List of Current Procedures

Procedure	Procedure Title	Revision Number
000 Series	Organization	
A.2-001	Emergency Organization	0
100 Series	Activation	
A.2-101	Classification of Emergencies	0
A.2-102	Notification of an Unusual Event	0
A.2-103	Alert	0
A.2-104	Site Area Emergency	0
A.2-105	General Emergency	0
A.2-106	Activation of Technical Support Center	0
A.2-107	Activation of Operations Support Center	0
200 Series	Assessment	
A.2-201	Onsite Monitoring During an Emergency	0
A.2-202	Offsite Monitoring During and Emergency	0
A.2-203	Evacuation Criteria for Onsite Personnel	0
A.2-204	Offsite Protective Action Recommendations	0
A.2-205	Personnel Accountability-Control Room/TSC	0
A.2-206	Personnel Accountability-Assembly Points	0
300 Series	Protective Actions	
A.2-301	Emergency Evacuation	0
A.2-302	Assembly Point Activation	0
A.2-303	Search and Rescue	0
A.2-304	Thyroid Prophylaxis	0
400 Series	Radiological Surveillance and Control	
A.2-401	Emergency Exposure Control	0
A.2-402	Contamination Control	0
A.2-403	Emergency Surveys	0
A.2-404	Emergency Sampling and Analysis	0
A.2-405	Release Rate Determination	0
A.2-406	Offsite Dose Projection	1
A.2-407	Personnel and Vehicle Monitoring	0
A.2-408	Sample Coordination During an Emergency	0
500 Series	Communications and Documentation	
A.2-501	Communication During an Emergency	0
A.2-502	Recordkeeping During an Emergency	0
A.2-503	Emergency Reports and Documentation	0
600 Series	Re-Entry and Recovery	
A.2-601	Re-entry	0
A.2-602	Transition to Recovery Plan	0
700 Series		
A.2-702	Response to an Emergency at Prairie Island	0

Op. Com. Rev. Req'd.	Yes X	No
Q.A. Review Req'd.	Yes	No X
ALARA Review Req'd.	Yes	No X

OFF-SITE DOSE PROJECTION

A.2-406

REVIEW AND APPROVAL

Prepared by: K. Nolan ALARA Review: Revision 0 Date 3/29/81

Reviewed by: [signature] Q.A. Review: Revision 0 Date 3/29/81

Operations Committee Final Review: Meeting Number 958 Date 4/29/81

Approved by: [signature] Date 29APR81

Op. Com. Results Review: Not Required Mtg.# 949 Date 3/26/81

PURPOSE

The purpose of this procedure is to provide guidance and instructions for estimating off-site doses resulting from an unplanned and/or abnormal airborne release of radioactive material. The main body of this procedure identifies criteria and guidelines for dose projection, such as when it is required, how often it should be performed, and which dose projection method to use. The attachments to this procedure provide instructions for performing dose projection using the various methods. Alternate methods are provided to cover possible contingencies such as offscale monitors, inoperative instrumentation, etc.

CONDITIONS AND PREREQUISITES

A. An emergency condition has been declared at Monticello Nuclear Generating Plant as provided in the Emergency Plan.

B. An airborne release of radioactive materials in excess of environmental technical specifications has occurred, is suspected to have occurred, or is imminent.

PRECAUTIONS

Precautions are verified in the text of the applicable attachment(s).

RESPONSIBLE INDIVIDUAL

Radiation Protection Specialist

DISCUSSION

A. General Applicability

The region surrounding the plant site is divided into sixteen 22 1/2 degree sectors. The regions of interest extend from the effluent release points out to fifty miles in each sector. Contained within the regions of interest are three special locations of interest. The special locations are the site

boundary, the nearest receptor and the Low Population Zone outer boundary. The site boundary and the nearest receptor locations differ for each sector. The L.P.Z. outer boundary locations coincide with the one mile distance from the plant.

B. Dose Projection Methods

This procedure provides 3 different calculational methods for performing dose projections. The method(s) used will depend on the availability of release and meteorology information and the operability of computers. They appear as attachments to this procedure with Attachment 1 being the most preferred method and Attachment 3 being the least preferred.

1. Dose Projection By Computer (MODCOM)

The Monticello Off-Site Dose Computation System (MODCOM) is a computerized atmospheric dispersion and radiological dose assessment software system. The system is specific for the Monticello Nuclear Generating Plant and is structured in the form of an executive main program (MODCOM) and several subprograms. The software system is coded in a high level interpretive language called C.L.A.S.S.. The software runs on a Digital Equipment Corporation PDP-11/05 computer system which is located at the plant site. The software system uses methodology similiar to that prescribed in U.S. NRC Regulatory Guide 1.145, August, 1979 for the calculation of the atmospheric dispersion parameters.

Data required for input to the software system are: (1) meteorlogical information acquired from the meteorological tower (MET Tower) S.E.D.A.R. computer system, and, (2) plant stack and R.B. ventilation radioactive airborne effluents release rate information acquired from effluents monitors or dose rate readings converted to release rates. Wind direction data is used to determine the correct sector. Wind speed data is used to determine the plume dispersion parameters and maximum plume distance. Temperature difference values are used to determine the plume dispersion parameters. The plume is assumed to completely fill the sector in which it is located.

Release rate data is combined with dispersion data to yield dose rate data. The release rate data is input in the form of μCi/sec for noble gases and iodines for the plant stack and Reactor Building ventilation release points. Whole body, skin, and thyroid dose factors as well as default nuclide concentration ratios are contained in system mass storage files for use in calculating dose rates. Data is accumulated into the program at 15 minute intervals. The program computes dose rates at the site boundary, the nearest receptor, and out to the maximum plume distance which may be anywhere from one mile to 10 miles in one mile increments or 15, 20, 30, 40 and 50 miles.

The dose rate values are reported in mrem/hour. The dose rate values are multiplied by 0.25 to convert them to an accumulated dose for that 15 minute period. The dose values are then stored according to sector for the whole body, skin, and thyroid. During the course of an accident, dose values are accumulated in several sectors, as the stack plume and R.B. vents plume are sometimes not in the same sector, and wind direction shifts will cause the

accumulated doses to be placed into several different sectors over a period of time. Accumulated dose information may be extracted from storage and read out according to sector, or a specific distance from the plant for all sectors. Accumulated dose information is reported in "mrem".
NOTE: Thyroid doses are calculated for the adult thyroid.

Subprogram CALDOS (Option 1): The CALDOS subprogram accepts meteorological tower data and effluents release data and calculates dose rates at various locations. Radioactive effluents release data are automatically corrected for decay during the course of an accident, but not for the time spent traveling in a plume after leaving the plant site.

Subprogram LSTSEC (Option 2): The LSTSEC subprogram extracts data from computer mass storage and reports accumulated dose values in any sector desired. The accumulated dose values are reported in mrem.

Subprogram FINDHI (Option 3): The subprogram FINDHI searches the computer mass storage files and reports which sector contains the highest whole body dose, the highest skin dose, and the highest thyroid dose. FINDHI also compares all the sector dose values to predetermined limits and reports in which sectors the maximum dose exceeded the predetermined limit for whole body doses and thyroid doses.

2. Dose Projection By Hand Calculation Based On Known Release Rate

This method projects whole body and thyroid doses resulting from a known release rate. Correction factors are provided for noble gases and iodines to adjust for elapsed time.

3. Dose Projection By Hand Calculation Based On FSAR Accident Analysis

This method calculates the whole body and thyroid doses in the event that no specific release data is readily available. The method is based upon FSAR Accident Analysis. Since it is unlikely that the actual accident parameters will be the same as the accident analysis assumptions, this method is, at best, conservative.

PROCEDURE

STEP 1: In the event of a known or suspected release of airborne radioactive materials, greater than MNGP Technical Specifications, immediately take actions to ascertain if a release did in fact take place (or will take place imminently). If a release did or will take place, proceed with the remaining steps of this procedure.

STEP 2: Determine the appropriate magnitude of the release using available monitors or procedure A.2-405 (Release Rate Determinations). Further dose projection should be performed based on this preliminary estimate and the following criteria:

a. For all monitored releases in the NUE classification, dose projections in accordance with this procedure need not be performed as a general rule, due to the minimal off-site significance of such releases. Post-event evaluation of off-site doses for releases in the NUE classification may be

necessary to comply with environmental technical specifications. In such cases, the off-site doses may be calculated using the methodology contained in the MNGP Off-Site Dose Calculation Manual (ODCM).

b. For all other releases, dose projection shall be performed.

STEP 3: Based on the known parameters about the incident and the availability of data and time, choose the most advantageous dose projection method. Use the "Discussion" section of this procedure for guidance as necessary. Go to the appropriate attachment of this procedure.

STEP 4: Ensure that all calculations are documented on supplied worksheets and/or computer printout. Ensure that the date and time appear on all worksheets.

STEP 5: Discontinue dose projection activities with the concurrence of the Radiological Emergency Coordinator when:

a. The release has been terminated and no further release is expected, and

b. The emergency condition has been terminated or downgraded by the Emergency Director.

STEP 6: Complete Form 5790-406-3, OFF-SITE DOSE PROJECTION CHECKLIST (Attachment 6).

REFERENCES

1. Monticello Nuclear Generating Plant Emergency Plan

2. Monticello Nuclear Generating Plant Offsite Dose Calculations Manual

3. NUREG-0654/FEMA-REP-1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants"

ATTACHMENTS

1. Dose Projection by Computer (MODCOM)
2. Dose Projection by Hand Calculation Based on Known Release Rate
3. Example of Off-Site Dose Rate Projection Worksheet-Know Release Rate
4. Dose Projection by Hand Calculation Based on FSAR Accident Analysis
5. Example of Off-Site Dose Projection Worksheet-FSAR Accident Analysis
6. Example of Off-Site Dose Projection Checklist
7. Determination of Meteorological Data Using Instrumentation Available in the Control Room

ATTACHMENT 1

Page 1 of 4

DOSE PROJECTION BY COMPUTER (MODCOM)

PREREQUISITES

Move the LA-36 terminal from the Body Burden Analyzer Room as follows:

1. Proceed to the Chemistry Count Room and place the computer system in the timesharing mode (RUN TSGO).

2. Proceed to the Body Burden Analyzer Room and perform the following behind the LA-36 terminal:

   a. Disconnect the cable labeled "LA-36" from the cable labeled "computer".

   b. Connect the cable labeled "computer" to the cable labeled "Tech. Supp. Center".

   c. Unplug the LA-36 terminal from the 120 VAC line.

3. Carry the LA-36 terminal to a predesignated position in the Technical Support Center.

4. Connect the cable labeled "LA-36" to the cable labeled "computer" and plug the LA-36 terminal into the 120 VAC line.

5. Turn on the MET Tower Data Terminal and the Plant Computer CRTs, if this has not already been done. Release and meteorological data must be available for this method.

PROCEDURE

STEP 1: Turn on printer and depress the "300 BAUD" button. Ensure that the terminal is on line. The terminal will print:

TSX Version CI07E (Date-Time)

STEP 2: Type in "RUN CLASS" and press carriage return. The terminal will respond with:

CLASS V04.24-RT
(DATE)

STEP 3. Type in "RUN MODCOM" and press carriage return. The terminal will respond with:

INITIAL EVALUATION ? :

ATTACHMENT 1 (Cont'd.)

Page 2 of 4

STEP 4: Respond as follows.

a. If this is the initial evaluation, type in "Y" and press carriage return. The terminal will respond with a list of the available options in the MODCOM program ending with:

PLEASE ENTER THE OPTION YOU DESIRE:

CAUTION: Do not respond with "Y" unless this is the first post-release execution of this procedure, as all stored data will be lost.

b. If this is a subsequent evaluation, type in "N" and press carriage return. The terminal will respond with:

PLEASE ENTER THE OPTION YOU DESIRED:

STEP 5: Select one of the following options:

OPTION	DESCRIPTION
1	PERFORM TYPICAL 15 MIN. DOSE RATE CALCULATION
2	LIST ACCUMULATED DOSES FOR ANY SECTOR (A-R)
3	SEARCH ALL SECTORS FOR HIGHEST DOSE AND REPORT DOSE DATA

and proceed to the appropriate portion of this procedure.

NOTE: Option 1 should be used unless specific information available through one of the other options is sought.

STEP 6: PERFORM TYPICAL 15 MIN. DOSE RATE CALCULATION:

a. Type in "1" and press carriage return. The terminal will respond by requesting that you enter current date information. Type in this information as it is requested. The terminal will then respond with:

PLEASE ENTER THE FOLLOWING METEOROLOGICAL DATA FROM
THE SEDAR COMPUTER PRINTOUT:

NOTE: If the meteorological tower data is unavailable, wind speed, direction and stability class can be obtained from Control Room Instrumentation at Panel C-20. See Attachment 7 of this procedure.

ATTACHMENT 1 (Cont'd.)

and proceed to request specific numerical information. Obtain this information from the Met Tower Data Terminal and type it in as requested. The terminal will respond with:

PLEASE ENTER THE FOLLOWING EFFLUENTS RELEASE RATE DATA:

and proceed to request specific numerical information. Obtain this information from the Plant Computer CRTs and type it in as requested.

b. The terminal will respond with a printout of off-site dose projections for the affected sector(s) from the Site Boundary to a distance of 50 miles. Communicate this information to the Radiological Emergency Coordinator.

c. The terminal will then print:

PLEASE ENTER THE OPTION YOU DESIRE:

d. Type in the option number per STEP 5 or STEP 9.

NOTE: MET data is updated every 15 minutes and that should be the frequency with which Option 1 is run during an emergency condition with an airborne release. You should continue to update dose rate data every 15 minutes until the Radiological Emergency Coordinator directs otherwise.

STEP 7: LIST ACCUMULATED DOSES FOR ANY SECTOR

a. Type in "2" and press carriage return. The terminal will respond with:

ENTER THE SECTOR (A-R) FOR WHICH YOU WANT THE ACCUMULATED DOSES REPORTED.

SECTOR:

b. Type in the sector letter (A-R). The terminal will respond with a printout of the accumulated doses for the affected sector from the Site Boundary to a distance of 50 miles. Communicate this information to the Radiological Emergency Coordinator.

c. The terminal will then print:

PLEASE ENTER THE OPTION YOU DESIRE:

ATTACHMENT 1 (Cont'd.)

d. Type in the option number per STEP 5 or STEP 9.

STEP 8: SEARCH ALL SECTORS FOR HIGHEST DOSE AND REPORT DOSE DATA

a. Type in "3" and press carriage return. The terminal will respond with a printout of the accumulated dose values to the highest sector(s) as well as a list of the sectors where accumulated whole body or thyroid doses exceeded pre-programmed limits. Communicate this information to the Radiological Emergency Coordinator.

b. The terminal will then print:

PLEASE ENTER THE OPTION YOU DESIRE:

c. Type in the option numbers per STEP 5 or STEP 9.

STEP 9: Should it be desirable to cease dose projection activities for extended periods of time (with the concurrence of the Radiological Emergency Coordinator), when the terminal prints:

PLEASE ENTER THE OPTION YOU DESIRE:

Type in "8" and press carriage return. You may subsequently re-enter the program by typing in "RUN MODCOM".

STEP 10 Upon receiving instructions from the Radiological Emergency Coordinator to secure from dose projection activities, turn off all equipment and ensure that all data is appropriately filed. Return to STEP 4 of the main procedure.

ATTACHMENT 2

DOSE PROJECTION BY HAND CALCULATION
BASED ON KNOWN RELEASE RATE

EQUIPMENT REQUIRED

1. X/Q Catalog (TSC)
2. Calculator (with scientific notation capability)
3. Supply of OFF-SITE DOSE RATE PROJECTION WORKSHEET-KNOWN RELEASE RATE Forms (TSC), Form 5790-406-1 (Attachment 3)

PROCEDURE

STEP 1: In the INPUT DATA section of the worksheet, enter the date and time for which this projection will be made.

STEP 2: Enter the TIME AFTER REACTOR TRIP value. This is the elapsed time from the reactor trip to the time recorded in STEP 1. If there has not been a reactor trip, enter ZERO.

STEP 3: Determine the necessary meteorological parameters and record as indicated on the worksheet. This data should be taken from the meteorological tower printer in the Technical Support Center. If the printer is unavailable, an individual may be stationed at the meteorological tower to relay the information via the telephone

DELETED

a. RB Vent Stability Class - Divide the value for DT1 by 100, paying attention to whether the value is positive or negative. Use the result to enter Table I. Record the class designation.

b. Stack Stability Class - Divide the value for DT2 by 100, paying attention to whether the value is positive or negative. Use the result to enter Table I. Record the class designation.

c. RB Vent Windspeed - Record the windspeed at the 33 feet level (use 1 mph when indication is zero).

d. Stack Windspeed - record the windspeed at the 330 feet level (use 1 mph when indication is zero).

e. Stack Wind Direction - Record the wind direction at the 300 feet level. (If value is greater than 360, subtract 360 before recording.)

NOTE: If meteorological tower data is unavailable, windspeed, wind direction and stability class can be obtained from Control Room instrumentation at Panel C-20. See Attachment 7 of this procedure.

ATTACHMENT 2 (Cont'd.)

TABLE I

Stability Class	RB Vent (DT1/100)	Stack (DT2/100)
A*	Less than -0.62	Less than -1.71
B	-0.62 to -0.56	-1.71 to -1.53
C	-0.55 to -0.49	-1.52 to -1.35
D	-0.48 to -0.16	-1.34 to -0.45
E	-0.15 to +0.49	-0.44 to +1.35
F	+0.50 to +1.31	+1.36 to +3.60
G**	Greater than +1.31	Greater than +3.60

* Use Stability Class B (A not analyzed)

** Stability Class G is not to be used. (Ref: Letter of 3/9/81 from certified consulting meteorologist to Bert Clark.) Use Class F when G is indicated.

STEP 4: Determine and record the SECTOR designation (A-R). Use the 330 feet wind direction and Table II to find the letter designation for the area directly downwind from the plant.

NOTE: If the wind speed indicates zero, use Sector designation "L" (most critical sector based on nearest receptor).

TABLE II

Wind Direction (degrees from)	Sector
168.75 to 191.25	A
191.25 to 213.75	B
213.75 to 236.25	C
236.25 to 258.75	D
258.75 to 281.25	E
281.25 to 303.75	F
303.75 to 326.25	G
326.25 to 348.75	H
348.75 to 11.25	J
11.25 to 33.75	K
33.75 to 56.25	L
56.25 to 78.75	M
78.75 to 101.25	N
101.25 to 123.75	P
123.75 to 146.25	Q
146.25 to 168.75	R

STEP 5: From the X/Q Catalog, select and record the X/Q values as required. Part One of the Catalog is divided into sectors and contains the values for Stack releases and Vent releases to the Site Boundary and nearest receptor. Part two contains the values for other Vent releases (which values are independent of sector designation). Use the fumigation X/Q value for one hour after sunrise. (This is a conservative approach.)

ATTACHMENT 2 (Cont'd.)

Page 3 of 3

STEP 6: From Table III, determine and record the Noble Gases Factor and the Iodines Factor as appropriate for the elapsed time value previously recorded.

TABLE III

Elapsed Time (Hours) From	To	Noble Gases Factor	Iodines Factor
0.00	0.50	6.49E-01	1.14E-05
0.50	1.00	5.48E-01	1.29E-05
1.00	2.00	4.06E-01	1.43E-05
2.00	4.00	3.43E-01	1.66E-05
4.00	8.00	2.93E-01	1.97E-05
8.00	16.00	1.65E-01	2.37E-05
16.00	24.00	8.70E-02	2.92E-05
24.00	48.00	6.10E-02	3.36E-05
48.00	96.00	3.90E-02	4.34E-05
96.00	168.00	3.30E-02	5.39E-05
168.00	336.00	3.30E-02	5.79E-05
336.00	720.00	3.20E-02	5.87E-05
720.00	1440.00	2.60E-02	5.87E-05
1440.00	Beyond	3.60E-03	5.87E-05

STEP 7: Record the release rates (μCi/sec) for the gas and iodine portions of the stack and vent effluents. The gas portion release rates may be obtained directly from effluent monitor readings. If direct monitor readings are unavailable, obtain release rates from procedure A.2-425 (Release Rate Determination). The iodine portions will be determined by Radiation Protection Group personnel through actual samples. If sample analysis data is not available, record "not available".

STEP 8: Using the values recorded in the INPUT DATA section, complete calculations for the Site Boundary, Nearest Receptor, and 1 mile, as required.

NOTE: If actual data is not available for iodine release rate, estimate dose rates to the thyroid by applying a factor of 6E-07 to the whole-body dose rate as calculated by this procedure.[1]

STEP 9: If calculations for additional locations are required, select the appropriate X/Q values and complete the calculations in the spaces provided for LOCATION OF INTEREST.

STEP 10 Upon receiving instructions from the Radiological Emergency Coordinator to secure from dose projection activities, return to STEP 4 of the main procedure.

1/ This factor is taken from EPA-520/1-75-001. The calculation is based assumption that the ratio of iodines to noble gases in the mixture available for release is 0.4.

ATTACHMENT 3

Form 5790-406-1, Rev. 0, 03/12/81
Page 1 of 2

Example of
OFF-SITE DOSE RATE PROJECTION WORKSHEET - KNOWN RELEASE RATE
(For Use With Procedure A.2-406, Attachment 2)

INPUT DATA

Time _____ Date _____
Time After Reactor Trip _____ hours
Stability Class: RB Vent _____ Stack _____
Windspeed: RB Vent _____ mph Stack _____ mph
Wind Direction: _____ Sector _____

X/Q Values: RB Vent - Site Boundary _____ (AA)
- Nearest Receptor _____ (BB)
- LPZ Outer Boundary _____ (CC)

Stack - Site Boundary _____ (DD)
- Nearest Receptor _____ (EE)
- LPZ Outer Boundary (1 mile) _____ (FF)

- Noble Gases Factor _____ (GG)
- Iodines Factor _____ (HH)

Release Rates: RB Vent - Gas _____ (JJ)
(μCi/sec) - Iodines _____ (KK)

Stack - Gas _____ (LL)
- Iodines _____ (MM)

FORMAT OF DATA FROM MET TOWER

DAYTIME	33' WS	140' WS	330' WS	33' WD	140' WD	330' WD	33' TEMP	DT1 140	DT2 330	DEW PNT	RAIN	RN	ACOF	DVI

ATTACHMENT 3 (Cont'd.)

Form 5790-406-1, Rev. 0, 03/12/81
Page 2 of 2

Example of
OFF-SITE DOSE RATE PROJECTION WORKSHEET - KNOWN RELEASE RATE (Cont'd.)

CALCULATIONS

1. Site Boundary

GG x [(AA x JJ) + (DD x LL)] = _____ Whole Body-mrem/hour
HH x [(AA x KK) + (DD x MM)] = _____ Thyroid-mrem/hour (adult)

2. Nearest Receptor

GG x [(BB x JJ) + (EE x LL)] = _____ Whole Body-mrem/hour
HH x [(BB x KK) + (EE x MM)] = _____ Thyroid-mrem/hour (adult)

3. LPZ Outer Boundary (1 mile)

GG x [(CC x JJ) + (FF x LL)] = _____ Whole Body-mrem/hour
HH x [(CC x KK) + (FF x MM)] = _____ Thyroid-mrem/hour (adult)

4. Location of Interest

RB Vent X/Q at Location of Interest _____ (NN)
Stack X/Z at Location of Interest _____ (PP)
GG x [(NN x JJ) + (PP x LL)] = _____ Whole Body-mrem/hour
HH x [(NN x KK) + (PP x MM)] = _____ Thyroid-mrem/hour (adult)

5. Location of Interest

RB Vent X/Q at Location of Interest _____ (NN)
Stack X/Q at Location of Interest _____ (PP)
GG x [(NN x JJ) + (PP x LL)] = _____ Whole Body-mrem/hour
HH x [(NN x KK) + (PP x MM)] = _____ Thyroid-mrem/hour (adult)

6. Location of Interest

RB Vent X/Q at Location of Interest _____ (NN)
Stack X/Q at Location of Interest _____ (PP)
GG x [(NN x JJ) + (PP x LL)] = _____ Whole Body-mrem/hour
HH x [(NN x KK) + (PP x MM)] = _____ Thyroid-mrem/hour (adult)

REVIEW AND APPROVAL

Completed by: _____ / _____ Date: _____

Reviewed by: _____ Date: _____
Rad. Emerg. Coordinator

NOTE: After this checklist is completed and is not required for immediate use, it shall be placed in the appropriate container provided for Emergency Records.

EMPROC3G

ATTACHMENT 4

DOSE PROJECTION BY HAND CALCULATION
BASED ON FSAR ACCIDENT ANALYSIS

EQUIPMENT REQUIRED

1. Calculator - if available
2. Supply of OFF-SITE DOSE PROJECTION WORKSHEET - FSAR ACCIDENT ANALYSIS FORMS (TSC)

PROCEDURE

STEP 1: Enter the date and time for which this projection is being made.

STEP 2: Determine the necessary meteorological parameters and record as indicated on the worksheet. This data should be taken from the meteorological tower printer in the Technical Support Center. If the printer is unavailable, an individual may be stationed at the meteorological tower to relay the information via telephone.

DELETED

a. Stack Stability Class - Divide the value for DT2 by 100, paying attention to whether the value is positive or negative. Use the result to enter Table I. Record the class designation.

b. Stack Windspeed - Record the windspeed at the 330 feet level (use 1 mph when indication is zero). Convert to meters per second as indicated on the worksheet.

c. Stack Wind Direction - Record the wind direction at the 330 feet level. (If value is greater than 360, subtract 360 before recording.)

NOTE: If meteorological tower data is unavailable, windspeed, wind direction and stability class data can be obtained from Control Room instrumentation, at Panel C-20. See Attachment 7 of this procedure.

TABLE I

Stability Class	Stack (DT2/100)
A*	Less than -1.71
B	-1.71 to -1.53
C	-1.52 to -1.35
D	-1.34 to -0.45
E	-0.44 to +1.35
F	+1.36 to +3.60
G**	Greater than +3.60

* Use Stability Class B (A not analyzed)
** Use Stability Class F (Ref: Letter of 3/9/81 from certified consulting meteorologist to Bert Clark.)

ATTACHMENT 4 (Cont'd.)

STEP 3: Determine and record the SECTOR designation (A-R). Use the 330 feet wind direction and Table II to find the letter designation for the area directly downwind from the plant.

NOTE: If the wind speed indicates zero, use Sector designation "L" (most critical sector based on nearest receptor).

TABLE II

Wind Direction	Sector
168.75 to 191.25	A
191.25 to 213.75	B
213.75 to 236.25	C
236.25 to 258.75	D
258.75 to 281.25	E
281.25 to 303.75	F
303.75 to 326.25	G
326.25 to 348.75	H
348.75 to 11.25	J
11.25 to 33.75	K
33.75 to 56.25	L
56.25 to 78.75	M
78.75 to 101.25	N
101.25 to 123.75	P
123.75 to 146.25	Q
146.25 to 168.75	R

STEP 4: After the Stability Class has been determined, use the appropriate table (Tables III through VI) for dose projections. Note that four accidents are analyzed. If the accident is unknown or not one of the four, use Table VI (Steam Line Break Accident). Enter the dose projections on the worksheet. Note the Table used.

STEP 5: Upon receiving instructions from the Radiological Emergency Coordinator to secure from dose projection activities, return to STEP 4 of the main procedure.

ATTACHMENT 4 (Cont'd.)

TABLE III

RADIOLOGICAL EFFECTS OF THE CONTROL ROD DROP ACCIDENT

First 2-Hour Dose

Distance Miles	G	F	E	D	C	B
1/3	7.2×10^{-3}	4.8×10^{-3}	4.8×10^{-3}	1.4×10^{-3}	4.8×10^{-3}	1.5×10^{-3}
1	4.4×10^{-3}	2.4×10^{-3}	2.8×10^{-3}	1.1×10^{-3}	1.7×10^{-3}	6.8×10^{-4}
3	2.0×10^{-3}	1.2×10^{-3}	1.1×10^{-3}	4.2×10^{-4}	3.8×10^{-4}	1.6×10^{-4}
5	1.2×10^{-3}	8.4×10^{-4}	5.9×10^{-4}	2.2×10^{-4}	1.6×10^{-4}	7.9×10^{-5}
10	6.2×10^{-4}	4.4×10^{-4}	1.7×10^{-4}	8.6×10^{-5}	4.2×10^{-5}	2.8×10^{-5}
Lifetime Thyroid Dose (rem)						
1/3	a	a	3.4×10^{-7}	1.7×10^{-3}	9.4×10^{-5}	2.8×10^{-5}
1	a	2.0×10^{-7}	7.4×10^{-5}	2.0×10^{-5}	5.6×10^{-5}	2.2×10^{-5}
3	a	9.8×10^{-6}	3.6×10^{-5}	1.4×10^{-5}	1.2×10^{-5}	5.0×10^{-6}
5	a	1.8×10^{-5}	1.9×10^{-5}	7.9×10^{-6}	6.2×10^{-6}	2.4×10^{-6}
10	3.2×10^{-9}	2.2×10^{-5}	7.4×10^{-6}	3.0×10^{-6}	2.2×10^{-6}	8.6×10^{-7}

Total Dose

Distance Miles	G	F	E	D	C	B
Passing Cloud Whole Body Dose (rem)						
1/3	7.4×10^{-3}	5.0×10^{-3}	5.2×10^{-3}	1.5×10^{-3}	5.0×10^{-3}	1.6×10^{-3}
1	4.6×10^{-3}	2.6×10^{-3}	3.0×10^{-3}	1.1×10^{-3}	1.8×10^{-3}	7.2×10^{-4}
3	2.2×10^{-3}	1.3×10^{-3}	1.2×10^{-3}	4.6×10^{-4}	4.0×10^{-4}	1.7×10^{-4}
5	1.3×10^{-3}	9.0×10^{-4}	6.0×10^{-4}	2.4×10^{-4}	1.6×10^{-4}	8.2×10^{-5}
10	6.6×10^{-4}	4.6×10^{-4}	1.8×10^{-4}	9.0×10^{-5}	4.6×10^{-5}	2.8×10^{-5}
Lifetime Thyroid Dose (rem)						
1/3	a	a	1.2×10^{-6}	6.2×10^{-9}	3.4×10^{-4}	1.0×10^{-4}
1	a	7.4×10^{-7}	2.8×10^{-4}	7.4×10^{-5}	2.0×10^{-4}	8.2×10^{-5}
3	a	3.6×10^{-5}	1.3×10^{-4}	5.4×10^{-5}	4.6×10^{-5}	1.8×10^{-5}
5	a	6.6×10^{-5}	7.0×10^{-5}	2.8×10^{-5}	2.2×10^{-5}	8.6×10^{-6}
10	1.1×10^{-8}	7.6×10^{-5}	2.6×10^{-5}	1.1×10^{-6}	8.2×10^{-6}	3.0×10^{-6}

The symbol "a" means less than 1×10^{-10}.

ATTACHMENT 4 (Cont'd.)

Page 4 of 6

TABLE IV

RADIOLOGICAL EFFECTS OF THE LOSS OF COOLANT ACCIDENT

First 2-Hour Dose

Distance Miles	G	F	E	D	C	B
Passing Cloud Whole Body Dose (rem)						
1/3	1.7×10^{-5}	1.1×10^{-5}	1.1×10^{-5}	3.4×10^{-6}	1.1×10^{-5}	3.8×10^{-6}
1	1.0×10^{-5}	5.8×10^{-6}	6.8×10^{-6}	2.6×10^{-6}	4.0×10^{-6}	1.6×10^{-6}
3	4.8×10^{-6}	3.0×10^{-6}	2.8×10^{-6}	1.0×10^{-6}	8.8×10^{-7}	4.0×10^{-7}
5	3.0×10^{-6}	2.0×10^{-6}	1.3×10^{-6}	5.4×10^{-7}	3.8×10^{-7}	1.8×10^{-7}
10	1.5×10^{-6}	1.0×10^{-6}	4.2×10^{-7}	2.0×10^{-7}	1.0×10^{-7}	6.4×10^{-8}
Lifetime Thyroid Dose (Rem)						
1/3	a	a	4.4×10^{-9}	a	1.3×10^{-6}	4.0×10^{-7}
1	a	2.8×10^{-9}	1.0×10^{-6}	2.8×10^{-7}	8.2×10^{-7}	3.4×10^{-7}
3	a	1.3×10^{-7}	5.2×10^{-7}	2.0×10^{-7}	1.8×10^{-7}	7.0×10^{-8}
5	a	2.4×10^{-7}	2.6×10^{-7}	1.1×10^{-7}	8.6×10^{-8}	3.2×10^{-8}
10	4.4×10^{-9}	3.0×10^{-7}	1.0×10^{-7}	4.2×10^{-8}	3.2×10^{-8}	1.1×10^{-8}

Total Dose

Distance Miles	G	F	E	D	C	B
Passing Cloud Whole Body Dose (Rem)						
1/3	5.8×10^{-4}	4.0×10^{-4}	4.0×10^{-4}	1.2×10^{-4}	4.0×10^{-4}	1.3×10^{-4}
1	3.6×10^{-4}	2.0×10^{-4}	2.4×10^{-4}	9.0×10^{-5}	1.4×10^{-4}	5.6×10^{-5}
3	1.6×10^{-4}	9.6×10^{-5}	1.0×10^{-4}	3.6×10^{-5}	3.2×10^{-5}	1.3×10^{-5}
5	1.0×10^{-4}	6.6×10^{-5}	4.8×10^{-5}	1.9×10^{-5}	1.3×10^{-5}	6.6×10^{-6}
10	5.0×10^{-5}	3.8×10^{-5}	1.4×10^{-5}	7.0×10^{-6}	3.6×10^{-6}	2.2×10^{-6}
Lifetime Thyroid Dose (Rem)						
1/3	a	a	1.8×10^{-7}	9.0×10^{-10}	5.2×10^{-5}	1.5×10^{-5}
1	a	1.1×10^{-7}	4.2×10^{-5}	1.1×10^{-5}	3.2×10^{-5}	1.3×10^{-5}
3	a	5.2×10^{-6}	2.0×10^{-5}	8.6×10^{-6}	7.0×10^{-6}	2.8×10^{-6}
5	a	1.0×10^{-5}	1.0×10^{-5}	4.4×10^{-6}	3.4×10^{-6}	1.3×10^{-6}
10	1.7×10^{-9}	1.1×10^{-5}	4.0×10^{-6}	1.6×10^{-6}	1.2×10^{-6}	4.6×10^{-7}

The symbol "a" means less than 1×10^{-10}

EMPROC3G

ATTACHMENT 4 (Cont'd.)

Page 5 of 6

TABLE V

RADIOLOGICAL EFFECTS OF THE REFUELING ACCIDENT

First 2-Hour Dose

Distance Miles	G	F	E	D	C	B
Passing Cloud Whole Body Dose (rem)						
1/3	1.4×10^{-3}	9.8×10^{-4}	1.0×10^{-3}	3.0×10^{-4}	9.8×10^{-4}	3.2×10^{-4}
1	9.0×10^{-4}	5.0×10^{-4}	6.0×10^{-4}	2.2×10^{-4}	3.4×10^{-4}	1.4×10^{-4}
3	4.0×10^{-4}	2.6×10^{-4}	2.4×10^{-4}	8.8×10^{-5}	7.6×10^{-5}	3.4×10^{-5}
5	2.6×10^{-4}	1.7×10^{-4}	1.2×10^{-4}	4.6×10^{-5}	3.2×10^{-5}	1.6×10^{-5}
10	1.3×10^{-4}	8.8×10^{-5}	3.6×10^{-5}	1.7×10^{-5}	8.8×10^{-6}	5.6×10^{-6}
Lifetime Thyroid Dose (rem)						
1/3	a	a	2.2×10^{-6}	1.0×10^{-8}	6.0×10^{-4}	1.7×10^{-4}
1	a	1.3×10^{-6}	4.8×10^{-4}	1.2×10^{-4}	3.6×10^{-4}	1.4×10^{-4}
3	a	6.2×10^{-5}	3.2×10^{-4}	9.4×10^{-5}	8.2×10^{-5}	3.2×10^{-5}
5	a	1.1×10^{-4}	1.2×10^{-4}	5.0×10^{-5}	4.0×10^{-5}	1.4×10^{-5}
10	2.0×10^{-8}	1.3×10^{-4}	4.6×10^{-5}	1.9×10^{-5}	1.4×10^{-5}	5.4×10^{-6}

Total Dose

	G	F	E	D	C	B
Passing Cloud Whole Body Dose (rem)						
1/3	7.0×10^{-3}	4.6×10^{-3}	4.8×10^{-3}	1.4×10^{-3}	4.6×10^{-3}	1.5×10^{-4}
1	4.4×10^{-3}	2.4×10^{-3}	2.8×10^{-3}	1.0×10^{-3}	1.6×10^{-3}	6.6×10^{-4}
3	1.9×10^{-3}	1.2×10^{-3}	1.2×10^{-3}	4.2×10^{-4}	3.6×10^{-4}	1.6×10^{-4}
5	1.2×10^{-3}	8.2×10^{-4}	5.6×10^{-4}	2.2×10^{-4}	1.5×10^{-4}	7.6×10^{-5}
10	6.0×10^{-4}	4.2×10^{-4}	1.7×10^{-4}	8.2×10^{-5}	4.2×10^{-5}	2.6×10^{-5}
Lifetime Thyroid Dose (rem)						
1/3	a	4.8×10^{-10}	1.4×10^{-5}	7.0×10^{-8}	3.8×10^{-3}	1.1×10^{-3}
1	a	8.4×10^{-6}	3.0×10^{-3}	8.4×10^{-4}	2.4×10^{-3}	9.2×10^{-4}
3	a	4.0×10^{-4}	1.5×10^{-3}	6.0×10^{-4}	5.2×10^{-4}	2.0×10^{-4}
5	a	7.4×10^{-4}	7.8×10^{-4}	3.2×10^{-4}	2.6×10^{-4}	9.6×10^{-5}
10	1.3×10^{-7}	8.6×10^{-4}	3.0×10^{-4}	1.2×10^{-4}	9.4×10^{-5}	3.4×10^{-5}

The symbol "a" means less than 1×10^{-10}.

ATTACHMENT 4 (Cont'd.)

Page 6 of 6

TABLE VI

RADIOLOGICAL EFFECTS OF STEAM LINE BREAK ACCIDENT (TOTAL DOSE)

Distance Miles	G	F	E	D	C	B
Passing Cloud Whole Body Dose (rem)						
1/3	4.3×10^{-3}	4.5×10^{-3}	4.3×10^{-3}	8.5×10^{-4}	2.0×10^{-3}	4.6×10^{-4}
1	3.0×10^{-3}	2.8×10^{-3}	1.9×10^{-3}	3.6×10^{-4}	4.5×10^{-4}	1.2×10^{-4}
3	1.6×10^{-3}	1.3×10^{-3}	4.9×10^{-4}	9.8×10^{-5}	6.7×10^{-5}	2.1×10^{-5}
5	9.8×10^{-4}	7.4×10^{-4}	2.1×10^{-4}	4.5×10^{-5}	2.4×10^{-5}	8.2×10^{-6}
10	4.3×10^{-4}	2.8×10^{-4}	4.9×10^{-5}	1.4×10^{-5}	4.8×10^{-6}	2.2×10^{-6}
Lifetime Thyroid Dose (rem)						
1/3	1.3×10^{-3}	1.6×10^{0}	2.0×10^{0}	4.1×10^{-1}	6.6×10^{-1}	1.7×10^{-1}
1	1.5×10^{-2}	1.0×10^{0}	4.8×10^{-1}	1.42×10^{-1}	8.9×10^{-2}	2.3×10^{-2}
3	9.9×10^{-2}	3.8×10^{-1}	7.3×10^{-2}	2.2×10^{-2}	1.2×10^{-2}	3.1×10^{-3}
5	1.4×10^{-1}	2.0×10^{-1}	2.9×10^{-2}	9.0×10^{-3}	4.7×10^{-3}	1.2×10^{-3}
10	1.3×10^{-1}	7.6×10^{-2}	8.4×10^{-3}	2.6×10^{-3}	1.3×10^{-3}	3.4×10^{-4}

ATTACHMENT 5

Form 5790-406-2, Rev. 0, 03/12/81
Page 1 of 2

Example of
OFF-SITE DOSE PROJECTION WORKSHEET-FSAR ACCIDENT ANALYSIS
(For Use With Procedure A.2-406, Attachment 4)

DATA

Time _____

Date _____

Stack Windspeed _____ mph x 0.447 = _____ m/s

Stack Stability Class _____

Wind Direction _____

Affected Sector(s) _____

DOSE PROJECTIONS

From Table: _____:

WHOLE BODY DOSE

Distance Miles	First 2 Hour Dose (Rem)	Total Dose (Rem)
1/3	_____	_____
1	_____	_____
3	_____	_____
5	_____	_____
10	_____	_____

ATTACHMENT 5 (Cont'd.)

Form 5790-406-2, Rev. 0, 03/12/81
Page 2 of 2

Example of
OFF-SITE DOSE PROJECTION WORKSHEET - FSAR ACCIDENT ANALYSIS (Cont'd.)

LIFETIME THYROID DOSE

Distance Miles	First 2 Hour Dose (Rem)	Total Dose (Rem)
1/3	_____	_____
1	_____	_____
3	_____	_____
5	_____	_____
10	_____	_____

REVIEW AND APPROVAL

Completed by: _____ / _____ Date: _____

Reviewed by: Rad. Emerg. Coord. _____ Date: _____

NOTE: After this checklist is completed and is not required for immediate use, it shall be placed in the appropriate container provided for Emergency Records.

ATTACHMENT 6

Form 5790-406-3, Rev. 0, 03/12/81
Page 1 of 1

Example of
OFF-SITE DOSE PROJECTION CHECKLIST
(For Use With Procedure A.2-406)

1. Release confirmed to have occurred or be imminent.
   Source of release: _____ _____ _____ _____
   Time Date Initial

2. Estimated magnitude of release: _____

   _____ _____ _____ _____
   Time Date Initial

3. Dose projection initiated? (YES / NO) Method selected:
   (Computer/know release rate/FSAR Accident Analysis). _____ _____ _____
   Time Date Initial

4. Dose projection discontinued: _____ _____; Reason: _____
   Time Date

   _____. _____
   Initial

Performed by: _____

Completed. Time: _____ Date _____

Reviewed: _____ Date: _____
Radiological Emergency Coordinator

NOTE: After this checklist is completed and is not required for immediate use, it shall be placed in the appropriate container provided for Emergency Records.

ATTACHMENT 7

Determination of Meteorological Data Using Instrumentation Available In The Control Room

In the event the Met Tower data is not available, either from the printer at the TSC, or from the recorders at the Met Tower, the wind speed, direction and stability class can be determined from the instrumentation in the Control Room. In this event, only one set of data (speed, direction and stability) is available, and is to be used for both reactor building and stack releases.

STEP 1: Read wind speed and direction off wind speed recorder on CO-20. Use the average wind speed and direction from the past 15 minutes - visual observation.

STEP 2: Determine the stability class using the STABILITY CLASS INDICATOR located in the back of panel C20. For the first reading, verify the instrument is properly set up by performing the following:

a. Verify the SIGMA thumbwheel switch is set at 15.

b. Verify the SYNCHRO-DC switch is set at 0-100.

c. Verify the A/C - D/C switch of the Fluke Multimeter is in the AC position (pushbutton in).

d. Verify the 200 mv range is selected.

e. Turn the power switch of the Fluke 8020A Multimeter to ON (green switch on left side of instrument).

f. Read the scale of the multimeter (units are mv).

g. Determine stability class by using the following table:

Multimeter Reading	Stability Class
$\geq$ 22.5 mv	A (extremely unstable) NOTE 1
< 22.5 mv to $\geq$ 17.5 mv	B (moderately unstable)
< 17.5 mv to $\geq$ 12.5 mv	C (slightly unstable)
< 12.5 mv to $\geq$ 7.5 mv	D (neutral)
< 7.5 mv to $\geq$ 3.8 mv	E (slightly stable)
< 3.8 mv to $\geq$ 2.1 mv	F (moderately stable)
Less than 2.1 mv	G (extremely stable) NOTE 2

NOTE 1: Use Stability Class B (A not analyzed).

NOTE 2: Use Stability Class F (Reference: Letter of March 9, 1981 from certified consulting meteorologist to Bert Clark).

h. When Met Tower data is no longer required, turn the multimeter power switch to OFF.