

EMERGENCY PLAN IMPLEMENTING PROCEDURES

REVISION CONTROL SHEET

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1.0 PURPOSE

This procedure describes the use of the manual dose assessment method for estimating the downwind dose rates resulting from radioactive releases following an emergency at DAEC. This procedure may also be used in conjunction with P.A.S.A.P. 7.4, "Estimation of Potential Release Rate," to evaluate the impact of potential releases to the general public.

NOTE

USE OF THE IDP COMPUTER PROGRAM IS DESCRIBED
IN EPIP 3.3b, "COMPUTERIZED DOSE PROJECTIONS".

2.0 APPLICABILITY

The method described in the procedure is basically a manual backup to the IDP computer program, which is the primary means of dose projection during an emergency at DAEC. This procedure will be used by members of the Operations staff in the early phases of an emergency or by other emergency response personnel whenever the IDP Computer program is not available.

3.0 RESPONSIBILITIES

3.1 Operations Shift Supervisor

- 3.1.1 Perform dose projection calculations until the Site Radiation Protection coordinator arrives, or the EOF is manned.
- 3.1.2 Initially advise local and State authorities of the results of dose projection calculations and provide protective action recommendations as required, until the EOF is manned.

3.2 Site Radiation Protection Coordinator

- 3.2.1 Perform dose projection calculations until the EOF is manned.
- 3.2.2 Initially evaluate the results of dose projection calculations.
- 3.2.3 Initially identify the need for field survey data to backup projected dose calculations.

3.3 Emergency Coordinator

- 3.3.1 Initially advise local and State authorities of the results of dose projection calculations and provide protective action recommendations as required.

3.4 Radiological Assessment Coordinator

- 3.4.1 Perform dose projection calculations
- 3.4.2 Provide protective action recommendations as required.

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4.0 INSTRUCTIONS

4.1 General Instructions

4.1.1 The manual method involves the use of four dose projection charts (see Attachments 2-5). The user must determine which of these four charts to use by determining the temperature differential (Delta T) from the meteorological tower readout. At the same time, he will find the wind speed and direction. To use the charts, he must calculate release rate by multiplying the appropriate monitor reading, by the system flow rate, a monitor correction factor, and .000472. In cross-referencing the release rate with the wind speed on the chart, the user will find a box that describes dose rates at five locations downwind for an elevated release and a ground level release. He will use the appropriate set of numbers and calculate the integrated dose at the desired location(s) by multiplying the dose rate from the chart, by the estimated duration of release. He will calculate elevated and ground level results separately, but will add the results to obtain a single dose rate for that location. This value should be compared with the EPA's Protective Action Guidelines, and will be the basis for protective action recommendations until the IDP computer program is available.

4.2 Specific Instructions

4.2.1 Initial Dose Projection

- a) Using plant meteorological and effluent monitor readouts, fill in the boxes of Attachment 1. Meteorological information can be obtained in the Control Room and release rate information can be obtained from the KAMAN System in the Control Room. Attachment 8 may be used by Control Room personnel to record this information for transfer to the Radiation Protection Coordinator, once the TSC is activated. If intermediate or high range monitors are used, these numbers must be corrected according to the graph in Attachment 6. Elevated and ground level releases must be calculated separately.

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- b) Using the Delta T value in Box A of Attachment 1, select the appropriate Dose Projection Chart to use (Attachments 2 to 5). The following chart will aid in this selection process:

Delta T	Class	Attachment
less than -1.26	AB	2
from -1.26 to -1.11	C	3
from -1.10 to 1.11	DE	4
greater than 1.11	FG	5

NOTE

IF METEOROLOGICAL DATA IS NOT AVAILABLE FROM THE PLANT, IT MAY BE OBTAINED FROM THE FLIGHT SERVICE STATION IN CEDAR RAPIDS AND/OR THE NATIONAL WEATHER SERVICE IN DES MOINES (PHONE NUMBERS ARE LOCATED IN THE EMERGENCY TELEPHONE BOOK). THE FOLLOWING CHART MAY BE USED AS AN ALTERNATE METHOD IN DETERMINING WHICH ATTACHMENT TO USE:

Wind Speed (mph)	D A Y T I M E		S O L A R R A D I A T I O N		N I G H T T I M E	
	Strong	Moderate	Slight	Overcast	clear or thin overcast	overcast
< 5	2	2	2	3	4	5
5- 7	2	2	3	4	4	5
7-10	2	3	3	4	4	4
10-13	3	4	4	5	4	4
> 13	3	4	4	5	4	4

- c) You will match the value of Rg (ground level release rate) and Re (elevated release rate) on Attachment 1 with the vertical axis of the chart (see Attachments 2-5). You will match the value in box W with the horizontal axis of the chart. If you cannot find a release rate that is close to the values listed in the vertical axis, then take the next most conservative value or multiples of existing chart values. For example, 80 Ci/Sec can be assumed to be an 100 Ci/sec release or you may use 4 times the value for 20 Ci/sec.
- d) The resultant intersecting rectangle from Step c) contains downwind doses at five specified downwind distances. The key on the chart describes the appropriate distances. Each rectangle is divided into two sets of values. The values on the left are for an elevated release and the values on the right are for a ground level release.

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- e) Thyroid doses are 4 times the whole body dose rates given for elevated releases with the Standby Gas Treatment System (SGTS) in operation. It is 400 times the whole body dose rate given for elevated releases without SGTS and for ground level releases. Thyroid dose rates described here are for children, and will provide the basis for protective action recommendations.

NOTE

THIS THYROID FACTOR HAS BEEN INTERPRETED FROM FIGURE 4.3 ON PAGE D.54 OF THE EPA PROTECTIVE ACTION GUIDELINES MANUAL.

- f) The user should next calculate the integrated dose for all three of the following distances: 0 to 2 miles, 2 to 5 miles, and 5 to 10 miles downwind. The values given by the charts are dose rates (mr/hr). To determine integrated dose, the user must estimate the duration of release in hours. Multiply this value by the dose rate for the location desired. For example, a 15 mr/hr dose rate will result in a total dose of 30 mr if the release was assumed to last 2 hours.

NOTE

IF NO ESTIMATE OF THE DURATION OF THE RELEASE IS READILY AVAILABLE, USE 12 HOURS.

- g) Refer to Attachment 1 to determine the significance of the integrated doses in regards to recommending protective actions for the downwind population.
- h) Attachment 7 describes a detailed example of the manual method described in Steps a) through g) above.

4.2.2 Manual Backup Dose Projection

If greater detail is desired in the dose calculation, the user may ignore the Dose Projection charts and use the following calculation method:

- a) To obtain dose rate (mr/hr), divide the release rate R (Ci/sec) by the wind speed W (mph) and then multiply the result by the dose factor DF for the appropriate Delta T , release elevation, and desired distance downwind.

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DF will be obtained from the following chart:

	Delta T < - 1.26 (AB stblty)		Delta T -1.26to-1.11 (C stblty)		Delta T -1.10to1.11 (DE stblty)		Delta T > 1.11 (FG stblty)	
	elev.	grnd.	elev.	grnd.	elev.	grnd.	elev.	grnd.
max loc. -	18.68	78.6	16.2	48.6	13.68	34.2	5.72	30.2
site bndry-	17.58	56.2	15.76	252	13.52	1050	12.02	6100
2 miles -	.45	.542	10.76	8.9	15.04	48.2	9.18	334
5 miles -	.068	.06	2.44	1.84	7.82	11.32	7.02	85
10 miles -	.028	.012	.61	.558	3.62	3.78	5.72	30.2

$$(R/W) \times DF = \text{dose rate mr/hr}$$

If wind speed is 0 mph, use 1 for W. R will be obtained from Attachment 1. Make sure your release rate was calculated based on corrected concentration monitor readings if intermediate or high range monitors were used.

Example

A 27 Ci/sec elevated release in 5 mph wind, with Delta T of -1.2 (DF=10.76), will cause a dose rate of 58 mr/hr at 2 miles downwind.

$$\frac{R}{W} \times DF = \text{Dose Rate} \frac{\text{mr}}{\text{hr}}$$

$$\frac{27 \text{ Ci/sec}}{5 \text{ mph}} \times 10.76 = 58 \text{ mr/hr}$$

- b) A back calculation can be performed to determine release rate, if a dose rate is known at one of the five given downwind locations:

$$(\text{dose rate} \times W)/DF = R$$

You may now use this release rate to determine the dose rates at the other 4 downwind locations.

Example

A dose rate of 17 mr/hr at 5 miles downwind, that was caused by a ground level release in a 9 mph wind, with Delta T of -1.05 (DF=11.32), resulted from a release of 14 Ci/sec.

$$(\text{dose rate} \times W)/DF = R$$

$$\frac{(17 \text{ mr/hr} \times 5 \text{ mph})}{11.32} = 14 \text{ Ci/sec}$$

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5.0 REFERENCES

- 5.1 DAEC Emergency Plan
- 5.2 Iowa Electric Light & Power Corporate Emergency Plan
- 5.3 EPIP 3.3b
- 5.4 EPA Protective Action Guides

6.0 ATTACHMENTS

- 6.1 Summary Sheet
- 6.2 Dose Projection Chart for Delta T < -1.26
- 6.3 Dose Projection Chart for Delta T from -1.26 to -1.11
- 6.4 Dose Projection Chart for Delta T from -1.10 to 1.11
- 6.5 Dose Projection Chart for Delta T > 1.11
- 6.6 Monitor Response Correction Factor for Time After Shutdown
- 6.7 Example of Manual Dose Projection Calculation
- 6.8 Radiological Release Information Log
- 6.9 Evacuation Areas

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APPROVED BY: *R. S. Zook for* Date: 7-21-83
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ATTACHMENT 1

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Summary Sheet

Calculation No.: _____ Date: _____

Performed by (print): _____ Time: _____

- Determine the following meteorological information from the met panel and Delta T recorder in the Control Room. Enter the information in the appropriate lettered box (information in non-lettered box is not critical but will be valuable for communications with off-site emergency organizations):

Delta T (degrees F/165 feet)
Stability class

A	

Delta T	Stability Class	Attachment
less than -1.26	AB	2
from -1.26 to -1.11	C	3
from -1.10 to 1.11	DE	4
greater than 1.11	FG	5

Wind Speed (mph)
Wind Direction from (degrees)

W	
B	

Affected area(s) (see Attachment 9)

Using Attachment 9, "Evacuation Areas," determine the affected downwind areas as follows and put a check in the appropriate box for the specified release.

a) 0 to 2 Miles

General Affected Area(s)

1	<input checked="" type="checkbox"/>
2	<input checked="" type="checkbox"/>

NOTE

WHENEVER PROTECTIVE ACTION RECOMMENDATIONS ARE BEING CONSIDERED, AREAS 1 AND 2 WILL ALWAYS BE INCLUDED.

b) 2 to 5 Miles

Downwind Direction

General Affected Area(s)

0° - 90°
90° - 180°
180° - 270°
270° - 360°

3	<input type="checkbox"/>
4	<input type="checkbox"/>
6	<input type="checkbox"/>
7	<input type="checkbox"/>

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NOTE

- (1) IF THE WIND IS BLOWING IN THE MIDDLE OF THE AREA, THAT AREA IS THE ONLY ONE WHICH SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.
- (2) IF THE WIND IS BLOWING NEAR THE EDGE OF AN AREA OR IS BLOWING IN TWO ADJACENT AREAS, BOTH AREAS SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.

c) 5 to 10 Miles

Downwind Direction

General Affected Area(s)

0° - 90°
90° - 180°
180° - 270°
270° - 360°

3
4,5
6
7

NOTE

- (1) IF THE WIND IS BLOWING IN THE MIDDLE OF THE AREA, THAT AREA IS THE ONLY ONE WHICH SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.
- (2) IF THE WIND IS BLOWING NEAR THE EDGE OF AN AREA OR IS BLOWING IN TWO ADJACENT AREAS, BOTH AREAS SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.

2. Determine the following release path(s) information from the Control Room KAMAN terminal and record this information in Sections a and b below. Do this for the Reactor Building, Turbine Building or Offgas Stack, as appropriate. If normal range instruments are used for determining concentration (Conc.), use 1 as a correction factor (corr. fac). If intermediate or high range instruments are used, then use the correction factor from the graph in Attachment 6.

NOTE

DURING THE FIRST HOUR AFTER SHUTDOWN USE A CORRECTION FACTOR OF 0.325 FOR THE MIDRANGE AND 0.275 FOR THE HIGH RANGE.

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a. GROUND LEVEL RELEASE

Path	Conc. uCi/cc	Flow CFM	cor. fac	constant	Ci/Sec
Rx Bld Stk A	x	x		x.000472	=
Rx Bld Stk B	x	x		x.000472	=
Rx Bld Stk C	x	x		x.000472	=
Turbine Bld	x	x		x.000472	=
Total ground level release = (sum the 4 boxes above)					Rg

b. ELEVATED RELEASE

	Conc. uCi/cc	Flow CFM	Corr. fac	Constant	Re Ci/sec
Offgas Stack	x	x		x.000472	=

Use Rg and/or Re separately (depending on type of release) as the release rate R for the vertical column in Attachment 2 thru 5. Use the value in box W, above, for the horizontal column. The values obtained from the charts are the dose rates for ground level and elevated releases and should be entered in the boxes under Whole Body Dose Rate for Rg and Re in Sections 3.1.a, 3.2.a, and 3.3a.

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3.0 DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATIONS

3.1 0 to 2 miles

- a) To calculate the integrated dose between 0 and 2 miles, use the dose rate at the location given below for a ground level release (Rg) and an elevated release (Re). Then, place the dose rates obtained from the charts (Att. 2-5) for the ground level and elevated releases in the boxes for whole body dose corresponding to Rg and Re.

Stability Class	Re	Rg
AB	.25 miles	.25 miles
C	.75 miles	site bndry
DE	site bndry	site bndry
FG	site bndry	site bndry

NOTE:

IF NO NUMBER IS GIVEN IN THE APPROPRIATE COLUMN THE DOSE RATE IS ASSUMED TO BE NEGLIGIBLE.

- b) Multiply the whole body dose rate by 400 for ground level releases and by 4 (if SGTS is on) or 400 (if SGTS is off) for elevated releases. The resulting numbers are thyroid dose rates. Sum all dose rates in the vertical columns and enter the results in boxes E and F, where $E = Rg + Re$ and $F = Rg(400) + Re(4 \text{ or } 400)$. Multiply these dose rates by the expected duration of the release (in hours).

Estimated duration of release (hr)
(Use 12 hrs, if no estimate of the duration
of the release is not readily available)

D	
---	--

	Whole Body Dose Rate	x	Thyroid Corr.	=	Thyroid Dose Rate
Rg	mr/hr	x	400	=	mr/hr
Re	mr/hr	x	4 or 400	=	mr/hr
E	mr/hr	//////////		F	mr/hr
Whole body dose (WB) = (D x E)/1000					Rem
Thyroid dose (TY) = (D x F)/1000					Rem

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3.2 2 to 5 miles

- a) To calculate integrated dose between 2 and 5 miles, use the dose rate given at the distance of 2 miles on Attachments 2 through 5 (depending on the stability class) for a ground level release and an elevated release.

NOTE:

IF NO NUMBER IS GIVEN IN THE APPROPRIATE COLUMN, THE DOSE RATE IS ASSUMED TO BE NEGLIGIBLE.

- b) Place the dose rates obtained from the charts (Attachments 2-5) for ground level and elevated releases in the boxes for whole body doses corresponding to Rg and Re and fill out the boxes below as discussed in Sect. 3.1.b.

Estimated duration of release (hr)
(Use 12 hrs, if no estimate of the duration
of the release is not readily available)

D	
---	--

	Whole Body Dose Rate	x	Thyroid Corr.	=	Thyroid Dose Rate
Rg	mr/hr	x	400	=	mr/hr
Re	mr/hr	x	4 or 400	=	mr/hr
E	mr/hr		//////////	F	mr/hr
Whole body dose (WB) = (D x E)/1000					Rem
Thyroid dose (TY) = (D x F)/1000					Rem

3.3 5 to 10 miles

- a) To calculate integrated dose between 5 and 10 miles, use the dose rate given at the distance of 5 miles on Attachments 2 through 5 (depending on the stability class) for a ground level release and an elevated release.

NOTE

IF NO NUMBER IS GIVEN IN THE APPROPRIATE COLUMN, THE DOSE RATE IS ASSUMED TO BE NEGLIGIBLE.

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- b) Place the dose rates obtained from the charts (Attachments 2-5) for ground level and elevated releases in the boxes for whole body dose corresponding to Rg and Re and fill out the boxes below as discussed in Section 3.1.b.

Estimated duration of release (hr)
(If no estimate of the duration of the release is not readily available, use 12 hrs)

D	
---	--

	Whole Body Dose Rate	x	Thyroid Corr.	=	Thyroid Dose Rate
Rg	mr/hr	x	400	=	mr/hr
Re	mr/hr	x	4 or 400	=	mr/hr
E	mr/hr	//////////		F	mr/hr
Whole body dose (WB) = (D x E)/1000					Rem
Thyroid dose (TY) = (D x F)/1000					Rem

- 3.4 Compare the doses in Sections 3.1.c, 3.2.c, and 3.3.c with the Protective Action Recommendations listed below to determine what protective action is to be taken.

NOTE

FOR CASES WHERE THE PROJECTED WHOLE BODY DOSE EXCEEDS ONE SET OF THE PAGs AND THE PROJECTED THYROID DOSE EXCEEDS ANOTHER, THE MORE CONSERVATIVE OF THE RECOMMENDED ACTIONS SHOULD BE USED TO FORMULATE PROTECTIVE ACTION RECOMMENDATIONS.

Example

If the projected whole body dose is 0.5 Rem and the projected thyroid dose is 200 Rem, the 200 Rem should be used to formulate protective action recommendations.

If the calculated dose rates for any area are > 1 Rem (Whole Body) or > 5 Rem (Thyroid) record the following:

1. Containment Pressure

Drywell
Torus

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2. Containment High Range Radiation Monitor Levels

Drywell # 1 _____
 # 2 _____

Torus # 1 _____
 # 2 _____

PROTECTIVE ACTIONS RECOMMENDATIONS

- 3.4.1 If the dose rate is > 50 mr/hr, but Total Exposure is projected to be < 1 Rem (Whole Body) and < 5 Rem (Thyroid) using the best estimate for release duration.

AREAS	0-2 Miles	2-5 Miles	5-10 Miles*
	1,2	3,4,6,7	3,4,5,6,7
1) Activate the Prompt Notification System	X	X	X
2) Activate county & State EOCs	X	X	X
3) As a precautionary measure, shelter in the affected areas.	1,2	Affected area(s) given in Section 1	Affected area(s) given in Section 1
4) Advise that an evacuation is not necessary, but if people so choose: a) Minimize the time out of doors b) Exit the areas by the most direct route possible.	X	X	X
5) People in other areas should stay tuned to the local EBS station.	X	X	X
6) Milk animals within the 2 mile radius should be placed on stored feed.	X		
* Area 5 includes metropolitan Cedar Rapids, Marion, Hiawatha area			

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3.4.2 For total exposure projected to be: > 1 but ≤ 5 Rem Whole Body or > 5 but ≤ 25 Rem Thyroid

AREAS	0-2 Miles	2-5 Miles	5-10 Miles
	1,2	3,4,6,7	3,4,5,6,7
1) Activate the Prompt Notification System	X	X	X
2) Activate county & State EOCs	X	X	X
3) If dose rates are confirmed by actual measurement to be			
a) > 300 mrem/hr @ 2 mile Radius	Evacuate (all areas)	Evacuate (all areas)	Shelter (all areas)
b) > 500 mrem/hr @ site Boundary	Evacuate (all areas)	Shelter (all areas)	
4) If containment pressure is greater than 40 psig, containment pressure is continuing to increase at a rate of 5 psig/hr and Containment High Range Radiation Monitor levels are:			
a) $> 5.4 \times 10^6$ rem/hr corresponding to 300 mrem/hr @ 2 miles	Evacuate (all areas)	Evacuate (all areas)	Shelter (all areas)
b) $> 10^7$ rem/hr corresponding to 500 mrem/hr @ site boundary	Evacuate (all areas)	Shelter (all areas)	
5) If neither 3) nor 4) are applicable	Shelter (all areas)	Shelter (all areas)	
6) If sheltering is recommended, advise that an evacuation is not necessary, but if people so choose:			
a) Minimize the time out of doors			
b) Exit the area by the most direct route possible			
7) People in other areas should stay tuned to the local EBS station	X	X	X
8) Milk animals within the 10 mile radius should be placed on stored feed	X	X	X
9) Dispatch the State of Iowa radiological monitoring personnel	X	X	X
10) Establish access controls within a 2 mile radius of the site	X	X	X

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3.4.3 For total exposure projected to be: > 5 Rem Whole Body or > 25 Rem Thyroid

AREAS	0-2 Miles	2-5 Miles	5-10 Miles
	1,2	3,4,6,7	3,4,5,6,7
1) Activate the Prompt Notification System	X	X	X
2) Activate county & State EOCs	X	X	X
3) If dose rates are confirmed by actual measurement to be:			
a) > 2.5 rem/hr @ the site boundary	Evacuate (all areas)	Evacuate (all areas)	Evacuate (all areas)
b) > 1.0 rem/hr at site boundary	Evacuate (all areas)	Evacuate (all areas)	Shelter (all areas)
c) > 300 mrem/hr @ 2 mile radius	Evacuate (all areas)	Evacuate (all areas)	Shelter (all areas)
d) > 500 mrem/hr @ site boundary	Evacuate (all areas)	Shelter (all areas)	
4) If containment pressure is > 56 psig or is expected to be so within 1/2 hour, containment pressure is continuing to increase, and Containment High Range Radiation Monitor levels are: $\geq 10^7$ rem/hr.	Evacuate (all areas)	Evacuate (all areas)	Evacuate (all areas)
5) If containment pressure is greater than 40 psig, containment pressure is continuing to increase at a rate of 5 psig/hr and Containment High Range Radiation Monitor levels are:			
a) > 5.4×10^6 rem/hr corresponding to 300 mrem/hr at 2 miles	Evacuate (all areas)	Evacuate (all areas)	Shelter (all areas)
b) > 10^7 rem/hr corresponding to 500 mrem/hr @ site boundary	Evacuate (all areas)	Shelter (all areas)	

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MANUAL DOSE PROJECTIONS	

ATTACHMENT 1

(Page 10 of 10)

AREAS	0-2 Miles	2-5 Miles	5-10 Miles
	1,2	3,4,6,7	3,4,5,6,7
6) If neither 3) nor 4) nor 5) are applicable	Shelter (all areas)	Shelter (all areas)	
7) If sheltering is recommended, advise that an evacuation is not necessary, but if people so choose: a) Minimize the time out of doors b) Exit the area by the most direct route possible			
8) People in other areas should stay tuned to the local EBS station	X	X	X
9) Milk animals within the 10 mile radius should be placed on stored feed	X	X	X
10) Dispatch the State of Iowa radiological monitoring personnel	X	X	X
11) Establish access controls within a 2 mile radius of the site	X	X	X

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EPIP 3.3a

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Date 6/6/83

MANUAL DOSE PROJECTIONS

All table values are in mr/hr
whole body dose rate.

ATTACHMENT 2

DOSE PROJECTION CHART FOR DELTA T <= 1.26

Thyroid Dose Correction:

SGTS on - multiply by 4

(AB Stability)

SGTS off - multiply by 400

elevated
release

.25 miles
site bndry
2 miles
5 miles
10 miles

ground level
release

W - Wind Speed (mph)

R	0 - 4		5 - 9		10 - 14		15 - 19		20 - 24		25 - 29		30 - 34		35 - 39		40 - 44		45 - 50 >	
C1/Sec																				
1	9 9	39 28	3 3	11 8	2 1	7 5	1 1	5 3	1 1	4 3	1 1	3 2	1 1	2 2	1 2	2 2		2 1		2 1
5	47 44	197 141	13 13	56 40	8 7	33 23	6 5	23 17	4 4	18 13	3 3	15 10	3 3	12 9	3 2	11 8	2 2	9 7	2 2	8 6
10	93 88 2	393 281 3	27 25 1	112 80 1	16 15	66 47	11 10	46 33	8 8	36 26	7 7	29 21	6 5	25 18	5 5	21 15	4 4	19 13	4 4	17 12
20	187 176 5 1	786 562 5 1	53 50 1	224 161 2	31 29 1	131 94 1	22 21 1	92 66 1	17 16	71 51	14 13	58 42	12 11	49 35	10 10	42 30	9 8	37 27	8 7	33 24
25	234 220 6 1	983 703 7 1	67 63 2	280 201 2	39 37	164 117	28 26	116 83	21 20	89 64	17 16	73 52	15 14	61 44	13 12	53 38	11 10	47 34	10 9	42 30
100	934 879 23 3	3930 2810 27 3	267 251 6 1	1120 804 8 1	156 146 4 1	655 469 5 1	110 103 3	462 331 3	85 80 2	357 256 2	69 65 2	291 208 2	58 55 1	245 176 2	51 48 1	212 152 1	45 42 1	187 134 1	40 37 1	167 120 1
250	2335 2198 56 8 4	9825 7025 68 8 1	668 628 16 2 1	2800 2010 19 2 1	390 365 9 1 1	1638 1173 11 1 1	275 258 7 1 1	1155 828 8 1 1	212 200 5 1 1	893 640 6 1 1	173 163 4 1 1	728 520 5 1 1	146 137 4 1 1	613 440 4 3	126 119 3 4	530 380 4 3	111 105 3 3	468 335 3 2	99 94 2	418 300 3
500	4670 4395 113 17 7	19650 14050 136 15 3	1335 1255 32 5 2	5600 4020 39 4 1	780 730 19 3 1	3275 2345 23 3 1	550 515 13 2 1	2310 1655 16 2 1	425 400 10 2 1	1785 1280 12 1 1	346 326 8 1 1	1455 1040 10 1 1	292 275 7 1 1	1225 880 8 1 1	253 238 6 1 1	1060 760 7 1 1	223 210 5 1 1	935 670 6 1 1	199 187 5 1 1	835 600 6 1
1000	9340 8790 225 34 14	39300 28100 271 30 6	2670 2510 64 10 4	11200 8040 77 9 2	1560 1460 37 6 2	6550 4690 45 5 1	1100 1030 27 4 2	4620 3310 32 4 1	849 799 21 3 1	3570 2560 25 3 1	692 651 17 3 1	2910 2080 20 2 1	584 549 14 2 1	2450 1760 17 2 1	505 475 12 2 1	2120 1520 15 2 1	445 419 11 2 1	1870 1340 13 1 1	397 374 9 1 1	1670 1200 12

NOTE: These values were calculated using the IDP/ECF computer program.

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EPIP 3.3a
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MANUAL DOSE PROJECTIONS

All table values are in mr/hr
whole body dose rate.

ATTACHMENT 3

DOSE PROJECTION CHART FOR DELTA T -1.26 to -1.11

Thyroid Dose Correction:

SGTS on - multiply by 4

SGTS off - multiply by 400

(C Stability)

elevated
release

.75 miles
site andry
2 miles
5 miles
10 miles

ground level
release

W - Wind Speed (mph)

R	0 - 4		5 - 9		10 - 14		15 - 19		20 - 24		25 - 29		30 - 34		35 - 39		40 - 44		45 - 50 & >	
CI/Sec																				
1	8	24	2	7	1	4	1	3	1	2	1	2	1	2		1		1		1
	8	126	2	36	1	21	1	15	1	12	1	9		8		7		6		5
	5	4	2	1	1	1	1	1												
	1	1																		
5	41	122	12	35	7	20	5	14	4	11	3	9	3	8	2	7	2	6	2	5
	39	630	11	181	7	105	5	74	4	58	3	47	2	39	2	34	2	30	2	27
	27	22	8	6	4	4	3	3	2	2	2	2	2	1	1		1	1	1	1
	6	5	2	1	1	1	1	1	1											
10	2	1																		
	81	243	23	69	14	40	10	29	7	22	6	18	5	15	4	13	4	12	3	10
	79	1260	23	361	13	210	9	148	7	115	6	94	5	79	4	68	4	60	3	54
	54	45	15	13	9	7	6	5	5	4	4	3	3	3	3	2	3	2	2	2
20	12	9	4	3	2	2	1	1	1	1	1	1	1	1	1		1		1	
	3	3	1	1	1															
	162	486	46	139	27	81	19	57	15	44	12	36	10	30	9	26	8	23	7	21
	158	2520	45	722	26	420	19	296	14	230	12	187	10	158	9	136	8	120	7	107
25	108	89	31	25	18	15	13	10	10	8	8	7	7	6	6	5	5	4	5	4
	24	18	7	5	4	3	3	2	2	2	2	1	2	1	1	1	1	1	1	1
	6	6	2	2	1	1	1	1	1	1										
	203	608	58	173	34	101	24	71	18	55	15	45	13	38	11	33	10	29	9	26
50	197	3150	56	903	33	525	23	370	18	288	15	234	12	197	11	171	9	150	8	134
	135	111	39	32	22	19	16	13	12	10	10	8	8	7	7	6	7	5	6	5
	31	23	9	7	5	4	4	3	3	2	2	2	2	1	2	1	1	1	1	1
	8	7	2	2	1	1	1	1	1	1	1	1								
100	810	2430	232	693	135	404	95	285	74	221	60	180	51	152	44	131	39	116	35	103
	788	12600	225	3610	131	2100	93	1480	72	1150	58	935	49	789	43	682	38	601	34	537
	538	445	154	127	90	74	63	52	50	40	40	33	34	28	29	24	27	21	23	19
	122	92	35	26	20	15	14	11	11	8	9	7	8	6	7	5	6	4	5	4
250	31	28	9	8	5	5	4	3	3	3	2	2	2	2	2	2	1	1	1	1
	2025	6075	580	1733	338	1010	238	713	184	553	150	450	127	380	110	328	97	290	86	258
	1970	31500	563	9025	328	5250	232	3700	179	2875	146	2338	123	1973	107	1705	94	1503	84	1343
	1345	1113	385	318	224	185	158	131	125	101	100	82	84	70	73	60	66	53	57	47
500	305	230	88	66	51	38	36	27	28	21	23	17	19	14	17	12	15	11	13	10
	76	70	22	20	13	12	9	8	7	6	6	5	5	4	4	4	4	3	3	3
	4050	12150	1160	3465	675	2020	477	1425	369	1105	300	900	253	760	219	655	193	580	173	515
	3940	63000	1125	18050	655	10500	464	7400	358	5750	292	4675	246	3945	213	3410	188	3005	168	2685
1000	2690	2225	770	635	448	371	317	262	249	202	199	165	168	139	146	120	133	106	115	95
	610	460	175	132	102	77	72	54	56	42	45	34	38	29	33	25	29	22	26	20
	153	140	44	40	25	23	18	16	14	13	11	10	10	9	8	8	7	7	7	6
	8100	24300	2320	6930	1350	4040	953	2850	737	2210	600	1800	506	1520	438	1310	386	1160	345	1030
1000	7880	12603	2250	36100	1310	21000	927	14800	716	11500	583	9350	492	7890	426	6820	375	6010	335	5370
	5380	4450	1540	1270	896	741	633	523	498	404	398	329	336	278	291	240	265	212	229	189
	1220	920	350	263	204	153	144	108	111	84	91	68	77	58	66	50	58	44	52	39
	305	279	87	80	51	47	36	33	28	25	23	21	19	18	17	15	15	13	13	12

NOTE: These values were calculated using the IDP/EOF computer program.

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Date 6/6/83

MANUAL DOSE PROJECTIONS

All table values are in mr/hr
whole body dose rate.

ATTACHMENT 4

DOSE PROJECTION CHART FOR DELTA T -1.10 to 1.11

Thyroid Dose Correction:

SGTS on - multiply by 4

(DE Stability)

SGTS off - multiply by 400

elevated
release2.5 miles
site boundary

2 miles

5 miles

10 miles

ground level
release

W - Wind Speed (mph)

R	0 - 4		5 - 9		10 - 14		15 - 19		20 - 24		25 - 29		30 - 34		35 - 39		40 - 44		45 - 50 & >	
Cl/Sec																				
1	7	17	2	5	1	3	1	2	1	2	1	1		1		1		1		1
	7	525	2	150	1	88	1	62	1	48	1	39		33		28		25		22
	8	24	2	7	1	4	1	3	1	2	1	2		2		1		1		1
	4	6	1	2	1	1		1		1										
	2	2	1	1																
5	34	86	10	24	6	14	4	10	3	8	3	6	2	5	2	5	2	4	1	4
	34	2625	10	750	6	438	4	309	3	239	3	195	2	164	2	142	2	125	1	112
	38	121	11	35	6	20	4	14	3	11	3	9	2	8	2	7	2	6	2	5
	20	28	6	8	3	5	2	3	2	3	1	2	1	2	1	2	1	1	1	1
	9	9	3	3	2	2	1	1	1	1	1	1	1	1		1				
10	68	171	20	49	11	29	8	20	6	16	5	13	4	11	4	9	3	8	3	7
	68	5250	19	1500	11	875	8	618	6	477	5	389	4	328	4	284	3	250	3	223
	75	241	22	69	13	40	9	28	7	22	6	18	5	15	4	13	4	12	3	10
	39	57	11	16	7	9	5	7	4	5	3	4	2	4	2	3	2	3	2	2
	18	19	5	5	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1
20	137	342	39	98	23	57	16	40	12	31	10	25	9	21	7	18	7	16	6	15
	135	10500	39	3000	23	1750	16	1236	12	954	10	778	8	656	7	568	6	500	6	446
	150	482	43	138	25	80	18	57	14	44	11	36	9	30	8	26	7	23	6	21
	78	113	22	32	13	19	9	13	7	10	6	8	5	7	4	6	4	5	3	5
	36	38	10	11	6	6	4	4	3	3	3	3	2	2	2	2	2	2	2	2
25	171	428	49	122	29	71	20	50	16	39	13	32	11	27	9	23	8	20	7	18
	169	13125	48	3750	28	2188	20	1545	15	1193	13	973	11	820	9	710	8	625	7	558
	188	603	54	173	31	101	22	71	17	55	14	45	12	38	10	33	9	29	8	26
	98	142	28	41	16	24	12	17	9	13	7	10	6	9	5	8	5	7	4	6
	45	47	13	13	8	8	5	6	4	4	3	4	3	3	2	3	2	2	2	2
100	684	1710	195	489	114	285	80	201	62	155	51	127	43	107	37	92	33	81	29	73
	676	52500	193	15000	113	8750	80	6180	61	4770	50	3890	42	3280	37	2840	32	2500	29	2230
	752	2410	215	690	125	402	89	284	68	219	56	179	47	151	41	130	36	115	32	103
	391	566	112	162	65	94	46	67	36	51	29	42	24	35	21	31	19	27	17	24
	181	189	52	54	30	32	21	22	16	17	13	14	11	12	10	10	9	9	8	8
250	1710	4275	488	1223	285	713	201	503	156	388	127	318	107	268	93	231	82	204	73	182
	1690	131E3	483	37500	283	21875	199	15450	154	11925	125	9725	106	8200	91	7100	81	6250	72	5575
	1880	6025	538	1725	313	1005	221	710	171	548	139	448	118	378	102	325	90	288	80	258
	978	1415	260	405	163	236	115	167	89	129	73	105	61	89	53	77	47	67	42	60
	453	473	129	135	75	79	53	56	41	43	34	35	28	30	24	26	22	22	19	20
500	3420	8550	975	2445	570	1425	402	1005	311	775	254	635	214	535	185	462	163	407	146	364
	3380	263E3	965	75000	565	43750	398	30900	307	23850	251	19450	211	16400	183	14200	161	12500	144	11150
	3760	12050	1075	3450	625	2010	443	1420	342	1095	279	895	235	755	204	650	179	575	160	515
	1955	2830	560	810	326	472	230	333	178	257	145	210	122	177	106	153	93	135	83	121
	905	945	259	270	151	158	107	111	82	86	67	70	57	59	49	51	43	45	39	40
1000	6840	17100	1950	4890	1140	2850	804	2010	622	1550	507	1270	427	1070	370	924	326	814	291	728
	6760	525E3	1930	150E3	1130	87500	795	61800	614	47700	501	38900	422	32800	365	28400	322	25000	288	22300
	7520	24100	2150	6900	1250	4020	885	2840	684	2190	557	1790	470	1510	407	1300	358	1150	320	1030
	3910	5660	1120	1620	652	943	460	666	356	514	290	419	244	354	211	306	186	269	166	241
	1810	1890	517	539	301	315	213	222	164	172	134	140	113	118	98	102	86	90	77	80

NOTE: These values were calculated using the IDP/EOP computer program.

EMERGENCY PLAN IMPLEMENTING PROCEDURE

MANUAL DOSE PROJECTIONS

EPIP 3.3a

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Revision 4

Date 6/6/83

All table values are in mr/hr

ATTACHMENT 5

whole Body dose rate.

DOSE PROJECTION CHART FOR DELTA T > 1.11

Thyroid Dose Correction:

SGTS on - multiply by 4

(FG Stability)

SGTS off - multiply by 400

elevated
release10 miles
site andry
2 miles
5 miles
10 milesground level
release

W - Wind Speed (mph)

R Ci/Sec	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 50 &>
1	3 15 6 3050 5 167 4 43 3 15	1 4 2 871 1 48 1 12 1 4	3 1 508 1 28 1 7 3	2 1 359 1 20 5 2	1 1 277 15 4 1	1 226 12 3 1	1 190 10 3 1	1 165 9 2 1	1 145 8 2 1	1 130 7 2 1
5	14 76 30 15252 23 835 18 213 14 76	4 22 9 4355 7 239 5 61 4 22	2 13 5 2540 4 139 3 35 2 13	2 9 4 1795 3 98 2 25 2 9	1 7 3 1385 2 76 2 19 1 1	1 6 2 1130 2 62 1 16 1 6	1 5 2 950 1 52 1 13 1 5	1 4 2 825 1 45 1 12 1 4	1 4 1 725 1 40 1 10 1 4	1 3 1 650 1 36 1 9 1 3
10	29 151 60 30500 46 1670 35 425 29 151	8 43 17 8710 13 477 10 121 8 43	5 25 10 5080 8 278 6 71 5 25	3 18 7 3590 5 196 4 50 3 18	3 14 5 2270 4 152 3 39 3 14	2 11 4 2260 3 124 3 32 2 11	2 9 4 1900 3 104 2 27 2 9	2 8 3 1650 2 90 2 23 2 8	1 7 3 1450 2 80 2 20 1 7	1 6 3 1300 2 71 1 18 1 6
20	57 302 120 61000 92 3340 70 850 57 302	16 86 34 17420 26 954 20 242 16 86	9 50 20 10160 15 556 12 142 9 50	7 36 14 7180 11 392 8 100 7 36	5 27 11 5540 8 304 6 77 5 27	4 22 9 4520 7 248 5 63 4 22	4 19 8 3800 6 208 4 53 4 19	3 16 7 3300 5 180 4 46 3 16	3 14 6 2900 4 159 3 40 3 14	2 13 5 2600 4 142 3 36 2 13
25	72 378 150 76250 115 4175 88 1063 72 378	20 108 43 21775 33 1193 25 303 20 108	12 63 25 12700 19 695 15 177 12 63	8 45 18 8975 14 490 10 125 8 45	7 34 14 6925 10 380 8 97 7 34	5 28 11 5650 9 310 7 79 5 28	4 24 9 4750 7 260 5 67 4 24	4 20 8 4125 6 226 5 58 4 20	3 18 7 3625 5 199 4 51 3 18	3 16 6 3250 5 178 4 45 3 16
100	286 1510 601 305E3 459 16700 351 4250 286 1510	81 431 172 87100 131 4770 100 1210 81 431	47 252 100 50800 77 2780 58 709 47 252	34 178 71 35900 54 1960 41 500 34 178	26 137 55 27700 42 1520 32 386 26 137	21 112 45 22600 34 1240 26 315 21 112	18 94 38 19000 29 1040 22 266 18 94	15 82 33 16500 25 902 19 230 15 82	14 72 29 14500 22 795 17 202 14 72	12 64 26 13000 20 710 15 181 12 64
250	715 3775 1503 763E3 1148 41750 878 10625 715 3775	203 1078 430 218E3 328 11925 250 3025 203 1078	118 630 250 127E3 192 6950 146 1773 118 630	84 445 177 89750 135 4900 103 1250 84 445	65 343 137 69250 105 3800 80 965 65 343	53 280 111 56500 85 3100 65 788 53 280	45 236 94 47500 72 2600 55 665 45 236	39 204 81 41250 62 2255 47 575 39 204	34 180 72 36250 55 1988 42 505 34 180	31 161 64 32500 49 1775 37 453 31 161
500	1430 7550 3005 153E3 2995 83500 1755 21250 1430 7550	405 2155 860 434E3 655 23850 500 6050 405 2155	235 1260 500 254E3 383 13900 292 3545 235 1260	168 890 354 180E3 271 9800 206 2500 168 890	130 685 274 139E3 209 7600 160 1930 130 685	106 560 223 113E3 170 6200 130 1575 106 560	90 472 188 95000 144 5200 110 1330 90 472	77 408 163 82500 124 4510 95 1150 77 408	68 360 143 72500 110 3975 84 1010 68 360	61 321 128 65000 98 3550 75 905 61 321
1000	2860 15100 6010 305E4 4590 167E3 3510 42500 2860 15100	810 4310 1720 871E3 1310 47700 1000 12100 810 4310	470 2520 1000 508E3 766 27800 584 7090 470 2520	336 1780 707 359E3 541 19600 412 5000 336 1780	260 1370 547 277E3 418 15200 319 3860 260 1370	212 1120 445 226E3 340 12400 260 3150 212 1120	179 944 376 190E3 287 10400 219 2660 179 944	154 816 325 165E3 248 9020 189 2300 154 816	136 719 286 145E3 219 7950 167 2020 136 719	122 642 256 130E3 196 7100 149 1810 122 642

NOTE: These values were calculated using the ICR/EPF computer program.

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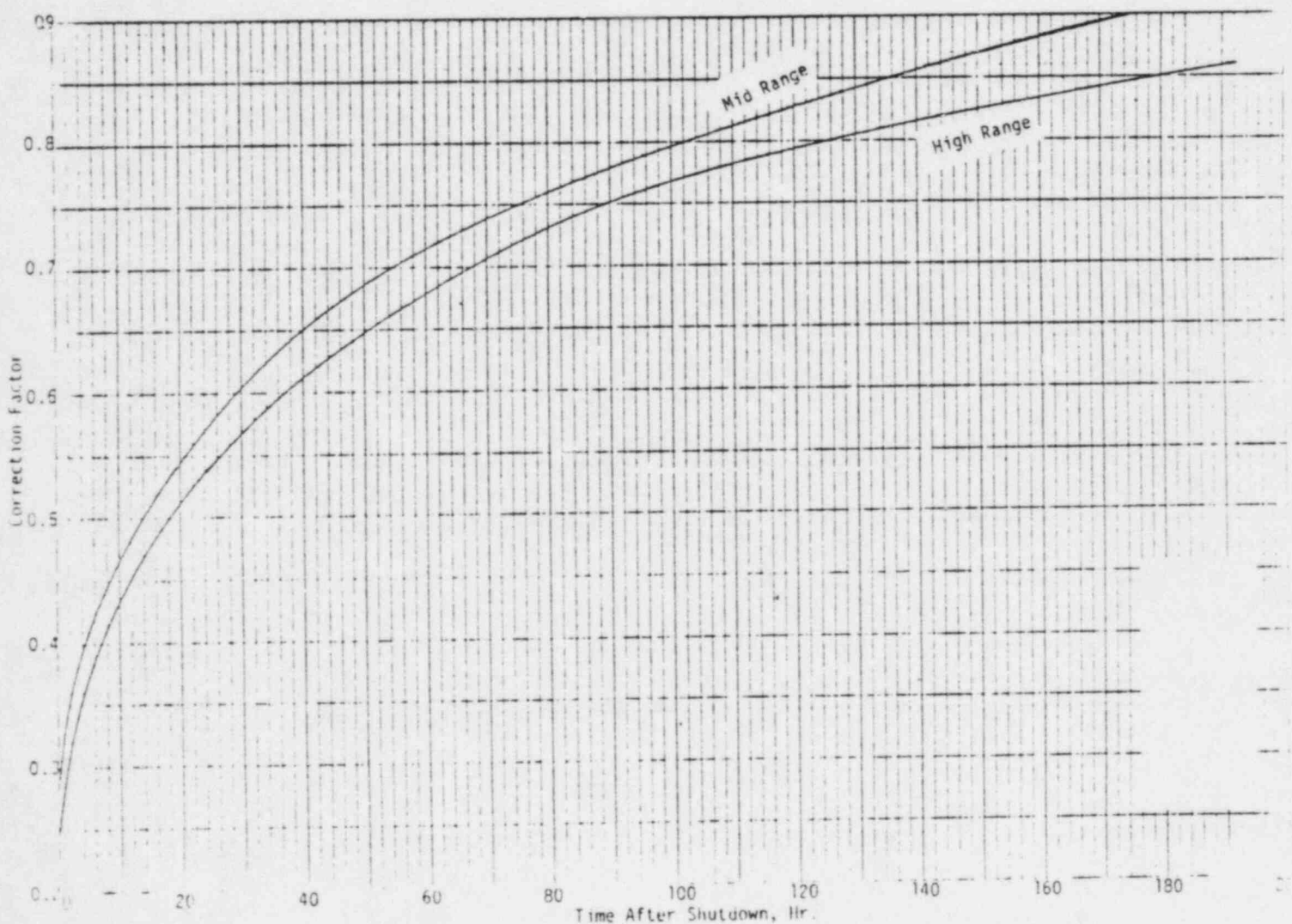
ATTACHMENT 6

Monitor Response Correction Factor for Time After Shutdown

This attachment is used to correct the process monitor readings for the intermediate and high range monitors of the Offgas Stack, Reactor Building Stacks and the Turbine Building.

Time
after
shutdown
hrs.

Example: 60 hrs. after shutdown the correction factor for the intermediate range monitor will be .72 and for the high range monitor .67.



NOTE: This graph is contained in P.A.S.A.P. 7.1, Page 19, Figure 7.1-1.

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MANUAL DOSE PROJECTIONS	

ATTACHMENT 7

(Page 1 of 6)

Example of Manual Dose Projection Calculation

The wind is 21 mph from 45° degrees and delta T is -1.20. DAEC is releasing radioactive material through the Offgas Stack and through 2 of 3 Reactor Building Stacks. Normal range instruments are used for the Reactor Building. An intermediate range instrument was used for Offgas Stack. The calculation is performed 1 hour after shutdown. SGTS is operating.

Summary Sheet

Calculation No.: _____ Date: _____

Performed by (print): _____ Time: _____

- Determine the following meteorological information from the met panel and Delta T recorder in the control Room. Enter the information in the appropriate lettered box (information in non-lettered box is not critical but will be valuable for communication with off-site emergency organizations):

Delta T (degrees F/165 feet)
Stability class

A	-1.20
	C

Delta T	Stability Class	Attachment
less than -1.26	AB	2
from -1.26 to -1.11	C	3
from -1.10 to 1.11	DE	4
greater than 1.11	FG	5

Wind Speed (mph)
Wind Direction from (degrees)

W	21
B	45°
	1, 2, 6

Affected area(s) (see Attachment 9)

Using Attachment 9, "Evacuation Areas", determine the affected downwind areas as follows and put a check in the appropriate box for the specified release.

NOTE

WHENEVER PROTECTIVE ACTION RECOMMENDATIONS ARE BEING CONSIDERED, AREAS 1 AND 2 WILL ALWAYS BE INCLUDED.

a) 0 to 2 Miles General Affected Area(s)

1	<input checked="" type="checkbox"/>
2	<input checked="" type="checkbox"/>

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MANUAL DOSE PROJECTIONS	

ATTACHMENT 7

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b) 2 to 5 Miles

Downwind Direction

0° - 90°
90° - 180°
180° - 270°
270° - 360°

General Affected Area(s)

3	
4	
6	X
7	

NOTE

- (1) IF THE WIND IS BLOWING IN THE MIDDLE OF THE AREA, THAT AREA IS THE ONLY ONE WHICH SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.
- (2) IF THE WIND IS BLOWING NEAR THE EDGE OF AN AREA OR IS BLOWING IN TWO ADJACENT AREAS, BOTH AREAS SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.

c) 5 to 10 Miles

Downwind Direction

0° - 90°
90° - 180°
180° - 270°
270° - 360°

General Affected Area(s)

3	
4,5	
6	X
7	

NOTE

- (1) IF THE WIND IS BLOWING IN THE MIDDLE OF THE AREA, THAT AREA IS THE ONLY ONE WHICH SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.
- (2) IF THE WIND IS BLOWING NEAR THE EDGE OF AN AREA OR IS BLOWING IN TWO ADJACENT AREAS, BOTH AREAS SHOULD BE GIVEN CONSIDERATION FOR INCLUSION IN PROTECTIVE ACTION RECOMMENDATIONS.

2. Determine the following release path(s) information from the Control Room KAMAN terminal and record this information in Sections a and b below. Do this for the Reactor Building, Turbine Building or Offgas Stack, as appropriate. If normal range instruments are used for determining concentration (Conc.), use 1 as a correction factor (corr. fac). If intermediate or high range instruments are used, then use the correction factor from the graph in Attachment 6.

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NOTE

DURING THE FIRST HOUR AFTER SHUTDOWN USE A CORRECTION FACTOR OF 0.325 FOR THE MIDRANGE AND 0.275 FOR THE HIGH RANGE.

a. GROUND LEVEL RELEASE

Path	Conc. uCi/cc	Flow CFM	cor. fac	constant	Ci/Sec
Rx Bld Stk A	.010	x 50,000	x 1 *	x.000472	= .24
Rx Bld Stk B	.034	x 0	x 1 *	x.000472	= 0
Rx Bld Stk C	.025	x 60,000	x 1 *	x.000472	= .71
Turbine Bld	0	x 0	x 1 *	x.000472	= 0
Total ground level release = (sum the 4 boxes above)					Rg .95

* Monitor is reading out of the normal range instrument. Use Rg = 1

b. ELEVATED RELEASE

	Conc. uCi/cc	Flow CFM	Corr. fac	Constant	Re Ci/sec
Offgas Stack	90	x 4,000	x .275 *	x.000472	= 46.7 **

* Monitor is reading out of the high range instrument 1 hour after shutdown.

** Since there is no value for 47, use the value for 2 times 25 Ci/sec on the chart. This gives you a value of 50 Ci/sec which is conservative.

Use Rg and/or Re separately (depending on type of release) as the release rate R for the vertical column in Attachment 2 thru 5. Use the value in box W, above, for the horizontal column. The values obtained from the charts are the dose rates for ground level and elevated releases and should be entered in the boxes under Whole Body Dose Rate for Rg and Re in Sections 3.1.a, 3.2.a, and 3.3a.

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3.0 DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATIONS

3.1 0 to 2 miles

- a) To calculate the integrated dose between 0 and 2 miles, use the dose rate at the location given below for a ground level release (Rg) and an elevated release (Re). Then, place the dose rates obtained from the charts (Att. 2-5) for the ground level and elevated releases in the boxes for whole body dose corresponding to Rg and Re.

Stability Class	Re	Rg
AB	.25 miles	.25 miles
C	.75 miles	site bndry
DE	site bndry	site bndry
FG	site bndry	site bndry

NOTE:

IF NO NUMBER IS GIVEN IN THE APPROPRIATE COLUMN THE DOSE RATE IS ASSUMED TO BE NEG'IGIBLE.

- b) Multiply the whole body dose rate by 400 for ground level releases and by 4 (if SGTS is on) or 400 (if SGTS is off) for elevated releases. The resulting numbers are thyroid dose rates. Sum all dose rates in the vertical columns and enter the results in boxes E and F, where $E = Rg + Re$ and $F = Rg(400) + Re(4 \text{ or } 400)$. Multiply these dose rates by the expected duration of the release (in hours). If no estimate of the duration is readily available use 12 hours.

Estimated duration of release (hr)
(Use 12 hrs, if no estimate of the duration
of the release is not readily available)

D	12
---	----

	Whole Body Dose Rate		Thyroid Corr.	=	Thyroid Dose Rate
Rg	12 mr/hr	x	400	=	4800 mr/hr
Re	36 mr/hr	x	4 or 400 *	=	144 mr/hr
E	48 mr/hr	//////////		F	4944 mr/hr
Whole body dose (WB) = (D x E)/1000				=	0.6 Rem
Thyroid dose (TY) = (D x F)/1000				=	59.3 Rem

* Assume SGTS is operating.

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Protective Action Recommendation

Since both the whole body dose and thyroid dose do not satisfy one of the Protective Action Recommendations given in Section 3.4 of Attachment 1, use the more conservative dose, which is the thyroid dose of 59.3. Using this dose, refer to Section 3.4.3 for protective actions to be taken.

3.2 2 to 5 miles

- a) To calculate integrated dose between 2 and 5 miles, use the dose rate given at the distance of 2 miles on Attachments 2 through 5 (depending on the stability class) for a ground level release and an elevated release.

NOTE:

IF NO NUMBER IS GIVEN IN THE APPROPRIATE COLUMN, THE DOSE RATE IS ASSUMED TO BE NEGLIGIBLE.

- b) Place the dose rates obtained from the charts (Attachments 2-5) for ground level and elevated releases in the boxes for whole body doses corresponding to Rg and Re and fill out the boxes below as discussed in Sect. 3.1.b.

Estimated duration of release (hr)
(Use 12 hrs, if no estimate of the duration of the release is not readily available)

D	12
---	----

	Whole Body Dose Rate x		Thyroid Corr.	=	Thyroid Dose Rate	
Rg	0	mr/hr x	400	=	0	mr/hr
Re	24	mr/hr x	4 or 400 *	=	96	mr/hr
E	24	mr/hr	//////////	F	96	mr/hr
Whole body dose (WB) = (D x E)/1000					0.3	Rem
Thyroid dose (TY) = (D x F)/1000					1.2	Rem

* Assume SGTS is operating.

Protective Action Recommendation

Refer to Section 3.4.1 of Attachment 1 for protective actions to be taken.

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3.3 5 to 10 miles

- a) To calculate integrated dose between 5 and 10 miles, use the dose rate given at the distance of 5 miles on Attachments 2 through 5 (depending on the stability class) for a ground level release and an elevated release.

NOTE

IF NO NUMBER IS GIVEN IN THE APPROPRIATE COLUMN, THE DOSE RATE IS ASSUMED TO BE NEGLIGIBLE.

- b) Place the dose rates obtained from the charts (Attachments 2-5) for ground level and elevated releases in the boxes for whole body dose corresponding to Rg and Re and fill out the boxes below as discussed in Section 3.1.b.

Estimated duration of release (hr)
(If no estimate of the duration of the release is not readily available, use 12 hrs.)

D	12
---	----

	Whole Body Dose Rate		x	Thyroid Corr.	=	Thyroid Dose Rate	
Rg	0	mr/hr	x	400	=	0	mr/hr
Re	6	mr/hr	x	4 or 400 *	=	24	mr/hr
E	6	mr/hr			F	24	mr/hr
whole body dose (WB) = (D x E)/1000					=	0.1	Rem
Thyroid dose (TY) = (D x F)/1000					=	0.3	Rem

* Assume SGTS is operating.

Protective Action Recommendation

Refer to Section 3.4.1 of Attachment 1 for protective actions to be taken.

ATTACHMENT 8

RADIOLOGICAL RELEASE INFORMATION LOG

Date: _____

OFFGAS STACK				REACTOR BUILDING												TURBINE BUILDING		
				Vent A			Vent B			Vent C								
Time	Wind spd.	Wind dir.	Wind delta	Conc.	Range	Flow	Conc.	Range	Flow	Conc.	Range	Flow	Conc.	Range	Flow			
11:50	1000	090	7/165	N I H			N I H			N I H			N I H					
12:00	1000	090	7/165	N I H			N I H			N I H			N I H					
12:10	1000	090	7/165	N I H			N I H			N I H			N I H					
12:20	1000	090	7/165	N I H			N I H			N I H			N I H					
12:30	1000	090	7/165	N I H			N I H			N I H			N I H					
12:40	1000	090	7/165	N I H			N I H			N I H			N I H					
12:50	1000	090	7/165	N I H			N I H			N I H			N I H					
13:00	1000	090	7/165	N I H			N I H			N I H			N I H					
13:10	1000	090	7/165	N I H			N I H			N I H			N I H					
13:20	1000	090	7/165	N I H			N I H			N I H			N I H					
13:30	1000	090	7/165	N I H			N I H			N I H			N I H					
13:40	1000	090	7/165	N I H			N I H			N I H			N I H					
13:50	1000	090	7/165	N I H			N I H			N I H			N I H					
14:00	1000	090	7/165	N I H			N I H			N I H			N I H					
14:10	1000	090	7/165	N I H			N I H			N I H			N I H					
14:20	1000	090	7/165	N I H			N I H			N I H			N I H					
14:30	1000	090	7/165	N I H			N I H			N I H			N I H					
14:40	1000	090	7/165	N I H			N I H			N I H			N I H					
14:50	1000	090	7/165	N I H			N I H			N I H			N I H					
15:00	1000	090	7/165	N I H			N I H			N I H			N I H					
15:10	1000	090	7/165	N I H			N I H			N I H			N I H					
15:20	1000	090	7/165	N I H			N I H			N I H			N I H					
15:30	1000	090	7/165	N I H			N I H			N I H			N I H					
15:40	1000	090	7/165	N I H			N I H			N I H			N I H					
15:50	1000	090	7/165	N I H			N I H			N I H			N I H					
16:00	1000	090	7/165	N I H			N I H			N I H			N I H					
16:10	1000	090	7/165	N I H			N I H			N I H			N I H					
16:20	1000	090	7/165	N I H			N I H			N I H			N I H					
16:30	1000	090	7/165	N I H			N I H			N I H			N I H					
16:40	1000	090	7/165	N I H			N I H			N I H			N I H					
16:50	1000	090	7/165	N I H			N I H			N I H			N I H					
17:00	1000	090	7/165	N I H			N I H			N I H			N I H					
17:10	1000	090	7/165	N I H			N I H			N I H			N I H					
17:20	1000	090	7/165	N I H			N I H			N I H			N I H					
17:30	1000	090	7/165	N I H			N I H			N I H			N I H					
17:40	1000	090	7/165	N I H			N I H			N I H			N I H					
17:50	1000	090	7/165	N I H			N I H			N I H			N I H					
18:00	1000	090	7/165	N I H			N I H			N I H			N I H					

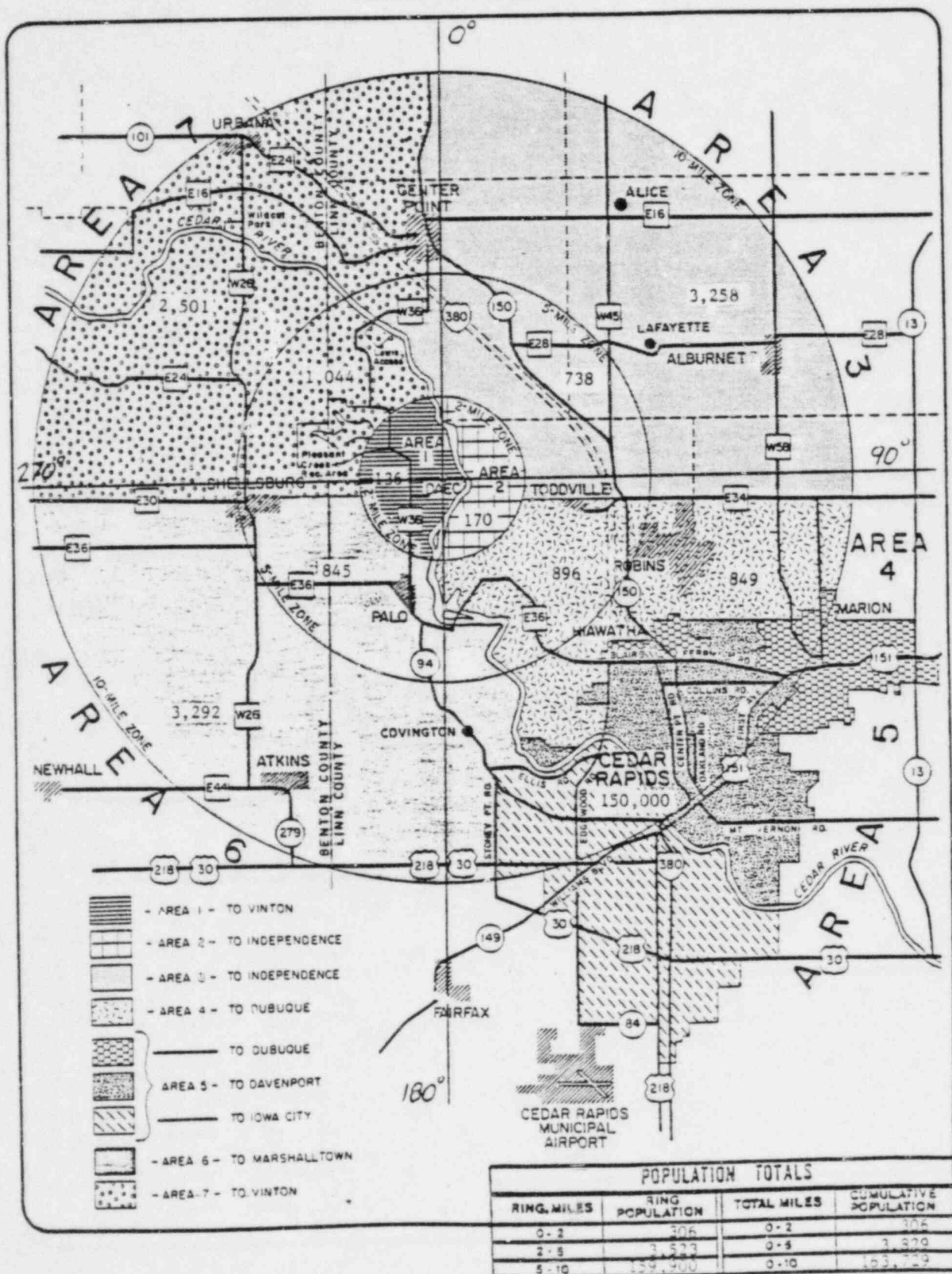
Conc. = Concentration reading of process monitor in uCi/cc.

conc. = Concentration reading of process monitor. in mg/l.
Range = Range of instrument used, N = normal, I = intermediate, H = high, Circle one.

Flow = Flow Rate in CFM

ATTACHMENT 9

EVACUATION AREAS



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1.0 PURPOSE

This procedure describes the use of the IDP and EOF dose projection programs for calculating the downwind dose rates resulting from radioactive releases following an emergency at DAEC.

NOTE

USE OF THE MANUAL DOSE PROJECTION METHOD IS DESCRIBED IN EPIP 3.3a, "MANUAL DOSE PROJECTIONS".

2.0 APPLICABILITY

This procedure will be used by the Site Radiation Protection Coordinator, the Radiological Assessment Coordinator and by other emergency response personnel assigned to operate the IDP/EOF programs.

3.0 RESPONSIBILITIES

3.1 Site Radiation Protection Coordinator

- 3.1.1 Perform dose projection calculations until the EOF is manned.
- 3.1.2 Initially evaluate the results of dose projection calculations.
- 3.1.3 Initially identify the need for field survey data to backup projected dose calculations.

3.2 Emergency Coordinator

- 3.2.1 Initially advise local and State authorities of the results of dose projection calculations and provide protective action recommendations as required.

3.3 IELP Radiological Assessment Coordinator

- 3.3.1 Perform dose projection calculations.
- 3.3.2 Provide protective action recommendations as required.

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4.0 INSTRUCTIONS

NOTE

THE IDP AND EOF PROGRAMS ARE ESSENTIALLY THE SAME COMPUTER PROGRAM BUT THEY USE DIFFERENT MEMORY STORAGE AREAS OF THE VAX COMPUTER. IDP AND EOF ARE THE COMPUTER USER AREA NAMES AND PASSWORDS FOR ACTIVATING THE SYSTEM. THE IDP (INITIAL DOSE PROJECTION) PROGRAM IS OPERATED BY SITE PERSONNEL AT DAEC AND THE EOF (EMERGENCY OPERATIONS FACILITY) PROGRAM IS OPERATED BY CORPORATE PERSONNEL AT THE EOF IN THE IOWA ELECTRIC TOWER. THEIR SEPARATION PERMITS INDEPENDENT OPERATION TO MAINTAIN DATA ENTRY CONTROL.

4.1 Starting the Program

- 4.1.1 Turn on the VAX computer terminal by flipping the black toggle switch, on the back of the video display, to the up position. The printer-terminal in the TSC or EOF may be turned on by flipping the white power switch, on the frame stand, to the on position.
- 4.1.2 Wait a few seconds and hit the RETURN key. IDP users will skip the next step (4.1.3), as it is for EOF users only.
- 4.1.3 Pick up the telephone receiver of the telephone next to the terminal, pull the left-most cradel button up as far as it will go (it is white, where the other one is clear). Listen for a normal dial tone and then dial the VAX data line phone number, as listed in the Emergency Telephone Book. After one ring, a shrill sound can be heard. Upon hearing this sound, carefully press the white cradel button down to its normal position, BUT NOT ALL THE WAY DOWN! Place the receiver on the table. If the EOF printer-terminal is used, there is no special cradel button but there is a voice/data switch. Dial the Vax data line phone number with the switch in the voice position. As soon as you hear the shrill sound, flip the voice/data switch to data position and place the phone back on the cradel.
- 4.1.4 Hit the RETURN key
- 4.1.5

prompt	answer
USERNAME:	IDP (EOF for Corporate)
	hit RETURN key.
- 4.1.6

prompt	answer
PASSWORD:	IDP (EOF for Corporate)
	hit RETURN key.

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Protective Action

Recommendations - specific actions to take as a result of these calculations.

- 4.2.8 If you should need to break from the program to start anew, hold the CONTROL key down and hit the C key once.

prompt	answer
\$	LOG

hit RETURN key twice.

prompt	answer
\$	IDP (or EOF)

hit RETURN key.

You have now reentered the program anew. Repeat Steps 4.2.1 thru 4.2.6.

4.3 Continuing Use

- 4.3.1 When the output ends a prompt will request whether you desire to continue. Hit RETURN key and the following will be displayed:

For the IDP Program:

prompt	answer
TYPE: HELP IDP - For Help with IDP Program	IDP
LOG - To Log Off the Computer System	
IDP - Re-Run the IDP Program	

For the EOF Program:

prompt	answer
master menu list	2
YOUR CHOICE:	

hit RETURN key.

- 4.3.2 Repeat instructions in Steps 4.2.1 and 4.2.2.

4.3.3

prompt	answer
DO YOU WISH TO USE ANY OF THE INPUT DATA FROM THE PREVIOUS CASE (Y/N)	Y

Hit RETURN key.

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4.3.4	prompt	answer
	INPUT 0 FOR LIST OF EDIT ITEMS	1
	1 TO START CALCULATION OR	
	NUMBER OF ITEM TO EDIT (2-36)	

hit RETURN key.

- a) If you enter 0 at this prompt, you will be given a numbered list of all input edit items. This list is described in Attachment 2.
- b) If you enter 1, you will immediately go into dose calculation and output printout.
- c) If you enter 2-36 you will be shown the appropriately numbered input item and you can enter a new value.

4.3.5 You will now repeat steps 4.2.5 thru 4.2.7

4.4 Terminating the Program

4.4.1 For the IDP Program:

When you reach Step 4.3.1, type LOG and hit RETURN key. This will terminate the program and log you off the computer.

For the EOF Program:

Upon eventual return to master menu, select choice 9 and hit RETURN key. This will terminate the program and log you off the computer.

4.4.2 EOF video terminal users will put the phone receiver back on the phone cradle.

4.4.3 Shut off the terminal by flipping the black toggle switch, on the back of the video display, to the down position. Printer-terminals will be shut off by flipping the white power button, on the frame leg, to the off position.

4.5 Accessing and Eliminating Sum Tables

Each distinct set of input data causes a sum table list file to be produced and saved in computer storage. In the EOF Program, these files can be seen by selecting choice 4 from the master menu prompt. The IDP Program, however, will not directly give you a listing of the sum table list file. You must get a directory from the operating system cursor.

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As an example, the seventh version looks like this:

SUMTABLE.LIS;7

The computer will always use the latest version of the sum table (your last run of the program). If you want to use a sum table other than the latest one, see Attachment 3.

Occasionally, too many sum tables will be created for the limited space available in your computer user area. This will result in an OPEN FAILURE error. When this occurs, obtain the assistance of a system expert to eliminate unwanted sum tables, and make room for new ones.

4.6 Program Verification

In order to assure the user that the program is functioning properly, Attachment 4 lists a sample input set of values and the corresponding output release rate. If the user is uncertain that the program is functioning properly, he may input those values and see if the computer produces the same output.

NOTE

IF VERIFICATION FAILS, USE EPIP 3.3A, "MANUAL DOSE PROJECTIONS", INSTEAD OF THE COMPUTER.

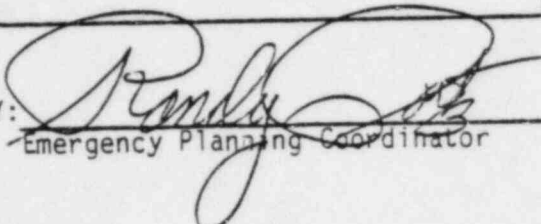
5.0 REFERENCES

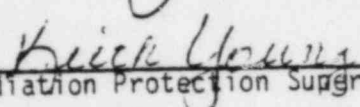
1. DAEC Emergency Plan
2. IELP Corporate Emergency Plan
3. EPA 3.3a
4. EPA Protective Action Guides
5. TEC Report No. : R-82-002 Interim Class A Model

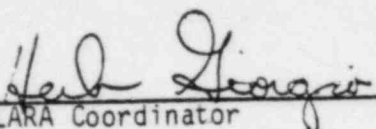
6.0 ATTACHMENTS

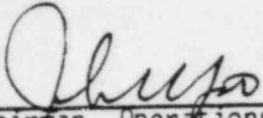
1. Other Functions of the EOF Program
2. Input Edit Items
3. Accessing Sum Tables
4. Program Verification

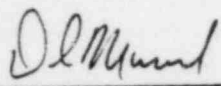
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APPROVED BY:  DATE: June 23, 1983
Emergency Planning Coordinator

APPROVED BY:  DATE: 6/24/83
Radiation Protection Supervisor

REVIEWED BY:  DATE: 6/25/83
ALARA Coordinator

REVIEWED BY:  DATE: 7-5-83
Chairman, Operations Committee

APPROVED BY:  DATE: 7-6-83
Plant Superintendent - Nuclear

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ATTACHMENT 1

Other Functions of the EOF Program

The purpose of the attachment is to briefly describe EOF master menu selections other than choice 2 (which is described in the body of this procedure). This attachment does not apply to IDP users even though the term IDP is used in the menu titles.

CHOICE 1 - HELP WITH THE IDP PROGRAM

This choice will simply describe the IDP/EOF program in narrative form.

CHOICE 3 - PRINT YOUR LATEST IDP RUN

This choice will repeat the output that you just calculated.

CHOICE 4 - COPY THE LATEST HP IDP DATA FOR YOUR OWN USE

This choice will make a file copy of the latest sum table list file and display your user area directory.

CHOICE 5 - SEE LATEST HP IDP DATA RUN - VT100

This choice will load the most recent sum table list file and display its output on the video terminal.

CHOICE 6 - SEE LATEST HP IDP DATA RUN - HARDCOPY

This choice is the same as choice 5, except you will receive a printout of the run.

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CHOICE 7 - EXAMINE CURRENT PLANT STATUS INFO

This choice will enable you to see what are the current plant operational and radiological parameters. Upon selecting this choice you will be shown another menu as follows:

P = PRINT the emergency status on the system lineprinter

V = VIEW the emergency status data on a video terminal

T = TYPE the emergency data on the current user terminal

L = LOGOFF the system

R = RETURN to normal timesharing (\$ prompt) or calling menu

Plant status is nothing more than an electronic notepad system. THERE IS NO DIRECT CONNECTION WITH PLANT INSTRUMENTATION FOR REAL TIME INPUT. This information is entered manually in the Control Rom thru menu option T. However, data entered from the site IDP will be visible on the Corporate EOF program. This is the only mode in which the IDP and EOF user areas will overlap in sharing data.

Menu option R will return you to the master menu.

CHOICE 8 - EXIT THIS MENU AND RETURN TO THE OPERATING SYSTEM

This choice allows you to terminate the program without logging off the computer. It will give you an operating system cursor (\$). From that cursor you may execute a wide range of operating system commands. It is suggested that the casual user avoid this choice unless he has full understanding of operating system commands.

CHOICE 9 - LOG OFF THE COMPUTER SYSTEM

As described in section 4.4, this is the standard method of terminating use of the program and computer terminal.

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ATTACHMENT 2

Input Edit Items

The purpose of this attachment is to list edit items that are input into the computer program. The item number corresponds to edit prompt number.

No.	Item	Response	Notes
0	summary of edit items	0	execution - not input
1	calculate	1	execution - not input
2	recorded by	name	person using program
3	calculation number	number	number of run
4	wind direction	degrees	direction FROM
5	wind speed	mph	
6	delta T	deg F/165ft	see * note * next page
9	time since shutdown	hours	
10	field rate determination	Y/N	if field data exists
11	Rx Bld A stack conc.	uCi/cc	
12	" " A " range	N I H	Normal Inter. High
13	" " B " conc.	uCi/cc	
14	" " B " range	N I H	
15	" " C " conc.	uCi/cc	
16	" " C " range	N I H	
17	" " A " flow	CFM	
18	" " B " "	"	
19	" " C " "	"	
20	Offgas Stack conc.	uCi/cc	
21	" " range	N I H	
22	" " flow	CFM	
23	Turbine Exhaust conc.	uCi/cc	
24	" " range	N I H	
25	" " flow type	C or %	select type of flow
26	" " flow	CFM or %	
27	SGTS on?	Y/N	standby gas treatment
28	release duration	hours	usually an estimate
29	Iodine % - ground	frac. %	default value is .3
30	" - elevated	frac. %	SGTS on/off .3/.003
31	release rate from field	Y/N	if field data exists
32	time of measurement	hours	answer if 31 is Y
33	distance of measurement	meters	answer if 31 is Y
34	exposure rate	mr/hr	answer if 31 is Y
35	additional locations (3)	miles	
36	release rate override	Ci/sec	This input allows you to force a specific release rate rather than letting the computer calculate one based on information from items numbered 11 to 26. This is ideal for complying with the requirements of PASAP 7.4 where certain release rates will be assumed that are not built into the IDP/EOF program.

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ATTACHMENT 2 (Cont'd)

* NOTE *

IF METEOROLOGICAL DATA IS NOT AVAILABLE FROM THE PLANT, IT MAY BE OBTAINED FROM THE FLIGHT SERVICE STATION IN CEDAR RAPIDS AND/OR THE NATIONAL WEATHER SERVICE IN DES MOINES (PHONE NUMBERS ARE LOCATED IN THE EMERGENCY TELEPHONE BOOK). THE COMPUTER USES DELTA T IN UNITS OF DEGREES FARENHEIT PER 165 FEET. SOURCES OTHER THAN THE PLANT MET TOWER MAY USE OTHER UNITS WHICH MUST BE CONVERTED. THE FOLLOWING CHART MAY BE USED AS AN ALTERNATE METHOD IN DETERMING THE DELTA T TO USE FOR COMPUTER INPUT:

Wind Speed (mph)	D A Y T I M E - SOLAR RADIATION				N I G H T T I M E	
	Strong	Moderate	Slight	Overcast	clear or thin overcast	overcast
< 5	-2	-2	-2	-1.2	1	2
5- 7	-2	-2	-1.2	1	1	2
7-10	-2	-1.2	-1.2	1	1	1
0-13	-1.2	1	1	2	1	1
> 13	-1.2	1	1	2	1	1

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ATTACHMENT 3

Accessing Sum Tables

The purpose of the attachment is to briefly describe the manner in which the user may load and run a sum table other than the most current one.

1. Hit CONTROL and C keys simultaneously.
2. When the operating system cursor (\$) appears, type DIR and hit RETURN.
3. Find the SUMTABLE.LIS;# file on the directory which has the largest version number (#).
4. Find the SUMTABLE.LIS version that you desire to view.
5. Rename the desired SUMTABLE.LIS file to a version number one larger than the largest one on your directory.

For example, SUMTABLE.LIS;34 is the latest file and you wish to view SUMTABLE.LIS;22.

type: RENAME SUMTABLE.LIS;22 TO SUMTABLE.LIS;35
hit RETURN.

6. Hit RETURN again to obtain USERNAME prompt and reenter the IDP/EOF program.
7. When you see the Previous Case prompt, answer Y. The program will use the file with the largest version number.
8. After viewing the data, it is recommended that you return to the operating system cursor and rename the version back to its original version number.

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ATTACHMENT 4

Program Verification

The purpose of the attachment is to list a simple set of input data and corresponding output to enable the user to verify whether or not the program is functioning properly.

I. METEOROLOGICAL DATA

4 WIND DIRECTION (degrees) -- 270.0
5 WIND SPEED (mph) ----- 8.0
6 DELTA T (degrees) ----- 1.20

*** MISCELLANEOUS INPUT ***

9 TIME SINCE SHUTDOWN (hrs) - 1.00
10 USE ONLY FIELD EXPOSURE RATES FOR DETERMINING
THE RELEASE RATES (Y/N) --- N

II. RELEASE DATA

A. Reactor Building Stacks

11 "A" STACK CONCENTRATION -----1.00E-06 uCi/cc
12 "A" STACK RANGE (HI/INT/NOR) -----H
13 "B" STACK CONCENTRATION -----1.00E-06 uCi/cc
14 "B" STACK RANGE (HI/INT/NOR) -----H
15 "C" STACK CONCENTRATION -----1.00E-06 uCi/cc
16 "C" STACK RANGE (HI/INT/NOR) -----H
17 "A" STACK FLOW RATE -----6.00E+04 CFM
18 "B" STACK FLOW RATE -----5.50E+04 CFM
19 "C" STACK FLOW RATE -----0.00E+00 CFM

B. OFFGAS STACK

20 OFFGAS STACK CONCENTRATION-----1.00E-06 uCi/cc
21 OFFGAS STACK RANGE (HI/INT/NOR)-----H
22 OFFGAS STACK FLOW -----4.00E+03 CFM

C. TURBINE EXHAUST

23 TURBINE EXHAUST CONCENTRATION -----0.00E+00 uCi/cc
24 TURBINE EXHAUST RANGE (HI/INT/NOR)-----H
25 TURBINE EXHAUST FLOW -----0.00E+00 CFM
TURBINE EXHAUST FLOW PERCENT -----0.00 %

D. MISCELLANEOUS DATA

27 STANDBY GAS TREATMENT FOR OFFGAS EXHAUST AVAILABLE
(Y/N) -----Y
28 DURATION OF RELEASE (hrs) -----1.77
29 RATIO OF IODINE TO TOTAL ACTIVITY FOR
GROUND LEVEL RELEASE -----3.00E-01
30 RATIO OF IODINE TO TOTAL ACTIVITY FOR
AN ELEVATED RELEASE -----3.00E-03

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ATTACHMENT 4 (Continued)

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31  III. FIELD EXPOSURE DATA
    USE FIELD EXPOSURE RATE MEASUREMENTS?
    (Y/N)-----N

    *** ANALYSIS LOCATIONS ***
35  ADDITIONAL LOCATIONS FOR CALCULATIONS.
    LOCATION # 1 (meters) -----8.05E+02
    LOCATION # 2 (meters) -----1.61E+03
    LOCATION # 3 (meters) -----2.41E+03

36  RELEASE RATE MANUAL OVERRIDE OPTION,
    CURRENT VALUES ARE:
    REACTOR BUILDING RELEASE RATE -----0.00E+00
    OFFGAS  STACK   RELEASE RATE -----0.00E+00
    TURBINE BUILDING RELEASE RATE -----0.00E+00
    -----
    TOTAL GASEOUS   RELEASE RATE -----0.00E+00

    INPUT 0 FOR LIST OF EDIT ITEMS
    1 TO START CALCULATION OR
    NUMBER OF ITEM TO EDIT (2-36)_1

    DO YOU WANT THE OUTPUT TO GO TO THE TSC PRINTER (Y/N)? : Y
    THE LATEST IDP CALCULATION WILL PRINT ON THIS TERMINAL . . .
    HOW MANY COPIES DO YOU WANT (1,2,3. . .)? : 1

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III. DOSE INFORMATION

	Down Wind Location					Additional Locations		
	X/Q	Site Boundary	2mi	5mi	10mi	#1	#2	#3
1. Distance to location, meters (miles)	16090.0 (10.00)	490.0 (0.30)	3218.0 (2.00)	8045.0 (5.00)	16090.0 (10.00)	804.5 (0.50)	1609.0 (1.00)	2413.5 (1.50)
2. Normalized concentration, X/Q, sec/m ³ , Ground level release	5.59E-06	1.03E-03	6.18E-05	1.57E-05	5.59E-06	4.90E-04	1.74E-04	9.50E-05
3. Normalized concentration, X/Q, sec/m ³ , Elevated release	4.75E-07	0.00E+00	1.42E-12	5.63E-08	4.75E-07	0.00E+00	1.40E-20	6.75E-16
4. Whole body dose rate, mrem/hr	2.06E-04	3.76E-02	2.27E-03	5.78E-04	2.06E-04	1.80E-02	6.38E-03	3.48E-03
5. Whole body dose mrem	3.65E-04	6.66E-02	4.01E-03	1.02E-03	3.65E-04	3.18E-02	1.13E-02	6.17E-03
6. Thyroid dose commitment, mrem	7.35E-02	1.35E+01	8.13E-01	2.07E-01	7.35E-02	6.44E+00	2.29E+00	1.25E+00
7. Total Plume width meters (miles)	2099.9 (1.31)	91.6 (0.06)	495.7 (0.31)	1127.6 (0.70)	2099.9 (1.31)	142.9 (0.09)	266.2 (0.17)	382.9 (0.24)
8. Plume arrival time, hr	1.25E+00	3.81E-02	2.50E-01	6.25E-01	1.25E+00	6.25E-02	1.25E-01	1.88E-01