quick assessment operation and calculation is identical to the full assessment method for a monitored release, but utilizes default release path and core damage assumptions for the determination of offsite doses. Default values incorporating a design basis LOCA accident are applied to allow a rapid assessment from within the Control Room during situations involving a monitored release. Base information is grouped into two areas; release information and meteorological data. The Quick Assessment window also contains command buttons for navigating to other areas or for performing application functions.



The quick assessment option takes monitor release and meteorological information inputs to determine a protective action recommendation. Information is entered directly into the appropriate text box or by selecting a choice from a group of option buttons.

The inputs for this assessment option are as follows:

Release Information		
Input	**Control**	**Options/Entry**
Monitor	Option Button	Main Stack Reactor Building Vent Turbine Building Vent
Range	Option Button	High Low (not available for turbine building vent)
Reading	Text Box	As indicated on Control Room monitors in CPS or R/hr (units are determined by the appropriate monitor range).

Release Information		
Input	**Control**	**Options/Entry**
Vent Flow Rate	Text Box	Values entered in SCFM for ventilation flow rate corresponding to the release point. If actual values are not known the default values for the common release points below may be used: Main Stack Low Range.....24,000 SCFM Main Stack High Range.....4,000 SCFM Reactor Building .....200,000 SCFM Turbine Building.....210,000 SCFM Each turbine building fan (six total) default flow rate is 35,000 SCFM.
Hours After Shutdown	Text Box	Entered as h:mm for time after reactor shutdown. Use '0:00' for conditions where the reactor is not yet shutdown. Automatically updated when window is reentered from the PAR screen.

Meteorological Data		
Input	**Control**	**Options/Entry**
Met. Tower	Option Button	220' Tower 160' Tower
Wind Speed	Text Box	As indicated on Control Room monitors in MPH.
Wind Direction	Text Box	As indicated on Control Room monitors in degrees from (valid input is 000° through 360°).
Delta T	Text Box	As indicated on Control Room monitors in °F (reported as '--N/A--' when user specifies a stability class).
Stability Class	Text Box	Automatic update based on the entered Delta T and met tower. Can be changed without a delta-T.
Set Weather	Command Button	Displays pop-up window for entry of offsite evacuation conditions (see Weather Conditions Table).
Fumigation	Check Box	Not visible unless appropriate conditions are met. Allows the selection of fumigation X/Qs for an elevated release. Necessary conditions are as follows: • The stability class is E, F, or G. • The date is 4/1 to 9/30. • The time is 8 AM to 6 PM. • Wind direction is between 000° and 120° or 270° and 360°. • The wind speed at the top elevation is between 2 and 10 mph. User is prompted to determine whether the 33' air temperature is greater than the condenser inlet temperature.
Max. ETE	Inf. Box	Information only. Maximum evacuation time based on wind direction and weather conditions.
Release Duration	Text Box	Automatic update based on maximum evacuation time estimate. Can be changed by user.

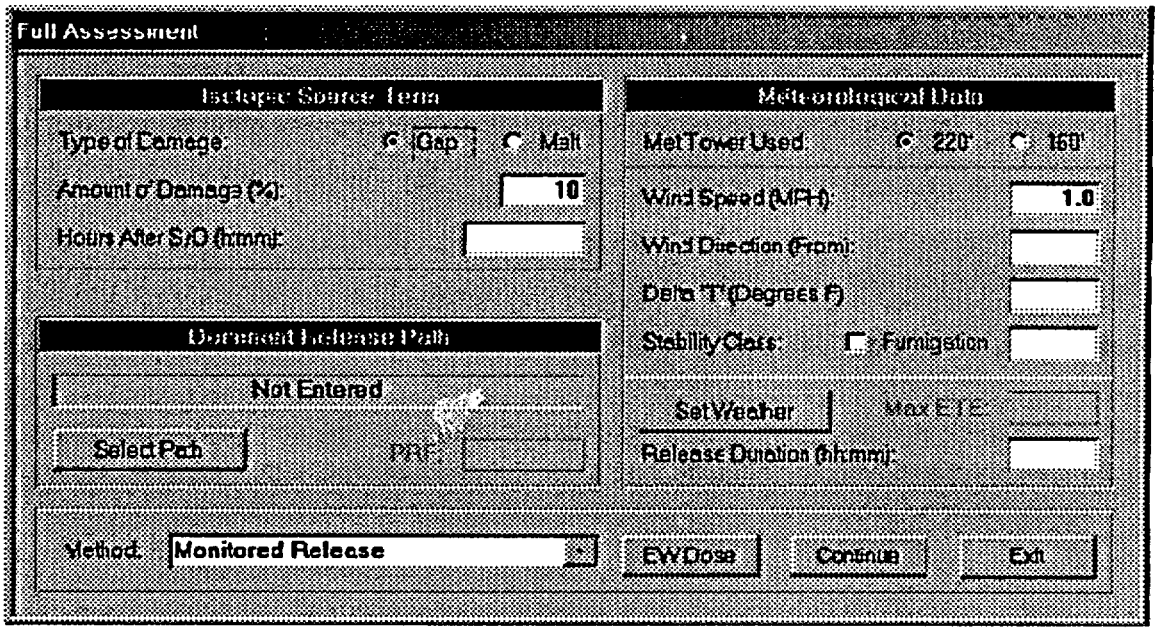
DAPAR uses the maximum Evacuation Time Estimates (ETEs) as the basis for the initial release duration. This method assumes that all of the affected (downwind) subareas out to 10 miles will be involved in the offsite protective action. By selecting the 'Set Weather' command button, the Weather Conditions window will display the applicable category options. Note that all options may not be available based on the selection within other categories (for example, if time of year is summer, snow will not be available as a condition). A selection within each category must be made, when more than one option is available, before the 'OK' command button is made visible to exit the window. ETEs are determined from a matrix by selecting the applicable conditions from the Weather Conditions window as follows:

Weather Conditions		
Input	**Control**	**Options/Entry**
Time of Year	Option Button	Summer (Memorial Day through Labor Day) Off Season
Time of Week	Option Button	Weekend Midweek
Time of Day	Option Button	Evening (N/A for Summer and Off Season Weekend) Midday (N/A for Summer and Off Season Weekend) All Day
Conditions	Option Button	Good Rain Snow (N/A for Summer)
OK	Command Button	Not visible unless each category has a selected item. Accepts the selected inputs and returns to the applicable assessment window

Command Bar		
Input	**Control**	**Options/Entry**
PARs	Command Button	Initially disabled. Enabled after the necessary base information is entered allowing the user to continue on to the PAR window (see PARs).
Quit	Command Button	The button may be used at any time to exit the application and return to Windows.

5.4 Full Assessment

Choosing the full assessment option directs the program to a baseline data entry window. The window is divided into three input areas; isotopic source term, dominant release path, and meteorological data.



Dominant release path determines the process reduction factors which are applied to all non-noble gas isotopes. It is allowable to choose a release path which does not relate to the specific accident in order to alter the process reduction factor. Isotopic source term establishes the source available for release from the core based on damage type, amount of damage, and time after shutdown. The source term is based on an end of life core, at 3.5% fuel enrichment, following operation at full power. This assumption will conservatively overestimate the long lived isotopes for power operations and enrichments less than those described above. Damage defaults of 10% Gap are initially entered upon startup but can be changed to reflect PASS or better damage estimates as they become available. Meteorological data provides the conditions under which offsite dose calculations are performed and evacuation time estimations are determined. Assessment options available for dose assessment include monitored release, containment leakage/failure, field team analysis, and release point analysis.

The baseline information inputs are as follows:

Dominant Release Path		
Input	**Control**	**Options/Entry**
Path Description	Text Box	Information only. Describes the currently selected release path.

Dominant Release Path		
Input	**Control**	**Options/Entry**
Select Path	Command Button	Transfer to the Release Path Window for selection of dominant release path (see Release Path Window).
PRF	Text Box	Information only. Gives the process reduction factor applied to all non-noble gas isotopes at the point of release.

The predominant release path is determined as follows:

Release Path and Process Reduction Inputs:		
Input	**Control**	**Options/Entry**
Path A-M	Option Button	Selects and highlights the dominant release path. Once selected, additional windows may prompt for process conditions.
Accept Path	Command Button	Not visible before path is chosen. Transfer to Full Assessment data entry window following selection of a release path.
Dry Well Spray	Option Button	Containment Spray Off (default) Containment Spray On
Dry Well Hold-Up	Option Button	< 1 Hour (default) 2-12 Hours 24 Hours
Torus Suppression	Option Button	Sub cooled (default) Saturated Bypassed
Torus Hold-Up	Option Button	< 1 Hour (default) 2-12 Hours 24 Hours
Reactor Bldg. Hold-Up	Option Button	< 1 Hour (default) 2-12 Hours 24 Hours
SBGT Filter Efficiency	Text Box	99.0% (default)

Isotopic Source Term		
Input	**Control**	**Options/Entry**
Damage Type	Option Button	Gap (default) Melt
Damage Amount	Text Box	10% (default)
Hours After Shutdown	Text Box	Entered as h:mm for time after reactor shutdown. Use '0:00' for conditions where the reactor is not yet shutdown. Automatically updated when window is reentered from any assessment method screen.

DAPAR uses an illustrated flow diagram to display the source term release pathway from the RCS to the environment. The path selected will determine the reduction factor applied to non-noble gases released to the environment. Depending on the path selected by the user, a pop-up window may be displayed to allow appropriate hold-up times and/or conditions (such as filter efficiency) to be entered.

Command Bar		
Input	**Control**	**Options/Entry**
Method	List Box	Monitored Release (default) Containment Leakage/Failure Field Team Analysis Release Point Analysis
Continue	Command Button	Initially disabled. Enabled after the necessary base data is entered allowing the user to continue on to the window for the selected method.
Exit	Command Button	The button may be used at any time to exit the application and return to Windows.

5.5 Assessment Methods

Four assessment methods are available from within the full assessment option; monitored release, containment leakage/failure, field team analysis, release point sample analysis. Each of the assessment method screens is divided into several sections: data entry, protective actions, downwind dose estimates, and command options. Specific details on data entry for each method are described in the respective sections of this procedure.

Protective action distances are presented for TEDE (whole body) and CDE thyroid dose exposure estimates which exceed the EPA-400 Protective Action Guides. The maximum distance at which the PAGs are exceeded are displayed in red for:

TEDE (Whole Body) ..... ≥ 1 rem

CDE Thyroid ..... ≥ 5 rem

The colors are only presented to represent the magnitude of the projected doses. Protective actions for highlighted distances should always be to evacuate (shelter is an option if evacuation is not possible).

Downwind dose rate and dose estimates are given for site boundary and each 0.5 mile increment to ten miles. For each method, except field team survey, data is presented on six columns which can be scrolled either up or down throughout the downwind distances. Information is given for external dose rate in mrem/hr, external dose, inhalation dose, deposition dose, Total (whole body) dose, and thyroid dose in rem. For the field team survey method data is presented on four columns which can be scrolled either up or down throughout the downwind distances. Information is given for centerline X/Qs, external dose rate in mR/hr, and external dose in rem.

The command options section, common to all methods, contains controls which allow movement and functions within the application. Options are as follows:

Command Bar		
Input	**Control**	**Options/Entry**
Print	Command Button	Initially disabled. Enabled after the necessary base data is entered to allow a dose assessment printout of current method screen information.
PARs	Command Button	Initially disabled. Enabled after the necessary base information is entered allowing the user to continue on to the PAR window (see PARs).
Exit	Command Button	May be used at any time to exit the current assessment method and return to the main data entry window.

5.5.1 Monitored Release

The monitored release method is based on information, actual or estimated, from the plant effluent monitors. Protective actions and downwind dose estimates will be updated for each change in input data. The release point is initially set to correspond to the elevation applicable to the release path regardless of the monitor chosen. Changing the release point will determine the X/Q values used to calculate the downwind doses (elevated or ground level), but will not alter the dominant release path chosen on the main data entry window. When switching between monitors or release points, it is necessary to reenter the dominant release path if a new process reduction factor is desired. Data entry options available in the monitored release window are as follows:

Release Information		
Input	**Control**	**Options/Entry**
Monitor	Option Button	Main Stack Reactor Building Vent Turbine Building Vent
Range	Option Button	High Low (not available for turbine building vent)
Reading	Text Box	As indicated on Control Room monitors in CPS or R/hr (units are determined by the selected monitor range).
Vent Flow Rate	Text Box	Default values in SCFM. Can be changed to user specified value if data is available.
Release Duration	Text Box	Information only. Corresponds to the release duration specified on the full assessment window.
Release Point	Option Button	Initially defaults to elevation of the applicable release path. Elevated Ground

5.5.2 Containment Leakage/Failure

The containment leakage/failure method is based on information, actual or estimated, which assumes a significant release of reactor coolant into primary containment (such as a LOCA). The amount of leakage is heavily dependent on containment pressure. Care should be taken when estimates of containment leakage are used to determine protective action recommendations. Containment penetrations and seals are not designed to withstand adverse environmental conditions for an extended period of time following a core damage accident. Under these conditions large leak rates are more appropriately considered as a failure to isolate. Controlled venting of containment can also be modeled as a failure to isolate, when the appropriate process reduction factor is utilized. A catastrophic containment failure is one that results in release of a large fraction of the fission products in the containment atmosphere in a very short period. Some examples of catastrophic failure include hydrogen detonation/burn, steam explosions or explosion induced missiles, direct containment heating, and containment overpressurization. Protective actions and downwind dose estimates will be updated for each change in input data. The release point is initially set to correspond to the elevation applicable to the release path. Changing the release point will determine the X/Q values used to calculate the downwind doses (elevated or ground level), but will not alter the dominant release path chosen on the main data entry window. When switching between release points, it is necessary to reenter the dominant release path if new a process reduction factor is desired. Data entry options available for this method are as follows:

Containment Information		
Input	**Control**	**Options/Entry**
Discharge Type	Option Button	Leakage Failure to Isolate Catastrophic Failure
% Leakage	Text Box	0.5% (default). Only affects PAR and dose data when the leakage option is selected.
Release Point	Option Button	Elevated Ground Defaults to elevation for the applicable release path.
Release Duration	Text Box	Information only. Corresponds to release duration specified on the full assessment window. • If release duration > 24 hours and the failure to isolate option is chosen, release duration will default to 24 hours. • If release duration is > 1 hour and catastrophic failure is chosen, release duration will default to 1 hour.

5.5.3 Field Team Analysis

The field team analysis method is based on radiological survey or isotopic sample information taken within the plume. Protective actions and downwind dose estimates will be updated for each change in input data. Protective action distances and the '*PAR*' command button are not available in the survey mode (ingestion and deposition components cannot be determined by surveys alone). Caution should be used when comparing external dose rates to field data. External dose rates are based on dose conversion factors in units of rem/hr applied to a projected isotopic concentration. All field team dose estimates are based on ground level X/Q values to eliminate the cross distance affect of terrain elevation changes. Isotopic concentrations can only be entered while in the sample mode; however, previously entered concentrations will be retained when switching from the sample into the survey mode. Data entry options available for this method are as follows:

Field Team Information		
Input	**Control**	**Options/Entry**
Downwind Distance	Text Box	As determined by field team location entered in miles. Distances beyond 10 miles are not accepted within this field.
Crosswind Distance	Text Box	As determined by field team location entered in miles. Distances beyond 5 miles are not accepted within this field.
Level	Text Box	As determined by field team survey results reported in mR/hr.
Survey Time	Text Box	Entered as h:mm for the time that the survey was performed.
Travel Time	Text Box	Information only. Represents the time it would take (under the given meteorological conditions) for a plant release to reach the field team location.
Release Time	Text Box	Information only. Represents the time a release left the plant corresponding to the conditions observed at the field team location at the time of survey or sample.
Field Team X/Q	Text Box	Information only. X/Q value related to the field team location.
Release Duration	Text Box	Information only. Corresponds to release duration specified on the full assessment window.
Basis	Option Button	Survey (default) Sample
Isotopic Conc	Sub form	Scrolling list of 66 isotopes. Values entered in µCi/cc. Disabled when '*Survey*' option button is selected. Values are retained when switching between modes.

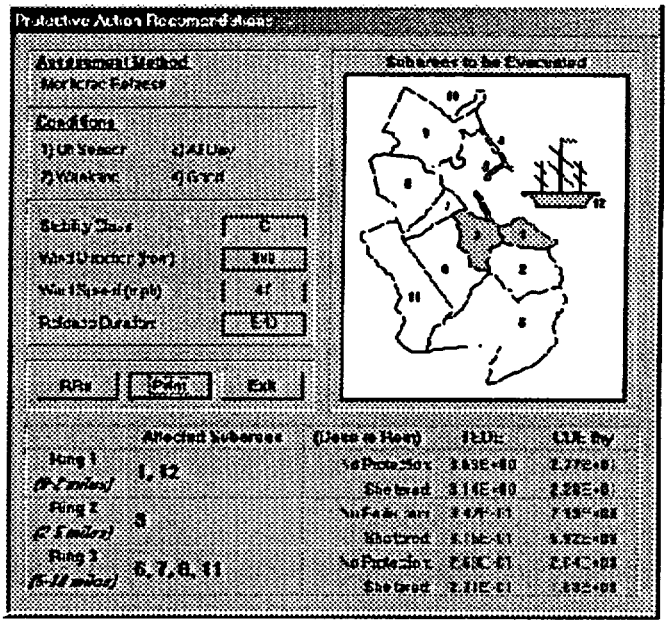
5.5.4 Release Point Analysis

The release point analysis method is based on isotopic sample information taken from any release point to the environment. Protective actions and downwind dose estimates will be updated for each change in input data. The release point is initially set to correspond to the elevation applicable to the dominant release path. Changing the release point will determine the X/Q values used to calculate the downwind doses (elevated or ground level). The process reduction factor is not applied to release point isotopic concentrations. Data entry options available in the release point analysis window are as follows:

Field Team Information		
Input	**Control**	**Options/Entry**
Isotopic Conc	Sub form	Scrolling list of 66 isotopes. Values entered in µCi/cc.
Vent Flow Rate	Text Box	Values entered in SCFM for ventilation flow rate corresponding to the release point. If actual values are not known the default values for the common release points below may be used: Main Stack Low Range.....24,000 SCFM Main Stack High Range.....4,000 SCFM Reactor Building .....200,000 SCFM Turbine Building.....210,000 SCFM • Each turbine building fan (six total) default flow rate is 35,000 SCFM. • For release point samples taken at other locations, the release rate must be estimated from information specific to the sample point.
Release Point	Option Button	Elevated Ground Defaults to elevation of the dominant release path.

5.6 Protective Action Recommendations

The Protective Action Recommendation window evaluates the downwind dose estimate in relation to the protective action guides. The window is divided into three primary sections; key information, subarea illustration, and dose projections. The key information section shows the assessment method utilized to generate the PARs, the current offsite evacuation conditions, meteorological data, and the release duration. The geographic evacuation illustration outlines the subareas within the ten mile EPZ. Subareas in which the projected dose exceeds the protective action guides are shaded to indicate an evacuation recommendation. The dose projections provide downwind radiological condition information in tabular format. Affected subareas and projected doses are given for the three rings surrounding the site. Dose information is color coded to indicate the projected exposure for unprotected and sheltered conditions. A value highlighted in red indicates a TEDE (whole body) dose equal to or greater than 1 rem or a CDE thyroid dose equal to or greater than 5 rem. Green values indicate TEDE (whole body) doses less than 1 rem and CDE thyroid doses less than 5 rem. A command options section is available to allow movement and provide functions within the PAR window. Command bar options are as follows:



Protective Action Recommendations		
Input	**Control**	**Options/Entry**
RRs (Rel Rates)	Command Button	Displays a pop-up window showing the projected release rates for noble gasses, halogens and particulates.
Print	Command Button	Prints a hard copy of the protective action recommendations.
Exit	Command Button	Used to exit the PAR window and return to the previous assessment method window.

The release rate information is necessary for compatibility with the NRC dose code RASCAL. Site team personnel and national or regional response centers do not maintain monitor conversion capabilities for each utility and therefore must rely on a common process to conduct independent dose assessment calculations.

5.7 Emergency Worker Dose Projection

Emergency worker dose projection allows for the quick evaluation of indicated to actual and thyroid dose rates, the comparison of projected doses for a given exposure period, and the estimation of the indicated dose and exposure period for targeted actual or thyroid doses. Projections are based on source term estimation decay time, damage type, and release path inputs. Projected doses are time integrated to account for decay during the exposure period. Projections should only be used for dose and exposure period evaluation prior to obtaining field sample analysis results. Data entry options and information available in the emergency worker dose projection window are as follows:

Emergency Worker Dose Information		
Input	**Control**	**Options/Entry**
Hours After Shutdown	Text Box	Entered as h:mm for time after reactor shutdown when exposure period begins. Enter '0:00' for conditions where the reactor is not yet shutdown.
Indicated to Actual	Text Box	Information only. Describes the instantaneous indicated to actual projected dose rate ratio.
Indicated to Thyroid	Text Box	Information only. Describes the instantaneous indicated to thyroid projected dose rate ratio.
Indicated Dose Rate	Text Box	As determined by projection or field team survey results at the exposure location reported in mR/hr.
RPF	Text Box	Respiratory protection factor. Can be used to account for inhalation source reduction by filtration/exclusion.
Exposure Period	Text Box	Entered as h:mm for the time duration of the projected exposure period.
Indicated Dose	Text Box	Information only. Represents the indicated dose for the given exposure duration.
Actual Dose	Text Box	Information only. Represents the actual dose for the given exposure duration.
Thyroid Dose	Text Box	Information only. Represents the thyroid dose for the given exposure duration.
Actual Dose	Text Box	Entered as a targeted actual dose to obtain indicated dose and exposure duration information.
Thyroid Dose	Text Box	Entered as a targeted thyroid dose to obtain indicated dose and exposure duration information.
Print	Command Button	Prints a hard copy of the emergency worker dose projection.
Exit	Command Button	Used to exit the emergency worker dose projection window and return to the main data entry window.

5.8 Offsite Dose Calculation, Back-up Method

Offsite dose rates may be estimated using data from effluent monitors. Release and meteorological data may be obtained from the Control Room via the Rad Data Communication Line. Attachment 1, "Offsite Dose and PAR Worksheet", should be used to calculate the dose rates. The step numbers in the following sections correspond to the item numbers on the worksheet.

Part A, Radiological Release Data

1. Select the release point. The release point is determined by whichever effluent radiation monitor is reading above normal. If more than one monitor is reading above normal, perform additional calculations on separate worksheets for all affected release points.

NOTE

Normally, the Reactor Building Vent and Main Stack monitors read less than 1000 cps.

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2. Record the release point radiation monitor reading and check the appropriate units (R/hr or cps). If the low range monitor is offscale high and the high range monitor is offscale low, record monitor reading of 0.1 R/hr.

3. Record the time elapsed since reactor shutdown in hours. Shutdown refers to the time when the reactor was made sub-critical and therefore stopped generating fission products.

4. Locate the appropriate monitor table (A.1 through 5). Determine the time after shutdown (TAS) column which represents the recorded time after shutdown in block A.3 (do not interpolate).

NOTE

Monitor reading to release rate is a linear relationship. Identify the row in which the monitor reading is closest to the recorded monitor reading in block A.2 (do not interpolate). For example, a reading of 200 R/hr would correspond to the 2 R/hr row on the table. Record the group release rates for noble gases, halogens, particulates, and total, accounting for any order of magnitude adjustments.

NOTE

Example: Main stack high range reading 200 R/hr at 10 hours after shutdown. Find the 10 hour column and the 2 R/hr row.

Noble Gas: 8.14E+01 x 100 = 8.14E+03 Ci/sec
Halogen: 2.32E-01 x 100 = 2.32E+01 Ci/sec
Particulate: 5.55E-02 x 100 = 5.55E+00 Ci/sec
Total: 8.14E+01 x 100 = 8.14E+03 Ci/sec

Table A.1: Main Stack High Range

Noble Gas Release Rate (Ci/sec) at TAS

R/hr	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	7.45E+00	4.07E+01	1.21E+03	5.22E+01
2	1.49E+01	8.14E+01	2.41E+03	1.04E+02
3	2.23E+01	1.22E+02	3.62E+03	1.57E+02
4	2.98E+01	1.63E+02	4.82E+03	2.09E+02
5	3.72E+01	2.03E+02	6.03E+03	2.61E+02
6	4.47E+01	2.44E+02	7.23E+03	3.13E+02
7	5.21E+01	2.85E+02	8.44E+03	3.65E+02
8	5.96E+01	3.25E+02	9.65E+03	4.18E+02
9	6.70E+01	3.66E+02	1.09E+04	4.70E+02

Halogen Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
2.74E-02	1.16E-01	1.69E+00	1.50E-01
5.49E-02	2.32E-01	3.37E+00	3.00E-01
8.23E-02	3.48E-01	5.06E+00	4.49E-01
1.10E-01	4.64E-01	6.74E+00	5.99E-01
1.37E-01	5.80E-01	8.43E+00	7.49E-01
1.65E-01	6.96E-01	1.01E+01	8.99E-01
1.92E-01	8.12E-01	1.18E+01	1.05E+00
2.20E-01	9.28E-01	1.35E+01	1.20E+00
2.47E-01	1.04E+00	1.52E+01	1.35E+00

Particulate Release Rate (Ci/sec) at TAS

R/hr	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	1.11E-02	2.78E-02	1.62E+00	3.51E+00
2	2.23E-02	5.55E-02	3.24E+00	7.01E+00
3	3.34E-02	8.33E-02	4.86E+00	1.05E+01
4	4.45E-02	1.11E-01	6.48E+00	1.40E+01
5	5.57E-02	1.39E-01	8.10E+00	1.75E+01
6	6.68E-02	1.67E-01	9.72E+00	2.10E+01
7	7.79E-02	1.94E-01	1.13E+01	2.45E+01
8	8.91E-02	2.22E-01	1.30E+01	2.81E+01
9	1.00E-01	2.50E-01	1.46E+01	3.16E+01

Total Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
7.48E+00	4.08E+01	1.21E+03	5.59E+01
1.50E+01	8.17E+01	2.42E+03	1.12E+02
2.25E+01	1.22E+02	3.63E+03	1.68E+02
2.99E+01	1.63E+02	4.84E+03	2.23E+02
3.74E+01	2.04E+02	6.04E+03	2.79E+02
4.49E+01	2.45E+02	7.25E+03	3.35E+02
5.24E+01	2.86E+02	8.46E+03	3.91E+02
5.99E+01	3.27E+02	9.67E+03	4.47E+02
6.74E+01	3.67E+02	1.09E+04	5.03E+02

Table A.2: Reactor Building Vent High Range

Noble Gas Release Rate (Ci/sec) at TAS

R/hr	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	1.12E+01	3.60E+01	7.58E+01	3.65E+00
2	2.24E+01	7.20E+01	1.52E+02	7.31E+00
3	3.36E+01	1.08E+02	2.27E+02	1.10E+01
4	4.48E+01	1.44E+02	3.03E+02	1.46E+01
5	5.60E+01	1.80E+02	3.79E+02	1.83E+01
6	6.72E+01	2.16E+02	4.55E+02	2.19E+01
7	7.84E+01	2.52E+02	5.31E+02	2.56E+01
8	8.96E+01	2.88E+02	6.07E+02	2.92E+01
9	1.01E+02	3.24E+02	6.82E+02	3.29E+01

Halogen Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1.65E+00	4.11E+00	4.24E+00	4.19E-01
3.30E+00	8.21E+00	8.48E+00	8.39E-01
4.96E+00	1.23E+01	1.27E+01	1.26E+00
6.61E+00	1.64E+01	1.70E+01	1.68E+00
8.26E+00	2.05E+01	2.12E+01	2.10E+00
9.91E+00	2.46E+01	2.54E+01	2.52E+00
1.16E+01	2.87E+01	2.97E+01	2.94E+00
1.32E+01	3.29E+01	3.39E+01	3.35E+00
1.49E+01	3.70E+01	3.82E+01	3.77E+00

Particulate Release Rate (Ci/sec) at TAS

R/hr	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	6.70E-01	9.83E-01	4.07E+00	9.82E+00
2	1.34E+00	1.97E+00	8.15E+00	1.96E+01
3	2.01E+00	2.95E+00	1.22E+01	2.94E+01
4	2.68E+00	3.93E+00	1.63E+01	3.93E+01
5	3.35E+00	4.92E+00	2.04E+01	4.91E+01
6	4.02E+00	5.90E+00	2.44E+01	5.89E+01
7	4.69E+00	6.88E+00	2.85E+01	6.87E+01
8	5.36E+00	7.87E+00	3.26E+01	7.85E+01
9	6.03E+00	8.85E+00	3.67E+01	8.83E+01

Total Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1.35E+01	4.11E+01	8.41E+01	1.39E+01
2.70E+01	8.22E+01	1.68E+02	2.78E+01
4.06E+01	1.23E+02	2.52E+02	4.17E+01
5.41E+01	1.64E+02	3.37E+02	5.56E+01
6.76E+01	2.06E+02	4.21E+02	6.94E+01
8.11E+01	2.47E+02	5.05E+02	8.33E+01
9.47E+01	2.88E+02	5.89E+02	9.72E+01
1.08E+02	3.29E+02	6.73E+02	1.11E+02
1.22E+02	3.70E+02	7.57E+02	1.25E+02

Table A.3: Turbine Building Vent High Range

Noble Gas Release Rate (Ci/sec) at TAS

R/hr	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	2.20E+00	6.85E+00	1.39E+01	7.20E-01
2	4.39E+00	1.37E+01	2.78E+01	1.44E+00
3	6.59E+00	2.06E+01	4.16E+01	2.16E+00
4	8.78E+00	2.74E+01	5.55E+01	2.88E+00
5	1.10E+01	3.43E+01	6.94E+01	3.60E+00
6	1.32E+01	4.11E+01	8.33E+01	4.32E+00
7	1.54E+01	4.80E+01	9.72E+01	5.04E+00
8	1.76E+01	5.48E+01	1.11E+02	5.76E+00
9	1.98E+01	6.17E+01	1.25E+02	6.48E+00

Halogen Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
3.24E-01	7.81E-01	7.76E-01	8.27E-02
6.48E-01	1.56E+00	1.55E+00	1.65E-01
9.71E-01	2.34E+00	2.33E+00	2.48E-01
1.30E+00	3.13E+00	3.11E+00	3.31E-01
1.62E+00	3.91E+00	3.88E+00	4.13E-01
1.94E+00	4.69E+00	4.66E+00	4.96E-01
2.27E+00	5.47E+00	5.44E+00	5.79E-01
2.59E+00	6.25E+00	6.21E+00	6.61E-01
2.91E+00	7.03E+00	6.99E+00	7.44E-01

Particulate Release Rate (Ci/sec) at TAS

R/hr	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	1.31E-01	1.87E-01	7.46E-01	1.94E+00
2	2.63E-01	3.74E-01	1.49E+00	3.87E+00
3	3.94E-01	5.61E-01	2.24E+00	5.81E+00
4	5.25E-01	7.48E-01	2.98E+00	7.74E+00
5	6.56E-01	9.36E-01	3.73E+00	9.68E+00
6	7.88E-01	1.12E+00	4.48E+00	1.16E+01
7	9.19E-01	1.31E+00	5.22E+00	1.35E+01
8	1.05E+00	1.50E+00	5.97E+00	1.55E+01
9	1.18E+00	1.68E+00	6.71E+00	1.74E+01

Total Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
2.65E+00	7.82E+00	1.54E+01	2.74E+00
5.30E+00	1.56E+01	3.08E+01	5.48E+00
7.95E+00	2.35E+01	4.62E+01	8.22E+00
1.06E+01	3.13E+01	6.16E+01	1.10E+01
1.33E+01	3.91E+01	7.70E+01	1.37E+01
1.59E+01	4.69E+01	9.24E+01	1.64E+01
1.86E+01	5.48E+01	1.08E+02	1.92E+01
2.12E+01	6.26E+01	1.23E+02	2.19E+01
2.39E+01	7.04E+01	1.39E+02	2.46E+01

Table A.4: Main Stack Low Range

Noble Gas Release Rate (Ci/sec) at TAS

CPS	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	2.88E-05	4.20E-05	5.61E-05	1.30E-04
2	5.77E-05	8.39E-05	1.12E-04	2.61E-04
3	8.65E-05	1.26E-04	1.68E-04	3.91E-04
4	1.15E-04	1.68E-04	2.24E-04	5.22E-04
5	1.44E-04	2.10E-04	2.80E-04	6.52E-04
6	1.73E-04	2.52E-04	3.36E-04	7.83E-04
7	2.02E-04	2.94E-04	3.93E-04	9.13E-04
8	2.31E-04	3.36E-04	4.49E-04	1.04E-03
9	2.60E-04	3.78E-04	5.05E-04	1.17E-03

Halogen Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1.06E-07	1.20E-07	7.84E-08	3.74E-07
2.13E-07	2.39E-07	1.57E-07	7.49E-07
3.19E-07	3.59E-07	2.35E-07	1.12E-06
4.25E-07	4.79E-07	3.14E-07	1.50E-06
5.32E-07	5.98E-07	3.92E-07	1.87E-06
6.38E-07	7.18E-07	4.70E-07	2.25E-06
7.44E-07	8.38E-07	5.49E-07	2.62E-06
8.51E-07	9.57E-07	6.27E-07	3.00E-06
9.57E-07	1.08E-06	7.06E-07	3.37E-06

Particulate Release Rate (Ci/sec) at TAS

CPS	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	4.31E-08	2.86E-08	7.53E-08	8.77E-06
2	8.62E-08	5.73E-08	1.51E-07	1.75E-05
3	1.29E-07	8.59E-08	2.26E-07	2.63E-05
4	1.72E-07	1.15E-07	3.01E-07	3.51E-05
5	2.16E-07	1.43E-07	3.77E-07	4.38E-05
6	2.59E-07	1.72E-07	4.52E-07	5.26E-05
7	3.02E-07	2.01E-07	5.27E-07	6.14E-05
8	3.45E-07	2.29E-07	6.03E-07	7.01E-05
9	3.88E-07	2.58E-07	6.78E-07	7.89E-05

Total Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
2.90E-05	4.21E-05	5.62E-05	1.40E-04
5.80E-05	8.42E-05	1.12E-04	2.79E-04
8.70E-05	1.26E-04	1.69E-04	4.19E-04
1.16E-04	1.68E-04	2.25E-04	5.58E-04
1.45E-04	2.11E-04	2.81E-04	6.98E-04
1.74E-04	2.53E-04	3.37E-04	8.38E-04
2.03E-04	2.95E-04	3.94E-04	9.77E-04
2.32E-04	3.37E-04	4.50E-04	1.12E-03
2.61E-04	3.79E-04	5.06E-04	1.26E-03

Table A.5: Reactor Building Vent Low Range

Noble Gas Release Rate (Ci/sec) at TAS

CPS	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	1.79E-04	2.60E-04	3.48E-04	8.10E-04
2	3.58E-04	5.21E-04	6.96E-04	1.62E-03
3	5.37E-04	7.81E-04	1.04E-03	2.43E-03
4	7.16E-04	1.04E-03	1.39E-03	3.24E-03
5	8.95E-04	1.30E-03	1.74E-03	4.05E-03
6	1.07E-03	1.56E-03	2.09E-03	4.86E-03
7	1.25E-03	1.82E-03	2.44E-03	5.67E-03
8	1.43E-03	2.08E-03	2.78E-03	6.48E-03
9	1.61E-03	2.34E-03	3.13E-03	7.29E-03

Halogen Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
2.64E-05	2.97E-05	1.95E-05	9.29E-05
5.28E-05	5.94E-05	3.89E-05	1.86E-04
7.92E-05	8.91E-05	5.84E-05	2.79E-04
1.06E-04	1.19E-04	7.79E-05	3.72E-04
1.32E-04	1.49E-04	9.73E-05	4.65E-04
1.58E-04	1.78E-04	1.17E-04	5.58E-04
1.85E-04	2.08E-04	1.36E-04	6.51E-04
2.11E-04	2.38E-04	1.56E-04	7.44E-04
2.38E-04	2.67E-04	1.75E-04	8.36E-04

Particulate Release Rate (Ci/sec) at TAS

CPS	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
1	1.07E-05	7.11E-06	1.87E-05	2.18E-03
2	2.14E-05	1.42E-05	3.74E-05	4.35E-03
3	3.21E-05	2.13E-05	5.61E-05	6.53E-03
4	4.28E-05	2.84E-05	7.48E-05	8.70E-03
5	5.35E-05	3.56E-05	9.35E-05	1.09E-02
6	6.42E-05	4.27E-05	1.12E-04	1.31E-02
7	7.49E-05	4.98E-05	1.31E-04	1.52E-02
8	8.56E-05	5.69E-05	1.50E-04	1.74E-02
9	9.64E-05	6.40E-05	1.68E-04	1.96E-02

Total Release Rate (Ci/sec) at TAS

T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
2.16E-04	2.97E-04	3.86E-04	3.08E-03
4.32E-04	5.95E-04	7.72E-04	6.16E-03
6.48E-04	8.92E-04	1.16E-03	9.24E-03
8.64E-04	1.19E-03	1.54E-03	1.23E-02
1.08E-03	1.49E-03	1.93E-03	1.54E-02
1.30E-03	1.78E-03	2.32E-03	1.85E-02
1.51E-03	2.08E-03	2.70E-03	2.16E-02
1.73E-03	2.38E-03	3.09E-03	2.46E-02
1.95E-03	2.68E-03	3.48E-03	2.77E-02

Part B, Atmospheric Dispersion Factor

NOTE

Meteorological data from the 220' tower are available from the EOF and the Control Room. Data from the 160' tower are only available in the EOF and at the base of the 160' tower. If meteorological data from the 220' tower are unavailable, use the data from the 160' tower. If 160' tower data are necessary in the Control Room, dispatch a monitoring team to the tower to obtain readings and radio the results back.

1. Record the wind direction, in degrees, for the 220' (or the 160' tower if necessary) and 33' met tower elevations. This is read directly from the strip charts and represents the direction the wind is coming from, not the downwind affected direction.

2. Record the wind speed, in MPH, for the 220' (or the 160' tower if necessary) and 33' met tower elevations.

3. Record the ΔT (temperature change with height, in °F). ΔT from either tower is the difference in temperature between the uppermost sensor and the 33' sensor (Higher – Lower).

4. Determine and record the atmospheric stability class from table B.1 below:

Table B.1

ΔT (F) 220' Tower	Stability Class	ΔT (F) 160' Tower
≤-1.9	A	≤-1.3
>-1.9 and ≤-1.7	B	>-1.3 and ≤-1.2
>-1.7 and ≤-1.5	C	>-1.2 and ≤-1.0
>-1.5 and ≤-0.5	D	>-1.0 and ≤-0.3
>-0.5 and ≤+1.5	E	>-0.3 and ≤+1.0
>+1.5 and ≤+4.1	F	>+1.0 and ≤+2.8
> +4.1	G	> +2.8

5. Determine and record the affected downwind subareas from table B.2 using the appropriate wind direction reading (wind direction *FROM*). If the release is from the main stack, use the 220' (or the 160') elevation wind direction. If the release is not from the main stack, use the 33' wind direction reading.

Table B.2

Wind Direction	Inner	Middle	Outer
006° to 019°	1	2	5
020° to 021°	1	2, 3	5, 6
022° to 056°	1	2, 3	5, 6, 11
057° to 063°	1	2, 3	6, 11
064° to 066°	1, 12	2, 3	6, 11
067° to 069°	1, 12	2, 3	6, 7, 11
070° to 103°	1, 12	3	6, 7, 8, 11
104° to 109°	1, 12	3	6, 7, 8, 9, 11
110° to 115°	1, 12	3	6, 7, 8, 9
116° to 122°	1, 12	3	7, 8, 9
123° to 129°	1, 12	3, 4	7, 8, 9
130° to 132°	1, 12	3, 4	7, 8, 9, 10
133° to 140°	1, 12	3, 4	8, 9, 10
141° to 175°	1, 12	4	9, 10
176° to 179°	1, 12	4	10
180° to 183°	1, 12	4	N/A
184° to 305°	1, 12	N/A	N/A
306° to 318°	1, 12	2	N/A
319° to 005°	1, 12	2	5

6. Determine the uncorrected X/Q values for the three rings. If the release is from the main stack, record the X/Q values from Table B.3, otherwise use Table B.4.

Table B.3: Main Stack

	Ring	A	B	C	D	E	F	G
350° to 011°	Inner	3.80E-05	3.12E-05	5.90E-05	5.81E-05	8.96E-05	1.32E-04	1.58E-04
	Middle	4.57E-07	1.95E-06	1.09E-05	2.53E-05	5.35E-05	1.20E-04	2.51E-04
	Outer	2.11E-07	2.54E-07	3.23E-06	7.81E-06	1.69E-05	3.65E-05	8.76E-05
012° to 034°	Inner	3.84E-05	3.12E-05	5.90E-05	6.87E-05	1.26E-04	2.01E-04	5.03E-04
	Middle	4.57E-07	1.95E-06	1.07E-05	2.56E-05	5.51E-05	1.32E-04	3.31E-04
	Outer	2.11E-07	2.54E-07	3.21E-06	7.70E-06	1.69E-05	3.74E-05	9.34E-05
035° to 056°	Inner	3.97E-05	3.06E-05	5.08E-05	4.55E-05	5.46E-05	3.78E-05	4.85E-06
	Middle	4.57E-07	1.96E-06	1.15E-05	2.19E-05	3.82E-05	3.91E-05	2.30E-05
	Outer	2.11E-07	2.54E-07	3.30E-06	8.03E-06	1.48E-05	2.25E-05	2.29E-05
057° to 079°	Inner	3.97E-05	3.04E-05	4.81E-05	4.23E-05	4.98E-05	3.78E-05	4.85E-06
	Middle	4.57E-07	1.96E-06	1.15E-05	2.19E-05	3.82E-05	3.91E-05	2.30E-05
	Outer	2.11E-07	2.54E-07	3.30E-06	8.03E-06	1.48E-05	2.25E-05	2.29E-05
080° to 101°	Inner	3.88E-05	3.02E-05	4.53E-05	3.02E-05	2.87E-05	6.65E-06	3.88E-08
	Middle	4.58E-07	1.97E-06	1.18E-05	1.88E-05	2.61E-05	1.46E-05	4.63E-06
	Outer	2.11E-07	2.54E-07	3.33E-06	8.05E-06	1.30E-05	1.90E-05	3.63E-05
102° to 124°	Inner	3.84E-05	2.96E-05	3.75E-05	2.24E-05	2.03E-05	2.21E-06	1.83E-09
	Middle	4.58E-07	1.97E-06	1.19E-05	1.72E-05	2.05E-05	9.63E-06	1.68E-06
	Outer	2.11E-07	2.54E-07	3.35E-06	8.04E-06	1.21E-05	9.76E-06	7.24E-06
125° to 146°	Inner	3.80E-05	2.81E-05	2.43E-05	1.31E-05	6.46E-06	5.57E-08	6.61E-14
	Middle	4.58E-07	1.97E-06	1.21E-05	1.37E-05	1.14E-05	2.88E-06	5.63E-08
	Outer	2.11E-07	2.55E-07	3.37E-06	8.01E-06	9.98E-06	9.02E-06	5.10E-06
147° to 169°	Inner	3.72E-05	2.77E-05	2.42E-05	1.15E-05	4.34E-06	1.41E-08	1.45E-15
	Middle	4.58E-07	1.97E-06	1.21E-05	1.29E-05	1.03E-05	1.89E-06	1.58E-08
	Outer	2.11E-07	2.55E-07	3.37E-06	8.00E-06	9.54E-06	4.05E-06	7.01E-07
170° to 281°	Inner	3.72E-05	2.77E-05	2.42E-05	1.15E-05	4.34E-06	1.41E-08	1.45E-15
	Middle	4.58E-07	1.97E-06	1.21E-05	1.29E-05	1.03E-05	1.89E-06	1.58E-08
	Outer	2.11E-07	2.55E-07	3.37E-06	8.00E-06	9.54E-06	3.45E-06	3.62E-07
282° to 304°	Inner	3.72E-05	2.77E-05	2.43E-05	1.24E-05	5.51E-06	3.26E-08	1.49E-14
	Middle	4.58E-07	1.97E-06	1.21E-05	1.33E-05	1.09E-05	2.43E-06	3.43E-08
	Outer	2.11E-07	2.55E-07	3.37E-06	8.01E-06	9.79E-06	3.79E-06	5.40E-07
305° to 326°	Inner	3.72E-05	2.77E-05	2.43E-05	1.31E-05	6.46E-06	5.57E-08	6.61E-14
	Middle	4.58E-07	1.97E-06	1.21E-05	1.37E-05	1.14E-05	2.88E-06	5.63E-08
	Outer	2.11E-07	2.55E-07	3.37E-06	8.01E-06	9.98E-06	4.05E-06	7.01E-07
327° to 349°	Inner	3.74E-05	2.93E-05	3.50E-05	4.23E-05	4.71E-05	2.27E-05	1.17E-06
	Middle	4.58E-07	1.96E-06	1.16E-05	2.09E-05	3.41E-05	2.72E-05	1.44E-05
	Outer	2.11E-07	2.54E-07	3.32E-06	8.04E-06	1.42E-05	1.93E-05	1.49E-05

Table B.4: Reactor and Turbine Building

Ring	A	B	C	D	E	F	G
Inner	9.70E-05	2.57E-04	5.87E-04	1.59E-03	3.02E-03	6.77E-03	1.69E-02
Middle	4.58E-07	1.99E-06	1.53E-05	5.11E-05	1.10E-04	2.65E-04	6.62E-04
Outer	2.11E-07	2.55E-07	3.59E-06	1.39E-05	3.37E-05	7.47E-05	1.87E-04

7. Divide the uncorrected X/Q values in B.6 by the appropriate wind speed and record the results. If the release is from the main stack, use the 220' (or the 160') elevation wind speed reading. If the release is not from the main stack, use the 33' wind speed reading.
8. Multiply the corrected X/Q values by the ***total release rate*** value from Part A.4 and record the results as projected downwind concentration.

Part C, Dose Projection Calculation

1. Determine and record the whole body and thyroid dose conversion factors for the appropriate time after shutdown from table B.5 below:

Table B.5

Time After Shutdown

Dose Conversion Factors (R/HR/μCi/cc)	T>0 T<3.2hrs	T≥3.2hrs T<31.6hrs	T≥31.6hrs T<316hrs	T≥316hrs T≤1000hrs
Main Stack Whole Body	3.69E2	1.73E2	1.49E2	3.29E3
Main Stack Thyroid	9.68E2	1.42E3	1.67E3	3.49E3
Reactor & Turbine Bldg Whole Body	2.77E3	3.58E3	4.71E3	3.69E4
Reactor & Turbine Bldg Thyroid	3.22E4	5.01E4	6.03E4	3.92E4

2. Multiply the projected downwind concentrations by the dose conversion factors and record the results as projected downwind dose rate.
3. Obtain and record an expected release duration based on plant conditions from Operations personnel. If the release duration is unknown, use 8 hours as an estimate until better information becomes available.
4. Multiply the projected downwind dose rate values by the release duration and record the results as projected downwind dose.

Part D, Protective Action Recommendations

1. For each ring, compare the projected downwind dose with the protective action criteria. If either the whole body or thyroid dose exceeds the criteria, record the affected subareas from Part B.5 in the evacuation block. If both the whole body and thyroid dose is less than the criteria, record the affected subareas from Part B.5 in the no action required block.
2. Complete the signature and date blocks and inform the Offsite Radiological Supervisor (or Operations Shift Supervisor if the EOF is not yet activated) of the results.

6.0 RECORDS

Dose assessment printouts are generated as a result of this procedure.

6.1 The Protective Action Recommendation and Dose Estimation output shall be submitted to the Emergency Offsite Manager.

6.2 If the hand calculation method is used, the Offsite Dose and PAR Worksheet shall be submitted to the Emergency Offsite Manager.

7.0 ATTACHMENTS

7.1 Attachment 1, Offsite Dose and PAR Worksheet

7.1 Attachment 2, Document Cross-Reference

7.1 Attachment 3, Identification of Commitments

7.1 Attachment 1, Offsite Dose and PAR Worksheet

Part A: Release Data

1. Release Point: ☐ Main Stack ☐ Reactor Bldg. Vent ☐ Turbine Bldg. Vent
2. Radiation Monitor Reading: _____ ☐ R/Hr ☐ CPS
3. Elapsed Time Since Rx S/D: _____ Hours
4. Group Release Rates (Tables A.1-5):

Noble Gas: _____ Ci/sec Halogens: _____ Ci/sec

Particulates: _____ Ci/sec **Total: _____ Ci/sec**

Part B: Atmospheric Disp

1. Wind Direction From: _____ _____° (33')
2. Wind Speed: _____ _____ MPH (33')
3. Delta T: _____ ☐ 220' ☐ 160'
4. Stability Class: _____ (Table B.1)
5. Affected Downwind Subareas (Table B.2):

	Inner Ring	Middle Ring	Outer Ring
Subarea(s)			

6. Uncorrected X/Q (Table B.3-4):

	Inner Ring	Middle Ring	Outer Ring

7. Corrected X/Q (Part B.6 / Part B.2):

	Inner Ring	Middle Ring	Outer Ring

8. Downwind Concentrations (Part B.7 * Part A.4, Total Release Rate):

Inner Ring	Middle Ring	Outer Ring

Attachment 1, Offsite Dose and PAR Worksheet (Cont.)

Part C: Dose Projection Calculation

1. Dose Conversion Factors (Table B.5): _____ (Whole Body)

   _____ (Thyroid)

2. Downwind Dose Rates (Part B.8 * Part C.1):

rem/hr	Inner Ring	Middle Ring	Outer Ring
Whole Body			
Thyroid			

3. Release Duration: _____ Hours

4. Downwind Dose (Part C.2 *

rem		lle Ring	Outer Ring
Whole Body			
Thyroid			

Part D: Protective Action Recommendations

Criteria: Whole Body ☐ 1 rem Thyroid ☐ 5 rem

1. Subarea Actions:

	Inner Ring	Middle Ring	Outer Ring
Evacuate			
No Action Required			

2. Completed By: _____ Date: _____ Time: _____

7.2 Attachment 2, Document Cross-References

This Attachment lists those documents, other than source documents, which may be affected by changes to this procedure.

Document Number	Document Title
EP-IP-100	Emergency Classification and Notification
EP-IP-520	Recovery

7.3 Attachment 3, Identification of Commitments

This Attachment lists those external commitments (NRC commitments, QA audit findings, and INPO inspection items) implemented in this procedure.

Reference Document	Commitment	Affected Section(s)
NRC Inspection Finding 84-41-05	Provide guidance for protective action recommendations during adverse weather conditions.	Incorporated within DAPAR
PR 97.2381.02	Account for seabreeze effects	Incorporated within DAPAR