PILGRIM NUCLEAR POWER STATION

CONTROLLED DOCUMENT TRANSMITTAL NOTICE

DOCUMENT TITLE: EP-IP-300

TO: U.S.N.R.C MAIL:

CONTROLLED COPY NO.: 11 TRANSMITTAL NO.: 03-287 DATE: 7-17-03

FOR DOCUMENT CONTROL USE ONLY

/X/ 1. The attached controlled document(s) are transmitted for your use. Please insert/remove as indicated on the attached Change Instruction Notice. Please check Block 6, sign this form and return upon receipt.

/_/ 2. The controlled document(s) listed on the attached Change Instruction Notice have been retired from use. Please check Block 7, sign this form and return upon receipt.

/_/ 3. This is your _____ notice. The document(s) indicated above were transmitted to you on _____. Please check the status of your controlled copy, sign this document and return. If you do not have these documents, check Block 5 and a new copy will be issued.

/_/ 4. Your name has been removed from the Distribution List of the controlled document listed above. Please check Block 7, sign this form and return it with the document to the Document Control Supervisor.

COPY HOLDER CHECK ONE

/_/ 5. I am not currently in possession of the above documents. Please issue another set to me.

/_/ 6. I have received from the sender the material and attachments as indicated above, and I have updated my controlled manual accordingly.

/_/ 7. I am returning the documents listed above.

PLEASE SIGN AND RETURN TO: *Controlled Document Clerk*, MAIL STOP #19
NO ENVELOPE REQUIRED FOR INTERNAL COMPANY MAIL

Entergy, Controlled Document Clerk
Pilgrim Nuclear Power Station
600 Rocky Hill Road, Support Building
Plymouth, Massachusetts 02360

A045

Date _____ Signature of Holder _____ Controlled Copy No. _____

CHANGE INSTRUCTION [illegible]

Transmittal No.: 03-287 Date: 7-17-03

Please update your copy of EP-IP-300 with the attachments to this transmittal as instructed below.

REMOVE AND DISCARD	REV. NO.	INSERT	REV. NO.
TOC	80	TOC	81
EP-IP-300	4	EP-IP-300	5

RType H8.24

TABLE OF CONTENTS

RType H8.24

TABLE OF CONTENTS

PILGRIM NUCLEAR POWER STATION

Procedure No. EP-IP-300

OFFSITE RADIOLOGICAL DOSE ASSESSMENT

Stop
Think
Act
Review

REVISION LOG

REVISION 5 **Date Originated 6/03**

Pages Affected	Description
4,12,36,39,40	Add Procedure guidance (Attachment 2) for obtaining meteorological data based on release point and available meteorological tower instrumentation.
4,36,41-47	Add Procedure guidance (Attachment 3) for obtaining 15-minute averaged meteorological data from the EOF MEDAP computer.
4,15,36,48-56	Add Procedure guidance (Attachment 4) for describing the constants, equations, and methods to calculate offsite dose projections in the DAPAR computer program.
13,21	Clarify Procedure guidance for obtaining met data when using the DAPAR computer code.
14,15	Clarify DAPAR quick assessment instructions.
15-22	Rearrange DAPAR full assessment baseline instructions to correlate with computer window screen layout. This includes adding meteorological data and set evacuation screen instructions.
17	Add computer screen to show the potential release paths (A-M) that are used in the DAPAR program.
17,21	Add Procedure guidance on the process reduction factors that are used in the DAPAR program.
20	Add Procedure guidance to include specific instructions on how to model the direct Torus release pathway with the existing DAPAR computer program.
57	Update Document Cross-References Attachment.

REVISION LOG (Continued)

REVISION 4 **Date Originated 3/01**

Pages Affected	Description
All	Reformat IAW current PNPS 1.3.4-1. Revision bars are not shown for reformatting.
1	Change "Protection" to "Assessment" in title.
4,6	Update to reflect current version of DAPAR program.
4	Add EP File 1.6.4 for DAPAR version 2.1 to References.
4	Change definition of "Planning Zone(s)" to "Emergency Planning Zones" and clarify the plume and ingestion pathways descriptions.
5,30	Revise/update organization titles.
7,8	Clarify DAPAR logon instructions.
9-13,16-22	Revise computer window screens and instructions to reflect new version of DAPAR 2.1.
11	Add clarification notes for obtaining meteorological data.
32	Add "Radiological" to Part A title.

TABLE OF CONTENTS

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 2.1

2.0 REFERENCES

[1] EP-PP-01, "PNPS Emergency Plan"

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

[3] EP File 1.6.4 "DAPAR Version 2.0 Computer Application Verification, Validation and Documentation"

[4] EP File 1.6.4 "DAPAR Version 2.1 Computer Application Verification, Validation and Documentation"

[5] NRC IE Information Notice No. 83-28, "Criteria for Protective Action Recommendations for General Emergencies", May 4, 1983

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

3.0 DEFINITIONS

[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.

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

[3] Emergency Planning Zone (EPZs) - Two zones that are established around all nuclear power stations in which predetermined protective action plans are needed.

(a) The first EPZ (plume) has an approximate radius of 10 miles for plume exposure pathway.

(b) The second EPZ (ingestion) has an approximate radius of 50 miles for food ingestion exposure pathway.

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

[5] 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.

[6] MEMA/OEP - Massachusetts Emergency Management Agency/Office of Emergency Preparedness.

[7] MDPH - Massachusetts Department of Public Health.

[8] Offsite - The area outside the Owner Controlled Area.

[9] 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.

[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 DISCUSSION

None

5.0 RESPONSIBILITIES

[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.

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

[3] The Shift Control Room Engineer is responsible for:

(a) Advising the Shift Manager on matters of offsite dose assessment and protective action recommendations.

(b) Performing all dose assessment activities prior to activation of the Emergency Operations Facility.

[4] The Offsite Radiological Supervisor is responsible for:

(a) Directing and monitoring all offsite dose assessment activities.

(b) 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.

(c) 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.

[5] The Dose Assessment Engineer is responsible for:

(a) 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.

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

(c) Performing dose projections whenever significant changes occur in meteorological, radiological, or plant conditions.

6.0 PROCEDURE

'DAPAR' Version 2.1 is a Windows 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.

6.1 APPLICATION STARTUP

[1] Verify the monitor is on. If it is not on, start the monitor.

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

[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.

[4] Verify that the keyboard is connected to the computer. If it is not, connect the keyboard to the computer.

[5] Remove any floppy disks inserted in the 'A' drive.

[6] If the computer is off, perform the following steps:

NOTE

The computer should boot-up by executing the initial diagnostic checks and then the Windows NT Ctrl+Alt+Delete to logon should appear on the monitor.

(a) Turn on the computer.

(b) Push "Ctrl+Atl+Delete" keys to display the User Logon window.

(c) Push "OK" to open the Windows NT Desktop.

NOTE

DAPAR program uses the computer internal date and time stamp for assessing program information that relates to date and time input parameters. The "Date/Time" property window can be assessed by double-clicking the time display located in the right-hand corner of the monitor or by opening the Windows Control Panel.

(d) Verify and set (if necessary) the computer internal date and time stamp with current date and time.

(e) Start DAPAR by double-clicking on DAPAR v2.1 icon.

[7] If the computer is on and DAPAR is not running, or another program is being run, perform the following steps:

(a) Exit current programs or switch to the Windows desktop window.

NOTE

DAPAR program uses the computer internal date and time stamp for assessing program information that relates to date and time input parameters. The "Date/Time" property window can be assessed by double-clicking the time display located in the right-hand corner of the monitor or by opening the Windows Control Panel.

(b) Verify and set (if necessary) the computer internal date and time stamp with current date and time.

(c) Start DAPAR by double-clicking the mouse on the DAPAR v2.1 icon.

[8] If the program is still not operating or the computer does not start up as described above, notify the appropriate supervisor and implement one of the following:

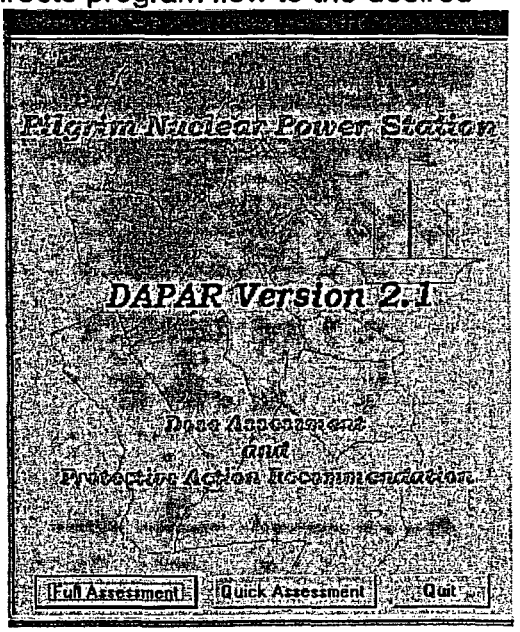
(a) Start DAPAR using another dose assessment computer.

(b) Obtain a backup application disk and install DAPAR program on any functional PC, preferably with a Microsoft Access 97 program installed.

(c) Proceed to Section 6.8 and implement backup dose assessment manual method until computer operational problems are resolved.

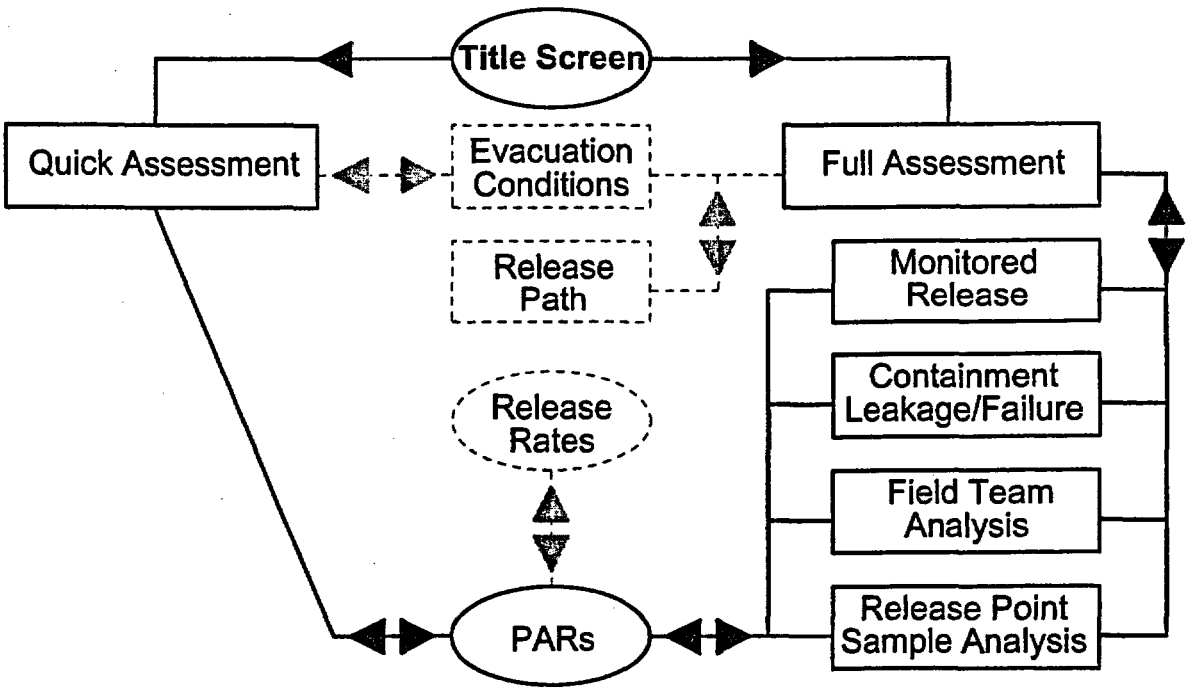
6.2 TITLE SCREEN

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.



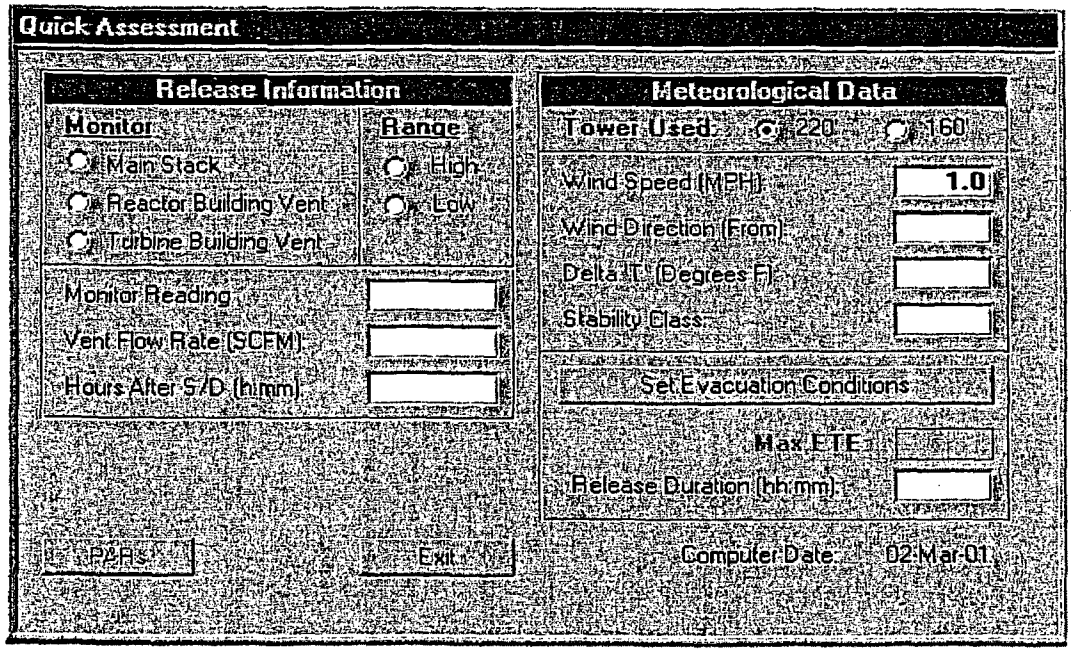
A basic program flow diagram is illustrated below.

DAPAR Input Window Flow Diagram



6.3 QUICK ASSESSMENT

Quick assessment operation and calculation are identical to the full assessment method for a monitored release but utilize 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 whether dose projections have or have not exceeded the Protective Action Guides (PAGs) for recommending protective actions (PARs) to offsite agencies. 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.

NOTE

Refer to Attachment 2 for aid in acquiring meteorological data based on release type and meteorological tower instrumentation.

Meteorological Data		
Input	**Control**	**Options/Entry**
Met. Tower	Option Button	220' Tower 160' Tower Notes • 220' Tower is first choice before using 160' Tower information. • For an elevated release (Main Stack), first choice is touse upper sensor data from the 220' Tower. • For a ground release (Reactor Bldg Vent, Turbine Bldg Vent, or Unmonitored Release), first choice is to use lower sensor data from the 220' Tower.
Wind Speed	Text Box	As indicated on Control Room monitors in MPH (valid input is 1 through 75 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 Evacuation Conditions	Command Button	Displays pop-up window for entry of offsite evacuation conditions (see Evacuation 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. Displays maximum evacuation time based on wind direction and evacuation conditions.
Release Duration	Text Box	Automatic update based on maximum evacuation time estimate. Can be changed by user.

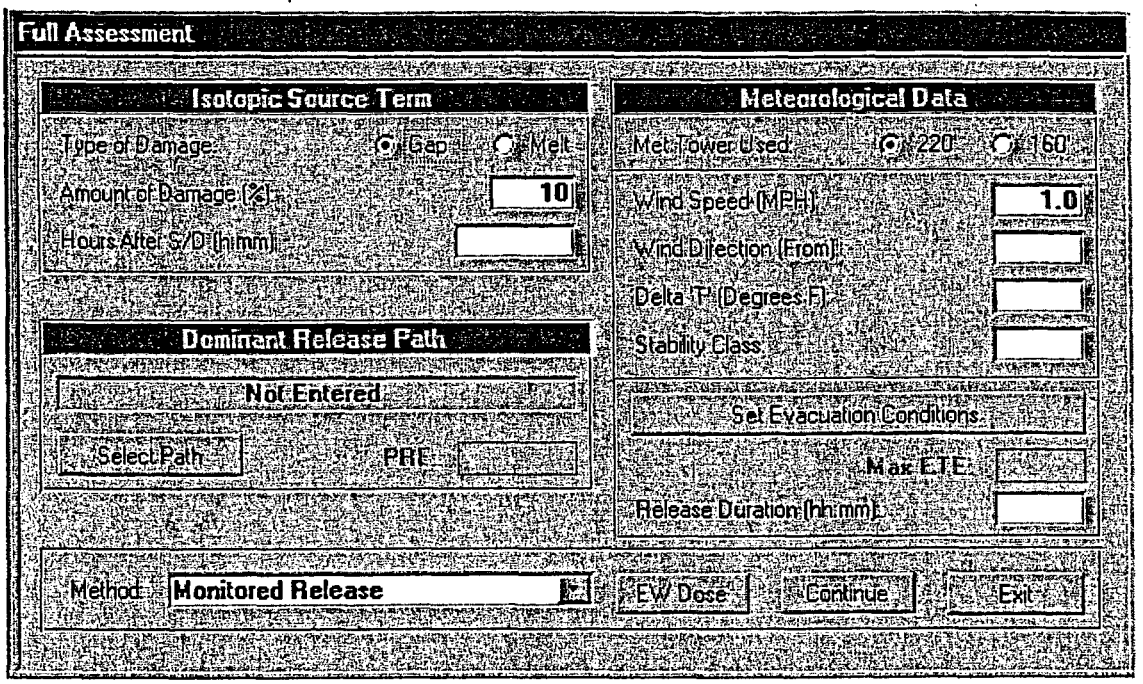
DAPAR uses the maximum Evacuation Time Estimates (ETEs) as the basis for the initial release duration. This method assumes that all of the affected (downwind) subareas out to 10 miles will be involved in the offsite protective action. By selecting the 'Set Evacuation Conditions' command button, the Evacuation 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 Evacuation Conditions window as follows:

Evacuation 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 Dose Assessment Results window (refer to Section 6.6 of this Procedure, if needed).
Quit	Command Button	The button may be used at any time to exit the application and return to Windows.

6.4 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 provide 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.

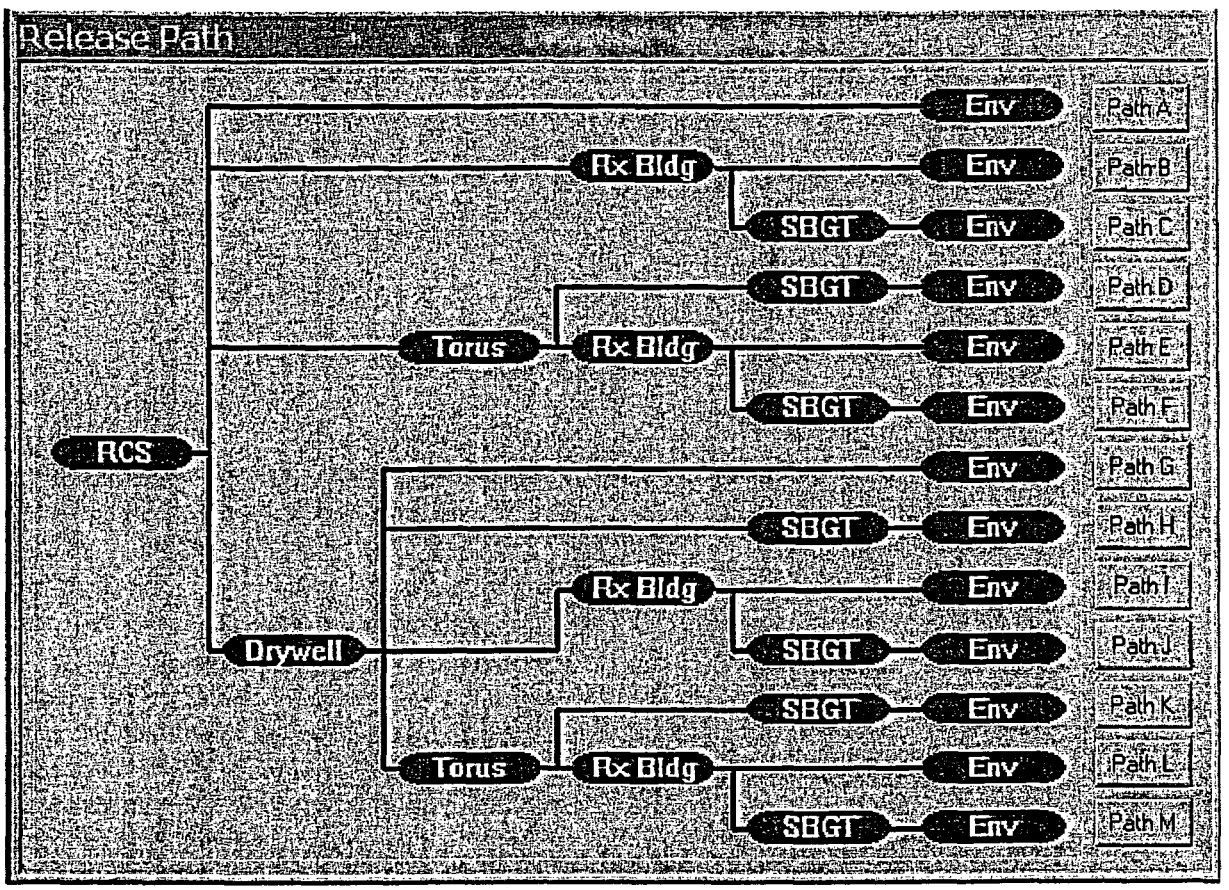
Refer to Attachment 4 for aid in obtaining information on the full assessment methods for calculating offsite dose projections when using the DAPAR computer program.

The baseline information inputs are as follows:

Isotopic Source Term		
Input	**Control**	**Options/Entry**
Damage Type	Option Button	Gap (default) Melt

Isotopic Source Term		
Input	Control	Options/Entry
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 dominant release paths displayed are as follows:



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. To account for potential overestimation of effective removal values due to multiple processes (other than SGT filters), the maximum product of the nonfilter PRFs is limited to 0.001 when the release path includes two or more structures or buildings from the reactor coolant system (e.g., RCS---D/W---Rx Bldg or RCS---D/W---Torus).

The inputs for the dominant release path are as follows:

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

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 condtions. If a direct Torus release pathway is postulated, the following guidance may be used to assess offsite dose projections. NOTE The Direct Torus Vent line discharges Torus air to the Main Stack downstream of the SGT filters but connects upstream of the SGT Total Air Flow Indicators and Main Stack Radiation Low and High Range Monitors. **A. Prior to Initiating a Direct Torus Vent** 1. Obtain core damage estimate from TSC. 2. For Dominant Release Path, select Path D and set SGT Filter Efficiency to 0%. All other prompts for process reduction factors should be based on existing plant conditions (Torus Suppression and Torus Hold-up). 3. Set meteorological data based on actual met tower information for an elevated release. 4. Set evacuation conditions; however, the release duration will default to 1 hour based on using the Catastrophic Failure option. 5. For Dose assessment method, select Containment Leakage/Failure and then use the Catastrophic Failure (100% in 1 hour) option to assess offsite dose projections and protective action recommendations. (This will provide an upper bound projection that releases the total fission products postulated in containment based on the core damage estimate for a 1-hour release duration.)

Release Path and Process Reduction Inputs		
Input	**Control**	**Options/Entry**
		B. During or After Initiating a Direct Torus Vent 1. Continue to use the method described in Section A or modify the dose assessment method (Step A.5) to select Monitored Release option and then obtain appropriate Main Stack radiation monitor readings and vent flow rates to assess offsite dose projections. 2. Confirm offsite dose projections with Radiation Monitoring Team survey results.
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) - No Spray PRF 0.4, Spray PRF 0.03 2-12 Hours - No Spray PRF 0.04, Spray PRF 0.02 24 Hours - No Spray PRF 0.01, Spray PRF 0.002
Torus Suppression	Option Button	Sub cooled (default) - PRF 0.01 Saturated - PRF 0.05 Bypassed - PRF 1.0
Torus Hold-Up	Option Button	< 1 Hour (default) - PRF 0.4 2-12 Hours - PRF 0.04 24 Hours - PRF 0.01
Reactor Bldg Hold-Up	Option Button	< 1 Hour (default) - PRF 0.4 2-12 Hours - PRF 0.04 24 Hours - PRF 0.01
SGT Filter Efficiency	Text Box	99.0% (default) - PRF 0.01

NOTE

Refer to Attachment 2 for aid in acquiring meteorological data based on release type and meteorological tower instrumentation.

Meteorological Data		
Input	**Control**	**Options/Entry**
Met Tower	Option Button	220' Tower 160' Tower Notes • 220' Tower is first choice before using 160' Tower information. • For an elevated release (Main Stack), first choice is to use upper sensor data from the 220' Tower. • For a ground release (Reactor Bldg Vent, Turbine Bldg Vent, or Unmonitored Release), first choice is to use lower sensor data from the 220' Tower.
Wind Speed	Text Box	As indicated on met tower data in MPH (valid input is 1 through 75 MPH).
Wind Direction	Text Box	As indicated on met tower data in degrees from (valid input is 000° through 360°).
Delta T	Text Box	As indicated on met tower data 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 Evacuation Conditions	Command Button	Displays pop-up window for entry of offsite evacuation conditions (see Evacuation 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. Displays maximum evacuation time estimate based on wind direction and evacuation conditions.
Release Duration	Text Box	Automatic update based on maximum evacuation time estimate. Can be changed by user after initial evacuation conditions are made.

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 Evacuation Conditions' command button, the Evacuation 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 Evacuation Conditions window as follows:

Evacuation 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**
Method	List Box	Monitored Release (default) Containment Leakage/Failure Field Team Analysis Release Point Analysis
EW Dose	Command Button	Initially disabled. Enabled after the necessary base data (amount of damage and release path) is entered allowing the user to continue with this option (refer to Section 6.7 of this Procedure).
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 (refer to Section 6.5 of this Procedure).
Exit	Command Button	The button may be used at any time to exit the application and return to Windows.

6.5 ASSESSMENT METHODS

Four assessment methods are available from within the full assessment option: monitored release, containment leakage/failure, field team analysis, and 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 10 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. Command bar 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 Dose Assessment Results window (refer to Section 6.6 of this Procedure, if needed).
Exit	Command Button	May be used at any time to exit the current assessment method and return to the main data entry window.

An explanation of each assessment method is described below:

[1] MONITORED RELEASE

The monitored release method is based on information, actual or estimated, from the plant effluent monitors. Downwind dose estimates and whether Protective Action Guides (PAGs) have been exceeded 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 or to reenter the meteorological data that corresponds to the chosen release point (elevated or ground level). Data entry options available in the monitored release window are as follows:

Monitored 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

[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. Downwind dose estimates and whether Protective Action Guides (PAGs) have been exceeded 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 a new process reduction factor is desired or to reenter the meteorological data that corresponds to the chosen release point (elevated or ground level). Data entry options available for this method are as follows:

Containment Leakage/Failure 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.

[3] FIELD TEAM ANALYSIS

The field team analysis method is based on radiological survey or isotopic sample information taken within the plume. Downwind dose estimates and whether Protective Action Guides (PAGs) have been exceeded 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 effect 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 Analysis 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.

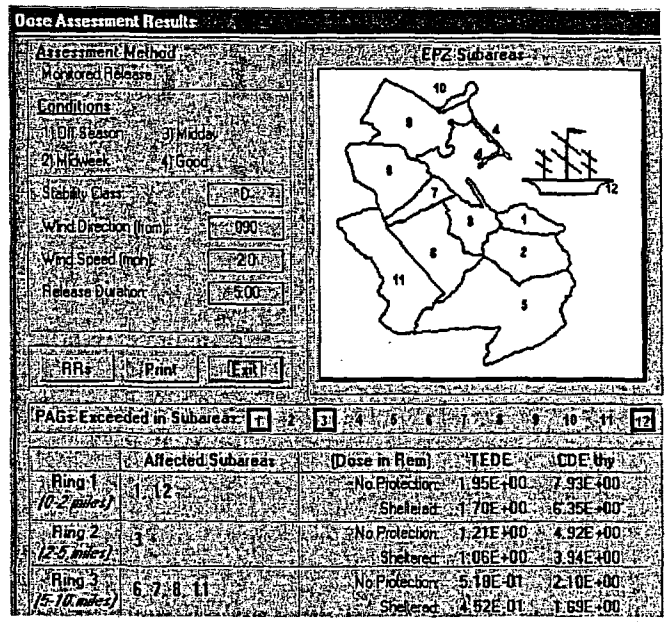
[4] RELEASE POINT ANALYSIS

The release point analysis method is based on isotopic sample information taken from any release point to the environment. Downwind dose estimates and whether Protective Action Guides (PAGs) have been exceeded 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:

Release Point Analysis 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.

6.6 PROTECTIVE ACTION RECOMMENDATIONS

The Dose Assessment Results window evaluates the downwind dose estimate in relation to the protective action guides (PAGs). The window is divided into four primary sections: key information, EPZ Subarea map, protective action guide information relating to EPZ Subareas, and dose projections. The key information section shows the assessment method, the current offsite evacuation conditions, meteorological data, and the release duration. The EPZ Subarea map graphically illustrates and outlines the subareas within the 10 mile EPZ. The protective action guide relating to an EPZ Subarea section provides information on what EPZ Subareas have or have not exceeded the PAGs. Subareas in which the projected dose exceeds the protective action guides are boxed for determining protective action recommendations based on dose assessment results (EPZ Subareas that require evacuation). The dose projection section provides 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 Dose Assessment Results window. Command bar options are as follows:



Dose Assessment Results		
Input	**Control**	**Options/Entry**
RRs (Release Rates)	Command Button	Displays a pop-up window showing the projected release rates for noble gases, halogens, and particulates.
Print	Command Button	Prints a hard copy of the protective action recommendations.
Exit	Command Button	Used to exit the Dose Assessment Results 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.

6.7 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 Projections 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.

6.8 OFFSITE DOSE CALCULATION, BACKUP 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.

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 subcritical and therefore stopped generating fission.

4. Locate the appropriate monitor table (A.1 through A.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 and record 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 Part 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 doses are 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 Shift Manager if the EOF is not yet activated) of the results.

7.0 RECORDS

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

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

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

8.0 ATTACHMENTS

ATTACHMENT 1 - OFFSITE DOSE AND PAR WORKSHEET

ATTACHMENT 2 - METEOROLOGICAL DATA ACQUISITIONS INSTRUCTIONS

ATTACHMENT 3 - MEDAP COMPUTER PROGRAM INSTRUCTIONS

ATTACHMENT 4 - DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES

ATTACHMENT 5 - DOCUMENT CROSS-REFERENCES

ATTACHMENT 6 - IDENTIFICATION OF COMMITMENTS

OFFSITE DOSE AND PAR WORKSHEET

Part A: Radiological 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 Dispersion Factor

1. Wind Direction From: _____° (220' or 160') _____° (33')
2. Wind Speed: _____ MPH (220' or 160') _____ MPH (33')
3. Delta T: _____ °F ☐ 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

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 * Part C.3):

Rem	Inner Ring	Middle 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: _____

METEOROLOGICAL DATA ACQUISITION INSTRUCTIONS

This Attachment is to be used as a procedural aid for obtaining meteorological data based on release point and available meteorological tower instrumentation from the Control Room and EOF.

[1] Based on release point pathway and available meteorological tower instrumentation, the following guidance should be used to determine meteorological data for Off-site Dose Projections, Protective Action Recommendations (wind direction to determine affected sub-areas), and Assembly Area Designation (wind direction to determine designated assembly area).

(a) **In the Control Room, use 15-minute averaged meteorological values from strip chart information.** This can be done by visually observing and estimating the trace of the strip chart division that corresponds to the last 15-minute period.

(b) **In the EOF, use 15-minute averaged meteorological values from the Meteorological Data Acquisition Program (MEDAP) computer or strip chart information from the Control Room.**

(1) Refer to Attachment 3 (MEDAP Computer Program Instructions) for aid in obtaining 15-minute averaged values from the MEDAP computer.

(2) Information can be obtained directly from status board information or through the use of the Radiation Data Communicator Phone Network to obtain 15-minute averaged values from Control Room strip charts.

(c) Use table below to determine primary (first choice) and alternate (second, third, etc.) sources for obtaining 15 minute-averaged meteorological data.

MAIN STACK RELEASE POINT:

Source Choice Options	Wind Direction/Wind Speed	Stability Class
First Choice	220' Met tower (220' level)	220' Met tower
Second Choice	160' Met tower (160' level)	160' Met tower
Third Choice	220' Met tower (33' level)	See Stability Class Estimator Table
Fourth Choice	160' Met tower (33' level)	N/A
Fifth Choice	Call National Weather Service (Taunton) at 508-823-2228 and ask for Senior Forecaster on duty.	

REACTOR OR TURBINE BUILDING VENT OR UNMONITORED RELEASE POINT:

Source Choice Options	Wind Direction/Wind Speed	Stability Class
First Choice	220' Met tower (33' level)	220' Met tower
Second Choice	160' Met tower(160' level)	160' Met tower
Third Choice	220' Met tower (220' level)	See Stability Class Estimator Table
Fourth Choice	160' Met tower (33' level)	N/A
Fifth Choice	Call National Weather Service (Taunton) at 508-823-2228 and ask for Senior Forecaster on duty.	

METEOROLOGICAL DATA ACQUISITION INSTRUCTIONS (Continued)

Stability Class Estimator Table

	Daytime - Intensity of Sunlight			Nighttime Conditions	
Surface Wind Speed, mph	Strong	Moderate	Slight	Cloudy	Clear
< 4.5	A	A-B	B	F	F
4.5	A-B	B	C	E	F
9	B	B-C	C	D	E
13	C	C-D	D	D	D
> 13	C	D	D	D	D

(d) If there is no Emergency Radioactive Release, then the first choice is to use the upper level meteorological data from either the 220' tower or 160' tower.

(e) If there are actual or potential multiple releases (elevated and ground level), then the following guidelines should be used.

(1) For Dose Projections, use both the upper and lower data to determine applicable off-site dose projections.

(2) For Protective Action Recommendations, use both the upper (for the elevated) and lower (for the ground level) wind direction to determine all affected subareas.

(3) For Assembly Area Designation, use upper wind direction if Main Stack radiation monitors have highest readings or use lower wind direction if Reactor Bldg or Turbine Bldg radiation monitors have highest readings.

MEDAP COMPUTER PROGRAM INSTRUCTIONS

This Attachment is to be used as a procedural aid for obtaining 15-minute averaged values from the EOF MEDAP computer.

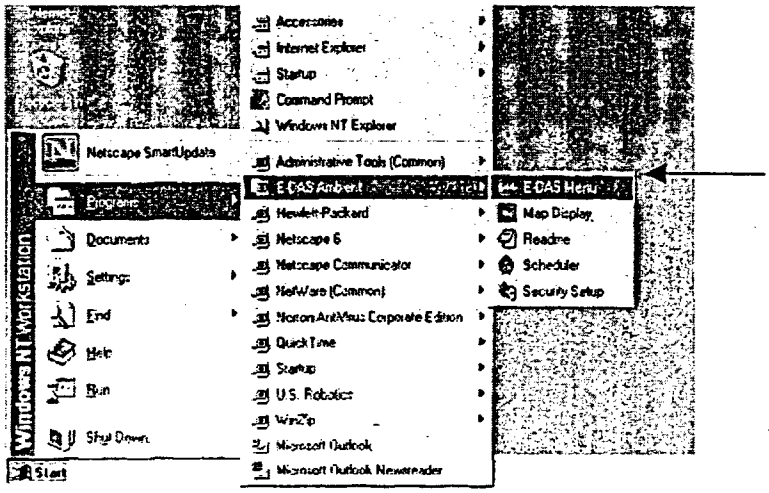
CAUTION

The computer clock for both Met Tower Data Loggers and EOF MEDAP computer are permanently set to Eastern Standard Time (EST). Time correction must be done when observing Eastern Daylight Saving Time (EDT).

[1] **CLICK** the E-DAS Ambient Menu located on taskbar. The E-DAS Ambient main menu will open:

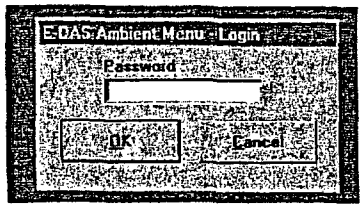
[2] IF E-DAS Ambient Menu is NOT minimized on taskbar, THEN **PERFORM** the following steps to open the E-DAS Ambient Menu:

(a) **CLICK ON** Start menu, THEN **SELECT** Programs and E-DAS Ambient folder. THEN **HIGHLIGHT** AND **CLICK** E-DAS Menu.



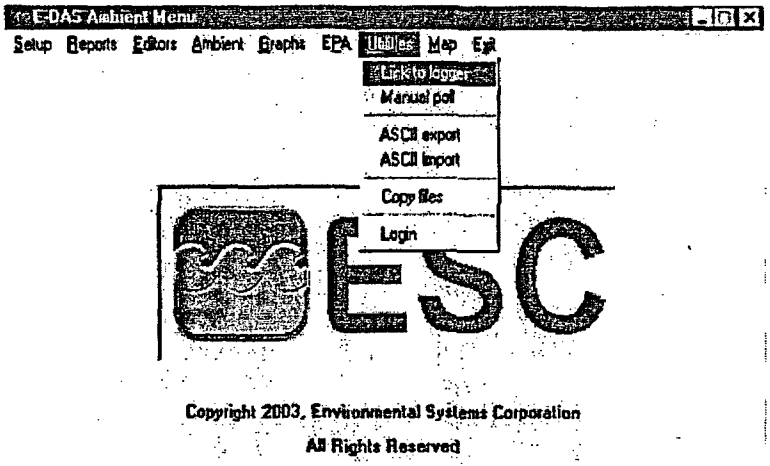
MEDAP COMPUTER PROGRAM INSTRUCTIONS (Continued)

(b) **AFTER** clicking the E-DAS Ambient Menu, the E-DAS Ambient Menu - Login screen will appear:

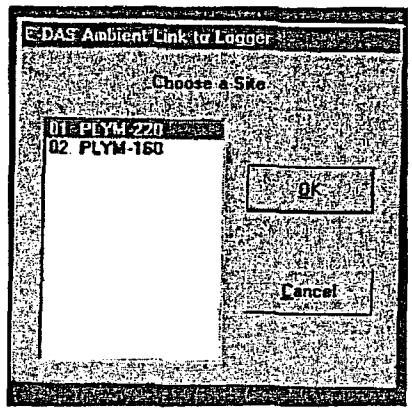


(c) **CLICK OK** with no password entered. This will open the E-DAS Ambient main menu (**REFER TO** Step [1] above).

[3] **AFTER** opening the E-DAS Ambient menu, **CLICK ON** Utilities on toolbar **AND THEN SELECT** "Link to logger" option.



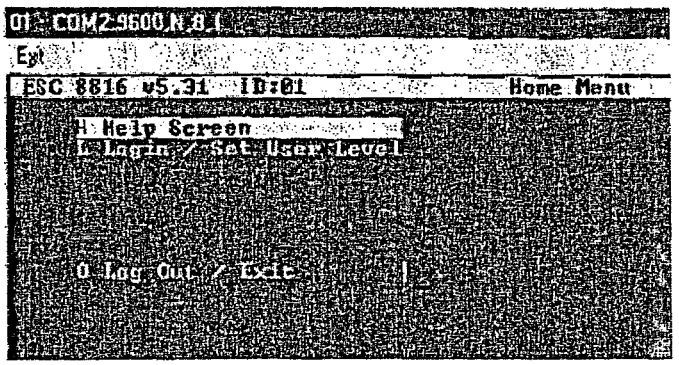
[4] This will open the "E-DAS Ambient Link to Logger" screen.



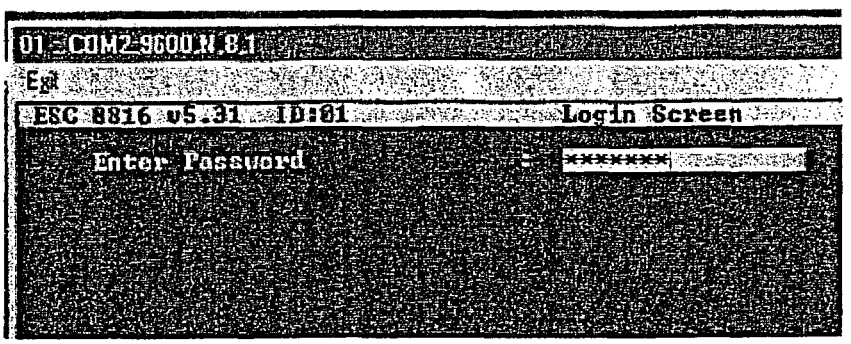
MEDAP COMPUTER PROGRAM INSTRUCTIONS (Continued)

[5] **SELECT** 220' or 160' **AND THEN CLICK OR ENTER** "OK" button. (Computer will automatically start modem to connect into the selected met tower data logger.)

[6] **AFTER** completing modem connection, the Home Menu screen will open:



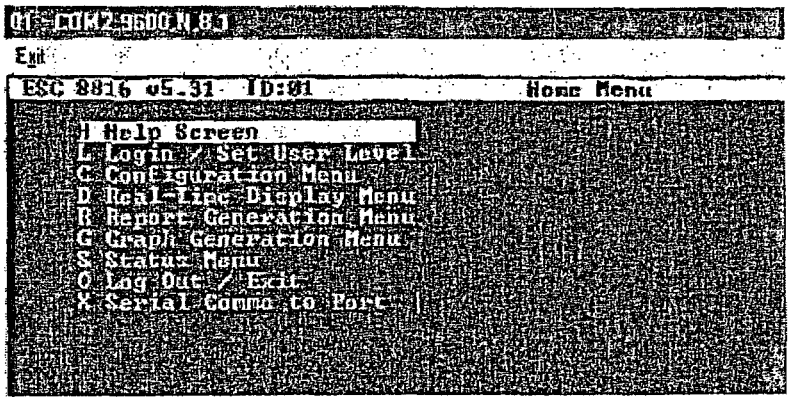
[7] Using the up and down arrow keys, **HIGHLIGHT** "Login / Set User Level" **AND PRESS** "ENTER" to select item **OR TYPE** "L" to select item. The "Login Screen" will open:



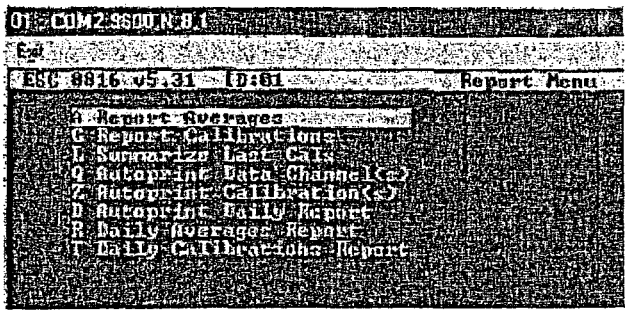
MEDAP COMPUTER PROGRAM INSTRUCTIONS (Continued)

[8] **ENTER** password: pilgrim **AND PRESS** "ENTER". This will log you into the data logger and the "Home Menu" screen will re-open with the logged in status options:

> **NOTE**
>
> Selecting the "Help Screen" on the Home Menu provides an explanation of the command function keys.

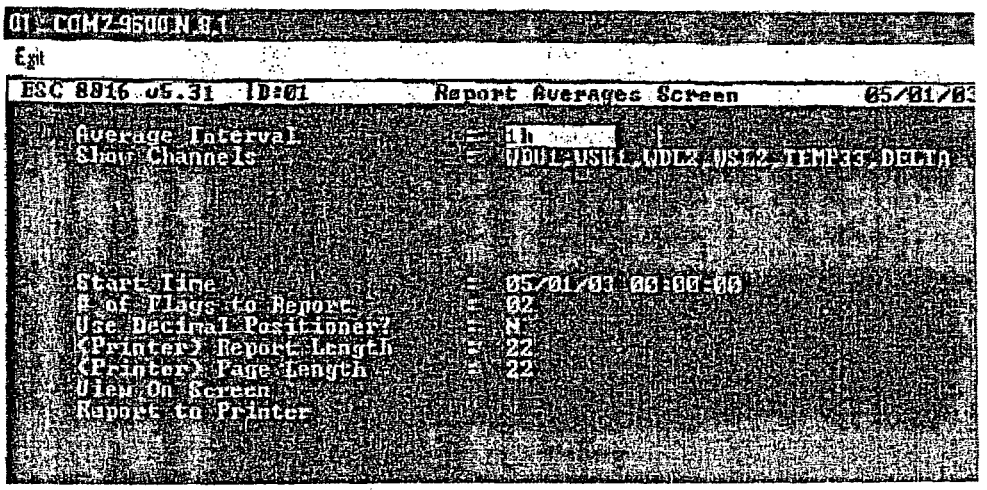


[9] Using the up and down arrow keys, **HIGHLIGHT** "Report Generation Menu **AND PRESS** "ENTER" **OR TYPE** "R". The "Report Menu" will open:



MEDAP COMPUTER PROGRAM INSTRUCTIONS (Continued)

[10] **HIGHLIGHT** "Report Averages" **AND PRESS** "Enter". The Report Averages Screen will open:



(a) On the "Report Averages Screen", the following parameters will need to be highlighted and then set to the desired settings:

(1) **CHANGE** the "Average Interval" from "1 h" to "15m" by typing "15m" **AND PRESS** "Enter".

a. The Average Interval will initially default to 1 hour.

b. **ENSURE** parameter is set to "15 m" to view 15-minute averaged data from selected met tower.

(2) **CHANGE** the "Start Time" to select the desired time period **AND PRESS** "Enter". **(REMEMBER TO USE** Eastern Standard Time.) **CONSIDER** setting time period to current date/time **AND THEN USE** cursor control (arrow keys) to view current or previous 15-minute averaged data.

a. The "Start Time" will initially default to current date and time setting of 00:00:00.

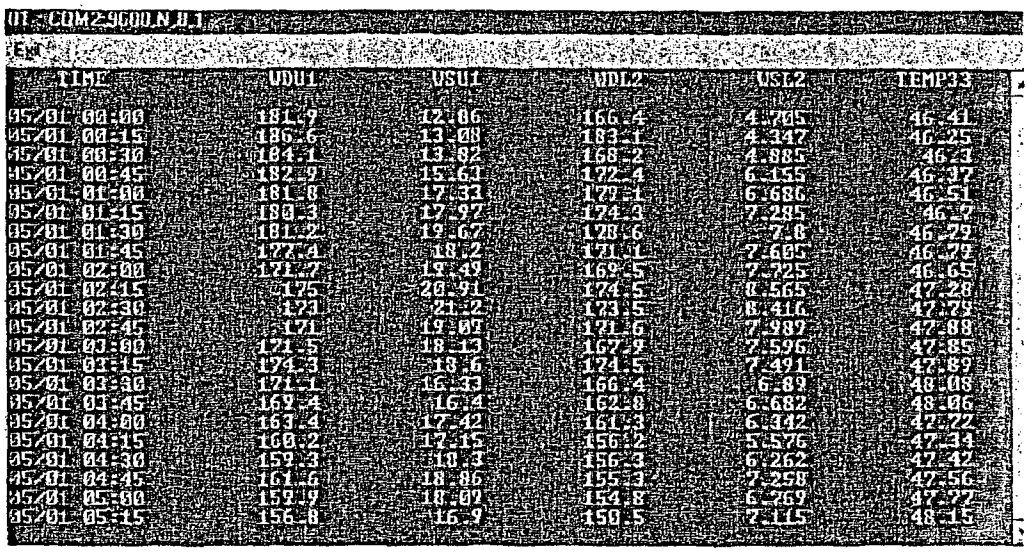
b. Data presented on the computer screen corresponds to the "Start Time" selected. The computer screen (View On Screen option) will display 5 and 1/4 hours of information from the date and time selected.

MEDAP COMPUTER PROGRAM INSTRUCTIONS (Continued)

NOTE

The "Report to Printer" option is not configured to the EOF MEDAP computer and therefore is not an option to be used.

(b) **AFTER** setting the desired parameters, **HIGHLIGHT** "View On Screen" **AND PRESS** "Enter". The 15-minute averaged data from selected met tower will appear on screen:



TIME	VDU1	VSU1	VDU2	VSU2	TEMP33
05/01 00:00	181.9	12.86	166.4	4.705	46.41
05/01 00:15	186.6	13.08	163.1	4.347	46.25
05/01 00:30	184.1	13.82	168.2	4.885	46.23
05/01 00:45	182.9	15.61	172.4	6.155	46.37
05/01 01:00	181.8	17.33	170.1	6.686	46.51
05/01 01:15	180.3	17.92	124.3	7.285	46.7
05/01 01:30	181.2	19.67	128.6	7.8	46.79
05/01 01:45	177.4	18.2	171.1	7.605	46.72
05/01 02:00	171.7	19.49	169.5	7.725	46.65
05/01 02:15	175	20.91	174.5	8.565	47.28
05/01 02:30	173	21.2	173.5	8.416	47.79
05/01 02:45	171	19.07	171.6	7.987	47.88
05/01 03:00	171.5	18.13	167.9	7.596	47.85
05/01 03:15	174.3	18.6	171.5	7.491	47.89
05/01 03:30	171.1	16.33	166.4	6.89	48.06
05/01 03:45	169.4	16.4	162.8	6.682	48.06
05/01 04:00	163.4	17.42	161.3	6.342	47.72
05/01 04:15	160.2	17.15	156.2	5.576	47.34
05/01 04:30	159.3	18.3	156.3	6.262	47.42
05/01 04:45	161.6	18.86	155.2	7.258	47.56
05/01 05:00	159.9	18.02	154.8	6.269	47.72
05/01 05:15	156.8	16.9	150.5	7.115	48.15

(1) **USE** the cursor control (arrow) keys to view data on screen.

a. The up and down arrow keys will allow user to view past and present data on the screen.

b. The left and right arrow keys will shift computer screen to show other columns not visible on the screen (e.g., delta temperature).

MEDAP COMPUTER PROGRAM INSTRUCTIONS (Continued)

NOTES

- The "View On Screen" option is a static screen that does not automatically update after selection.
- The screen displays up to 22 segments from the "Start Time" entered.
- The "Start Time" will default to the corresponding first row displayed on the screen when updating information.

(2) **PRESS** ESC to exit display **AND THEN REPEAT** data entry steps from Step [10](a) through Step [10](b) to update and obtain the current 15-minute averaged data. **REPEAT** this step as needed.

[2] To disconnect and exit from data logger, **PERFORM** the following steps:

(a) **PRESS** ESC until the "Home Menu" screen is displayed.

(b) On "Home Menu" screen, **HIGHLIGHT** "Log Out / Exit" **AND PRESS** "Enter".

(c) **SELECT** "Exit" on toolbar **AND THEN CLICK ON** Exit to complete logout and return to the E-DAS Ambient main menu.

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES

This Attachment is to be used as a procedural aid to describe the constants, equations, and methods for calculating offsite dose projections in the DAPAR computer program.

A. Source Term Determination

The basic method for estimating the source term isotopic mix available at the point of release to the environment is derived from the equation given in NUREG-1228, "Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents". The equation used is as follows:

$$\text{Source Term}_i = FPI_i * CRF_i * (\prod PRF_{(i,j)}) * e^{-\lambda_i t}$$

Where:

FPI_i : Fission Product Inventory for isotope i.

CRF_i : Core Reduction Factor for isotope i.

$PRF_{(i,j)}$: Process Reduction Factor for isotope i for process j.

$e^{-\lambda_i t}$: Decay Correction Factor for isotope i

An explanation of each of these terms is described below:

1. Fission Product Inventory (FPI)

   Lists of isotopes to be considered for use in the calculation of offsite doses from power reactors are available in numerous source documents. EPA 400-R-92-001 gives a comprehensive listing in order to cover the large number of facilities under which emergency planning is necessary for radiological accidents. The EPA criterion for establishing the source term specifies that isotopes which contribute greater than 10% of the exposure pathway to the dose incurred need be considered. The significant isotopes chosen for use in the Pilgrim Nuclear Power Station offsite radiological assessment code include 66 components which are derived from lists included in EPA 400, WASH-1400, NUREG-1228, NEDO-22215, and PNPS FSAR.

2. Core Reduction Factor (CRF)

   The core reduction factor is used to establish the amount and type of fission products available for release from the core. CRFs are taken from the nominal values given in Table 5 of NEDO-22215 (categorized by chemical group) for the conditions of fuel cladding rupture (gap release) or in-vessel fuel melt release and multiplied by the percent damage.

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

The Core Reduction Factors (uncorrected for % damage) used in DAPAR are as follows:

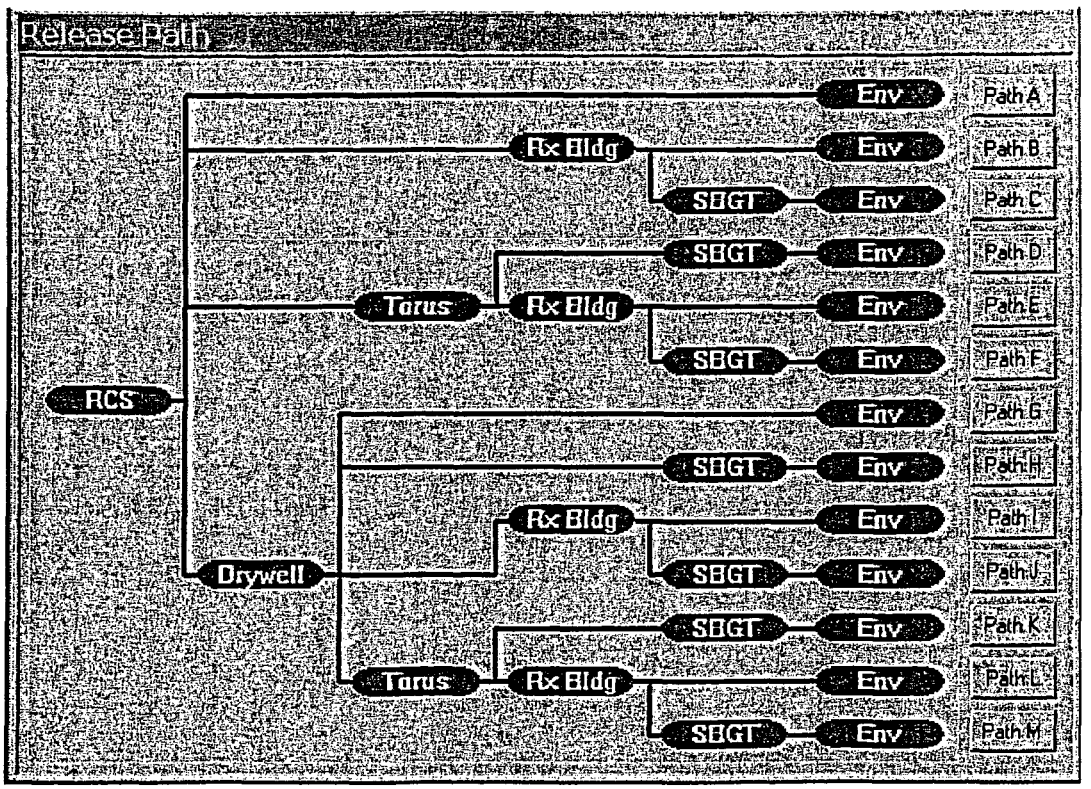
Chemical Group	Gap Release	Melt Release
Noble Gases	0.030	0.903
Halogens	0.017	0.902
Alkali Metals	0.050	0.810
Tellurium Group	0.0001	0.15001
Alkaline Earths	0.000001	0.100001
Noble Metals	N/A	0.030
Rare Earths	N/A	0.003
Refractories	N/A	0.003

3. Process Reduction Factor (PRF)

The process reduction factor is used to estimate the amount of fission products released from the core which are available for release to the environment. The determination of the PRF involves a two step process. The first, the release path from the core to the environment must be established, and secondly, the effectiveness of fission product removal mechanisms along the pathway must be determined.

a) Release Path

The release path options are established from NUREG-1228 and modified for PNPS. The dominant release paths displayed are as follows:



DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

b) Removal Mechanisms

Filtering and other removal mechanism efficiencies can vary depending on the chemical and physical characteristics of the individual radioisotope. For purposes of dose assessment it will be assumed that all non-noble gases will form a homogenous mix of aerosols and particulates which are acted upon equally by each removal process. The process reduction factors for specific removal mechanisms are taken from NUREG-1228. Process reduction factor (PRF) hold-up values for no spray can apply to the Torus and the Reactor Building as well as the Drywell. The process reduction factor total effective value is determined by multiplying each reduction encountered along the path. To account for potential overestimation of effective removal values due to multiple processes (other than SGT filters), the maximum product of the nonfilter PRFs is limited to 0.001 when the release path includes two or more structures or buildings from the reactor coolant system (e.g., RCS—D/W—Rx Bldg or RCS---D/W---Torus). The Process Reduction Factors used in the DAPAR program are as follows:

Removal Mechanism	PRF
Maximum (w/o SGT)	0.001
SGT	0.01
Bypass Accident	0.4
Torus Subcooled	0.01
Torus Saturated	0.05
Torus Bypassed	1.00
Torus Hold-up < 1Hr	0.4
Torus Hold-up 2 to 12 Hrs	0.04
Torus Hold-up 24 Hrs	0.01
D/W Hold-Up Spray < 1Hr	0.03
D/W Hold-Up Spray 2 to 12 Hrs	0.02
D/W Hold-Up Spray 24 Hrs	0.002
D/W Hold-Up No Spray < 1 Hr	0.4
D/W Hr Hold-Up No Spray 2 to 12 Hrs	0.04
D/W Hold-Up No Spray 24 Hrs	0.01
Rx Bldg Hold-up < 1Hr	0.4
Rx Bldg Hold-up 2 to 12 Hrs	0.04
Rx Bldg Hold-up 24 Hrs	0.01

B. Dose Assessment Methods

Any or all of the four primary dose assessment methods can be used to project offsite doses to the general public before, during, or after a release. Actual population dose, usually performed during the recovery phase, should be based on actual measurements at specific locations. Emergency worker dose projections do not reflect the 4-day deposition component and therefore should not be applied to members of the general public. They can, however, be used to assess the need for KI distribution and dose limit establishment prior to sample analysis at the worker locations.

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

The following methods used in DAPAR for dose assessment include:

1. Monitored Release: Offsite radiological assessment related to a monitored value taken at one of several release locations (Main Stack, Reactor Building Vent, and Turbine Building vent) within the plant.
2. Containment Leakage/Failure: Offsite radiological assessment related to a default, known, or predicted level of containment leakage or failure.
3. Field Team Survey and Sample Analysis: Offsite radiological assessment related to comparisons of field team radiological survey and isotopic sample concentrations with predicted plume dispersion.
4. Release Point Sample Analysis: Offsite radiological assessment related to a measured isotopic concentration taken at the point of release to the environment.
5. Emergency Worker Dose Projection: Offsite radiological assessment which allows prediction of actual and thyroid exposures and exposure periods relating to indicated dose readings when immersed in a radioactive plume.

An explanation for each method is described below:

1. Monitored Release

Previous to EPA 400, dose assessment was based on the consequences resulting from a design basis LOCA with isotopes other than noble gas and halogens largely ignored. This allowed for broad assumptions to be made as to the isotopic composition and its relation to a given monitor reading. The only correction necessary was for decay. With the change towards severe accident analysis and offsite dose calculations based on the contribution of each individual isotope, it became necessary to modify the old methodology to account for the constant variation in mix activity. Conversion factors which relate a known concentration to a specific monitor reading (i.e., *X* cps per µCi/cc or *X* R/hr per µCi/cc) for each isotope were developed to address those variations.

a) Release Rate Determination

The method used to relate a monitor reading to a projected release rate is performed by a series of calculations which ratio the expected source available for release fractions to a given monitor reading. The steps involved in the calculation are described as follows:

- Determine the source term available for release for each isotope (terms of the equation given in Section A of this Attachment).

$$\text{Source Term}_i = FPI_i * CRF_i * (\prod PRF_{(i,j)}) * e^{-\lambda_i t}$$

- Divide the individual source activities by the sum of all source activities to determine the fractional activities of each isotope.

$$\text{Source Term}_{i\ \text{fraction}} = \text{Source Term}_i / \Sigma\ \text{Source Term}_i$$

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

- Multiply the Source Term fractional activities by the isotopic Monitor Conversion Factors (MCF) and sum the results to determine the fractional Monitor Conversion Factor.

  $$MCF_{fraction} = \Sigma\ Source\ Term_{i\ fraction} * MCF_i$$

- Divide the user entered monitor reading by the fractional monitor reading total to obtain the monitor multiplication factor.

  $$MMF = Monitor\ Reading/MCF_{fraction}$$

- Multiply the fractional activities of each isotope by the monitor multiplication factor to determine the isotopic source available for release related to the given monitor reading.

  $$Source\ Term_i = Source\ Term_{i\ fraction} * MMF$$

The results of above calculations (µCi/cc) are then multiplied by the flow rate at the release point to obtain release rates for each isotope.

b) Downwind Dose and Dose Rate

Similar principals are applied by the monitored release, containment leakage/failure, and release point analysis methodologies to determine downwind exposure pathway dose rates and doses. In each case, once the release rate has been calculated, the exposure pathway dose rate and dose can be determined by the equations below:

- Initial dose rate is calculated by applying the EPA 400 dose conversion factors for immersion to the calculated isotopic downwind concentrations using the following equation:

  $$\text{Dose Rate}_{\text{Immersion Pathway}} = \sum RR_i \times \frac{X}{Q_x} \times DCF_i$$

- Dose is determined by calculating the time integrated concentration and then again applying the EPA 400 dose conversion factors for each pathway to the calculated isotopic downwind concentrations using the following equation:

  $$\text{Dose}_{\text{All Pathways}} = \sum RR_i \times \frac{X}{Q_x} \times DCF_i \times \left(\frac{-1}{\lambda_i} \times e^{-\lambda_i t} + \frac{1}{\lambda_i} \right)$$

  Where t is the release duration time in hours.

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

2. Containment Leakage/Failure

The containment leakage/failure method allows for offsite dose assessment without a release in progress. Consideration is given to the consequences of leakage less than design limits up to catastrophic failure. For purposes of definition, catastrophic failure can be assumed to occur at containment breaches greater than 2 ft^2.

a) Release Rate Determination

The method used to relate a containment leakage/failure to a projected release rate is performed by a series of calculations and evaluations. The steps involved are described as follows:

- Determine the source term available for release for each isotope (terms of the equation given in Section A of this Attachment).

$$\textbf{Source Term}_i = FPI_i * CRF_i * (\prod PRF_{(i,j)}) * e^{-\lambda_i t}$$

- Determine the escape fraction related to the desired containment leakage/failure amount and correct to units of seconds. The escape fraction (derived from NUREG-1228 Table 4.10) is that fraction of the containment volume released in one hour.

For design leakage (0.5%/Day) or other postulated values:

EF = (% Leakage / 100) / 86400

For failure to isolate (100%/Day) values:

EF = 1 / 86400

For catastrophic failure (100% in 1 hour) values:

EF = 1 / 3600

- Multiply the individual source activities by the escape fraction to obtain a release rate.

$$\textbf{Release Rate}_i = \textbf{Source Term}_i * EF$$

b) Downwind Dose Rate and Dose

Equations for downwind dose rate and dose are the same as described for Monitored Release with the following changes for release duration.

- Release duration values greater than 24 hours for failure to isolate scenarios are changed to 24 hours.
- Release duration values greater than 1 hour for catastrophic failure scenarios are changed to 1 hour.

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

3. Field Team Analysis

The field team analysis method employs two options for the determination of offsite doses; radiological survey and isotopic sample analysis. Downwind and crosswind distances are used to determine the X/Q value representative of the team location.

a) Radiological Surveys

Field team survey results from a known location are directly related to centerline dose rates for each downwind distance by X/Q ratios. Downwind centerline dose rates are determined as follows:

$$\text{Dose Rate}_x = \text{Dose Rate}_{\text{Field Team}} \times \frac{\left(\frac{X}{Q_x}\right)}{\left(\frac{X}{Q_{\text{Field Team}}}\right)}$$

Downwind dose estimates are also given by multiplying the dose rate by the projected release duration. These values allow for comparisons with projected dose rates and doses derived from other methods, provide expected survey results at other locations, and are useful for assessing a general whole body expected dose. Since this method is not consistent with the EPA 400 method of assigning dose for purposes of protective action recommendations, it cannot be used to determine protective actions.

b) Radiological Samples

Field team isotopic sample results from a known location are directly related to centerline doses for each downwind distance by X/Q ratios. Downwind centerline dose rate and dose are determined as follows:

$$\text{Dose Rate}_x = \sum_i Concentration_i \times DCF_i \times \frac{\left(\frac{X}{Q_x}\right)}{\left(\frac{X}{Q_{\text{Field Team}}}\right)}$$

$$\text{Dose}_x = \sum_i Concentration_i \times \left(\frac{-1}{\lambda_i} \times e^{-\lambda_i t} + \frac{1}{\lambda_i}\right) \times DCF_i \times \frac{\left(\frac{X}{Q_x}\right)}{\left(\frac{X}{Q_{\text{Field Team}}}\right)}$$

This method is consistent with the EPA 400 method of assigning dose for purposes of protective action recommendations and can be utilized to determine protective actions.

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

c) Plume Travel

Information is provided for the correlation of field team results with the expected time of release to the environment. The field team downwind distance and wind speed are used to calculate a plume travel time. The travel time is subtracted from the field team survey/sample time to predict an approximate time at which the release relating to the field results occurred. Time is presented on a 24-hour clock and corrects for periods which overlap time zero.

4. Release Point Analysis

The release point analysis method allows for offsite dose assessment using actual isotopic compositions from monitored or unmonitored release pathways.

a) Release Rate Determination

Release rate is determined by multiplying the isotopic concentration by the release path flow rate. Flow rates are entered in SCFM and are internally converted to units of cc/sec.

b) Downwind Dose Rate and Dose

Equations for downwind dose rate and dose are the same as the Monitored Release.

5. Emergency Worker Dose Projection

Emergency worker dose projections are used to allow assessment personnel the capability of comparing an indicated dose reading (from instruments such as self-reading pocket dosimeters) to an actual dose received, either whole body or thyroid. The fundamental assumption which allows comparisons is relationship of the indicated reading to the calculated exposure from immersion in the plume. Indicated (immersion component) to actual (immersion + inhalation components) ratios can then be determined which allow indicated dose levels to be established relative to a desired actual dose limit. The same principal can also be applied to thyroid dose to allow evaluation of indicated versus thyroid exposure for situations in which the thyroid dose is the limiting exposure pathway.

The first step in developing the relationship is to determine the source term fractions for each isotope considered in the plume. Section A of this Attachment describes the equation used to determine the isotopic source term available for release. The time component in the decay term is the time since Reactor shutdown at which the exposure period begins. A respiratory protection factor can be applied to non-noble gas isotopes if desired. The source term fractions are calculated by dividing the individual source activities by the sum of all source activities as follows:

$$\textbf{Source Term}_{j\ \textbf{fraction}} = \textbf{Source Term}_j / \Sigma\ \textbf{Source Term}_j$$

DESCRIPTION OF DAPAR OPTIONS AND OPERATIONAL FEATURES (Continued)

The source term fractions are then multiplied by the dose correction factors of EPA 400 for immersion, inhalation, and thyroid. The summations of those calculated exposure pathway values can then be compared to each other to determine an instantaneous ratio of indicated versus actual and indicated versus thyroid exposures.

$$\text{Exposure Pathway Value} = \Sigma \text{ Source Term}_{i \text{ fraction}} * DCF_i$$

$$\text{Indicated} = EPV_{immersion} / EPV_{immersion}$$

$$\text{Actual} = EPV_{immersion + inhalation} / EPV_{immersion}$$

$$\text{Thyroid} = EPV_{thyroid} / EPV_{immersion}$$

An instantaneous ratio will give assessment personnel a useful tool for determining the magnitude of the difference in indicated versus actual and thyroid exposures. These ratios however have important limitations and should only be used with caution. If short lived isotopes are present and the exposure period is long compared to the isotopic half-lives the ratios will change. For this reason additional calculation abilities have been developed to allow time integrated dose estimations which account for decay of short lived isotopes during the exposure period.

For a given survey reading taken at the location of exposure, a correction factor can be determined which relates the immersion exposure pathway value to the indicated dose rate. By multiplying this correction factor by the previously developed isotopic source term fractions, a projected isotopic concentration can be determined.

Time integrated indicated, actual, and thyroid dose can then be calculated for a given exposure period as follows:

$$\text{Exposure Pathway Dose} = \sum Concentration_i \times DCF_i \times \left(\frac{-1}{\lambda_i} \times e^{-\lambda_i t} + \frac{1}{\lambda_i} \right)$$

It is also possible to determine an exposure period and indicated dose based on a given actual or thyroid dose using the methodology described above.

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-400	Protective Action Recommendations
EP-IP-410	Evacuation/Assembly
EP-IP-520	Recovery

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)/Step(s)
NRC Inspection Finding 84-41-05	Provide guidance for protective action recommendations during adverse weather conditions.	Incorporated within DAPAR
PR97.2381.02	Account for seabreeze effects	Incorporated within DAPAR