Nebraska Public Power District
Nebraska's Energy Leader

NLS2000067
July 20, 2000

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

Subject: Emergency Plan Implementing Procedure
Cooper Nuclear Station, NRC Docket 50-298, DPR-46

Pursuant to the requirements of 10 CFR 50, Appendix E, Section V, "Implementing Procedures," Nebraska Public Power District is transmitting the following Emergency Plan Implementing Procedure (EPIP):

EPIP 5.7.17 Revision 23 "Dose Assessment"

Should you have any questions concerning this matter, please contact me.

Sincerely,

R. L. Zipfel
Emergency Preparedness Manager

/nr
Enclosure

cc: Regional Administrator w/enclosure (2)
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A045

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The following table identifies those actions committed to by the District in this document. Any other actions discussed in the submittal represent intended or planned actions by the District. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITTED DATE OR OUTAGE
None	

1. PURPOSE

[ ] 1.1 This procedure provides a means of dose projection based on meteorological and radiological conditions using the CNS-DOSE Computer Program.

[ ] 1.2 This procedure provides a manual backup method for Step 1.1.

[ ] 1.3 This procedure provides a method for rapid gross estimation of core damage based on in-containment high range radiation monitor readings for primary containment LOCA events.

2. PRECAUTIONS AND LIMITATIONS

[ ] 2.1 Actual dose rates will vary as a function of:

[ ] 2.1.1 The total curies released.

[ ] 2.1.2 Release rate.

[ ] 2.1.3 The duration of the release.

[ ] 2.1.4 The isotopic mixture of the release.

[ ] 2.1.5 Meteorological conditions.

[ ] 2.2 Update and refine dose calculations upon significant changes in one or more of the above parameters.

[ ] 2.3 Should a release occur which necessitates rapid decision making concerning the recommendation of protective actions, the guidance contained in Procedure 5.7.20 should be followed.

[ ] 2.4 Attachment 7 should be used to estimate core damage only in cases where the high range in-containment radiation monitors are exposed to coolant or steam (i.e., only for primary containment LOCA situations). For other accident sequences, utilize the Post-Accident Sampling System (PASS) and Core Damage Assessment Program (CORDAM).

3. REQUIREMENTS

| [ ] 3.1 Ensure following equipment and materials are available, as needed:

[ ] 3.1.1 COMPUTERIZED DOSE PROJECTION (CNS-DOSE)

[ ] 3.1.1.1 Computer terminals.

[ ] 3.1.1.2 Computer printers.

[ ] 3.1.2 MANUALLY CALCULATED DOSE PROJECTION

[ ] 3.1.2.1 Environs map.

[ ] 3.1.2.2 χ/Q isopleths.

[ ] 3.1.2.3 Scientific calculator.

[ ] 3.2 A release of airborne radioactive material has occurred or has the potential of occurring.

[ ] 3.3 Release Rate Determinations shall be conducted using Procedure 5.7.16 when KAMAN monitors are inoperable.

[ ] <u>NOTE</u> 1 - When PMIS data used by CNS-DOSE is unavailable or "unhealthy", refer to Attachment 5 for alternate sources of data.

[ ] <u>NOTE</u> 2 - If the user is not familiar with the use of PMIS, Attachment 6 is referred to for detailed instructions on access and selected use of PMIS.

4. COMPUTER DOSE PROJECTION (CNS-DOSE)

[ ] 4.1 To start the dose projection program on a PMIS terminal, enter the turn-on code "DOSE" on a terminal logged into either the Primary or Backup System.

[ ] 4.2 The dose projection program can also be run on a non-PMIS terminal. However, this is reserved for personnel having access to an account on the computer and familiar with its use. To start the dose projection program on a non-PMIS terminal, on either PMIS computer, log in to an account that has privileges to run PMIS software and run program [NPPD.EXECUTE]NPDOSEZ.

[ ] 4.3 Each time the program is started or the "New Sample" option is selected, new data will be loaded into the program. Verify that Field 1 correctly indicates the origin of the release and the data displayed is "healthy" and correct.

[ ] 4.4 Estimate the duration of release (consult with Operations and/or Engineering for this time estimate) in hours. If the estimated duration of release cannot be determined, use the 4 hour default value.

[ ] 4.5 Determine if SGT is in the effluent stream and if it is functional. Consult with Radiological, Operations, and Engineering personnel for this determination, if available.

[ ] 4.6 Determine if the core is degraded (indication of fuel overheat, fuel uncovered, SJAE > 1.5E4 mrem/hr, PASS results, or primary containment monitor reading ≥ 2.5E+3 rem/hr). Consult with Radiological, Operations, and Engineering personnel for this determination, if available.

[ ] 4.7 DETERMINE IF RELEASE BYPASSES SECONDARY CONTAINMENT

[ ] 4.7.1 If release bypasses secondary containment (i.e., direct venting of drywell or a release from the Turbine Building), then enter Y.

[ ] 4.7.2 If release does not bypass secondary containment, then enter N.

[ ] 4.8 Make corrections or changes, as necessary.

[ ] 4.9 Use the RETURN key to accept data and move to the next field.

[ ] 4.10 Press the RESULTS option to display the dose projections.

[ ] 4.11 Select either the PRINT or HARD COPY option to make a hard copy of the results.

[ ] 4.12 Select the "New Sample" or "Edit" option to return to the previous display and obtain new data or make additional changes.

[ ] 4.13 Exit the program by entering "Q" or pressing the "CANC" key on PMIS terminals.

[ ] 4.14 Select the "Help" option for additional program operational information.

5. HAND-CALCULATED DOSE PROJECTION (CENTERLINE)

[ ] <u>NOTE</u> - This method reflects the methodology used in the CNS-DOSE Program. It gives only downwind dose values for plume centerline at distances of 1, 2, 5, and 10 miles from the site. For calculating doses at specific receptor locations, the method in Section 7 is used.

[ ] 5.1 Obtain release rate from effluent KAMAN monitor digital readout in μCi/sec and record value in Block 1 on Attachment 3. If KAMAN is inoperable, complete appropriate attachment of Procedure 5.7.16 and record the noble gas release rate value (μCi/sec) in Block 1 on Attachment 3.

[ ] <u>NOTE</u> - The answer to the question concerning the status of the Standby Gas Treatment System has a significant impact on the resultant dose projection calculation. The answer to this question is coordinated with Radiological, Operations, and Engineering personnel, if available.©

[ ] 5.2 Determine if SGT is in the effluent stream.

- [ ] 5.2.1 If SGT <u>is</u> in the effluent stream, enter 0.01 in Block 2 of Attachment 3.

- [ ] 5.2.2 If SGT <u>is not</u> in the effluent stream, enter 1 in Block 2 of Attachment 3.

[ ] **<u>NOTE</u>** - The Iodine to Noble Gas ratio is very dependent on the answer to the core degraded question and has a significant impact on the resultant dose projection calculations. The answer to the core degraded question is coordinated between Radiological, Operations, and Engineering, if available.

[ ] 5.3 Determine if core is degraded (indication of fuel overheat, fuel uncovered, SJAE > 1.5E4 mrem/hr, PASS results, or primary containment radiation monitors reading ≥ 2.5E+3 rem/hr).

[ ] 5.3.1 If core <u>is</u> degraded, obtain the Iodine to Noble Gas ratio from Table 1 of Attachment 3 and enter that value in Block 3 of Attachment 3.

[ ] 5.3.2 If core <u>is not</u> degraded, enter 1.86E-7 in Block 3 of Attachment 3.

[ ] 5.4 Obtain the Noble Gas energy factor (MeV/dis) based on time since reactor shutdown in hours from Table 2 on Attachment 3 and enter this value in Block 4 on Attachment 3.

[ ] 5.5 Obtain the wind speed in miles per hour (mph) from PMIS or MET recorders in the Computer Room and record the value in Block 5 of Attachment 3.

[ ] 5.5.1 If the release is from the ERP, use wind speed at the 100 meter level. Default is 13 mph.

[ ] 5.5.2 If the release is from any other source, use the wind speed at the 10 meter level. Default is 8 mph.

[ ] 5.6 Determine the atmospheric stability class (A→G) from PMIS or the MET System and record in Block 6 on Attachment 3. If the stability class cannot be obtained from PMIS or Met System, use D as the default value and record this in Block 6 of Attachment 3.

[ ] 5.7 DETERMINE IF RELEASE BYPASSES SECONDARY CONTAINMENT

[ ] 5.7.1 If release bypasses secondary containment (for example, direct venting of drywell or a release from the Turbine Building), then enter 1 in Block 7 on Attachment 3.

[ ] 5.7.2 If release does not bypass secondary containment, then enter 0.5 in Block 7 on Attachment 3.

[ ] 5.8 Obtain TEDE Noble Gas Dose Conversion Factor from Table 3 of Attachment 3 and record in Block 8 on Attachment 3.

[ ] 5.9 Obtain TEDE Iodine Dose Conversion Factor from Table 3 of Attachment 3 and record in Block 9 on Attachment 3.

[ ] 5.10 Obtain CDE Iodine Dose Conversion Factor from Table 3 of Attachment 3 and record in Block 10 on Attachment 3.

[ ] 5.11 Compute TEDE "sub-calculation" value and record in Block 11 of Attachment 3.

$$\frac{[(\text{Block 1})(\text{Block 4})(\text{Block 8})] + [(\text{Block 1})(\text{Block 2})(\text{Block 3})(\text{Block 7})(\text{Block 9})]}{(\text{Block 5})}$$

[ ] 5.12 Using the appropriate release point (ERP or other) and stability class (Block 6), obtain the mixing factors (χ/Qs) for distances 1, 2, 5, and 10 miles from Table 4 on Attachment 3 and record in Block 12 of Attachment 3.

[ ] 5.13 Compute the TEDE dose rate for each distance and record values in Block 13 on Attachment 3.

(Block 11) x (Block 12)

[ ] 5.14 Estimate the duration of the release (consult with Operations and/or Engineering for this time estimate) in hours and record value in Block 14 on Attachment 3. If the estimated duration of release cannot be determined, use 4 hours as a default value.

[ ] 5.15 Compute integrated TEDE doses for each distance and record values in Blocks 15 on Attachment 3.

(Block 13) x (Block 14)

[ ] 5.16 Compute CDE "sub-calculation" value and record in Block 16 of Attachment 3.

$$\frac{(\text{Block 1})(\text{Block 2})(\text{Block 3})(\text{Block 7})(\text{Block 10})}{(\text{Block 5})}$$

[ ] 5.17 Compute the CDE dose rate for each distance and record values in Block 17 on Attachment 3.

(Block 16) x (Block 12)

[ ] 5.18 Compute the CDE dose for each distance and record values in Block 18 on Attachment 3.

(Block 17) x (Block 14)

[ ] 5.19 Refer to Procedure 5.7.1 to determine if an emergency should be declared due to radiological effluent (dose rate or integrated dose to a member of the public) calculated at or beyond 1 mile.

[ ] 5.20 Refer to Procedure 5.7.20 to determine if any protective action recommendations should be made to off-site authorities.

[ ] 5.21 Recalculate dose projections whenever conditions change significantly.

[ ] 5.22 Record name, time, and date at the bottom of Attachment 3.

6. HAND-CALCULATED DOSE PROJECTION (NON-CENTERLINE)

[ ] 6.1 Obtain release rate from effluent KAMAN monitor digital readout in μCi/sec and record value in Block 1 on Attachment 1. If KAMAN is inoperable, complete appropriate attachment of Procedure 5.7.16 and record the noble gas release rate value (μCi/sec) in Block 1 on Attachment 1.

[ ] <u>NOTE</u> - The answer to the question concerning the status of the Standby Gas Treatment System has a significant impact on the resultant dose projection calculation. The answer to this question is coordinated with Radiological, Operations, and Engineering personnel, if available.

[ ] 6.2 Determine if SGT is in the effluent path.

[ ] 6.2.1 If SGT <u>is</u> in effluent path, enter 0.01 in Block 2 on Attachment 1.

[ ] 6.2.2 If SGT <u>is not</u> in effluent path, enter 1 in Block 2 on Attachment 1.

[ ] <u>NOTE</u> - The Iodine to Noble Gas ratio is very dependent on the answer to the core degraded question and has a significant impact on the resultant dose projection calculations. The answer to this question is coordinated with Radiological, Operations, and Engineering, if available.

[ ] 6.3 Determine if the core is degraded (indication of fuel overheat, fuel uncovered, SJAE > 1.5E4 mrem/hr, PASS results, or primary containment radiation monitors reading ≥ 2.5E+3 rem/hr).

[ ] 6.3.1 If core <u>is</u> degraded, obtain the Iodine to Noble Gas ratio from Table 1 of Attachment 1 and enter that value in Block 3 on Attachment 1.

[ ] 6.3.2 If core <u>is not</u> degraded, enter 1.86E-07 in Block 3 on Attachment 1.

[ ] 6.4 Determine the energy factor (MeV/dis) based on time since reactor shutdown in hours and Table 2 on Attachment 1, and enter value in Block 4 on Attachment 1.

[ ] 6.5 Obtain the wind speed in miles per hour (mph) from PMIS or MET recorders in the Computer Room and record the value in Block 5 on Attachment 1.

[ ] 6.5.1 If the release is from the ERP, use wind speed at the 100 meter level. Default is 13 mph.

[ ] 6.5.2 If the release is from any other source, use the wind speed at the 10 meter level. Default is 8 mph.

[ ] 6.6 Determine the wind direction (from) in degrees from PMIS, MET, or direct observation and record in Block 6 on Attachment 1.

[ ] 6.7 Determine the atmospheric stability class (A-G) from PMIS or the MET System and record in Block 7 on Attachment 1. If the stability class cannot be obtained from the PMIS or MET System, use D as the default.

[ ] 6.8 DETERMINE IF RELEASE BYPASSES SECONDARY CONTAINMENT

[ ] 6.8.1 If the release bypasses secondary containment (for example direct venting of the drywell or a release from the Turbine Building), then enter 1 in Block 8 on Attachment 1.

[ ] 6.8.2 If the release does not bypass secondary containment, then enter 0.5 in Block 8 on Attachment 1.

[ ] 6.9 Obtain TEDE Noble Gas Dose Conversion Factor from Table 3 of Attachment 1 and record in Block 9 on Attachment 1.

[ ] 6.10 Obtain TEDE Iodine Dose Conversion Factor from Table 3 of Attachment 1 and record in Block 10 on Attachment 1.

[ ] 6.11 Obtain CDE Iodine Dose Conversion Factor from Table 3 of Attachment 1 and record in Block 11 on Attachment 1.

[ ] 6.12 Obtain the mixing factor (χ/Q) for the receptor point or location.

[ ] 6.12.1 Record location or receptor point ID at the top of Attachment 1.

[ ] 6.12.2 Obtain the proper χ/Q isopleth overlay based on stability class and release point.

[ ] 6.12.2.1 Overlays are available in the TSC or EOF for both elevated and ground level releases for each stability class. Use ground level isopleths for all releases which are not from the ERP.

[ ] 6.12.3 Place the isopleth overlay on an Emergency Planning Zone map scaled to 1" per mile. The preferred map is the "Cooper Nuclear Station 20 Mile Plume Exposure" map with sectors, radii, and wind direction labeled. One is posted in the TSC and EOF.

[ ] 6.12.4 Orient the isopleth overlay so the centerline of the isopleth is over the wind direction radius, the open end of the isopleth is downwind, and the asterisk is over CNS.

[ ] 6.12.5 Lightly mark the desired receptor location on the isopleth with a <u>pencil</u>.

[ ] <u>**NOTE**</u> - All χ/Qs have negative exponents.

[ ] 6.12.6 Using the legend in the lower right hand corner of the isopleth overlay, linearly interpolating as necessary, determine a χ/Q value for the receptor site.

[ ] 6.12.7 Record the χ/Q value in Block 12 on Attachment 1.

[ ] 6.13 Compute TEDE dose rate (rem/hr) and record in Block 13 on Attachment 1.

$$\frac{[(\text{Block 1})(\text{Block 4})(\text{Block 9})]+[(\text{Block 1})(\text{Block 2})(\text{Block 3})(\text{Block 8})(\text{Block 10})]}{(\text{Block 5})} \times (\text{Block 12})$$

[ ] 6.14 Estimate the duration of the release (consult with Operations and/or Engineering for this time estimate) in hours and record the value in Block 14 on Attachment 1. If the estimated duration of release cannot be determined, use 4 hours as a default value.

[ ] 6.15 Compute the integrated TEDE dose (rem) and record in Block 15 on Attachment 1.

(Block 13) x (Block 14)

[ ] 6.16 Compute CDE dose rate (rem/hr) and record in Block 16 on Attachment 1.

$$\frac{(\text{Block 1})(\text{Block 2})(\text{Block 3})(\text{Block 8})(\text{Block 11})}{(\text{Block 5})} \times (\text{Block 12})$$

[ ] 6.17 Compute CDE dose (rem) and record in Block 17 on Attachment 1.

(Block 14) x (Block 16)

[ ] 6.18 Record name, time, and date at the bottom of Attachment 1.

7. CORRELATING OFF-SITE SAMPLE RESULTS WITH DOSE PROJECTIONS©

[ ] NOTE 1 - This section describes the methodology to be used to correlate CNS-DOSE results (estimated gross iodine concentrations) with gross iodine concentrations sampled in the field.

[ ] NOTE 2 - This section is to be used by dose assessment personnel in the EOF once field teams have been dispatched and sample results become available.

[ ] NOTE 3 - Initial dose projections (computer and hand-calculated) are based upon assumed radionuclide concentrations until actual concentrations have been measured. Off-site sample results are used to determine a dose correction factor which may be applied to adjust the CNS-DOSE Program.

[ ] 7.1 CORRECTION FACTOR DETERMINATION USING OFF-SITE SAMPLE DATA

[ ] 7.1.1 Radiological Assessment Coordinator shall:

[ ] 7.1.1.1 Record off-site sample location, time, and gross iodine concentration as determined by field teams in Blocks 1 through 3, on Attachment 4.

[ ] 7.1.1.2 Obtain the CNS-DOSE calculated gross iodine concentration corresponding to the location of the above sample and record in Block 4 on Attachment 4.

[ ] 7.1.1.3 Divide Block 3 by Block 4 to obtain the correction factor (CF) and record the results in Block 5, Attachment 4.

[ ] 7.1.1.4 Report correction factor to the Radiological Control Manager or Chem/RP Coordinator.

[ ] 7.1.2 Radiological Control Manager or Chem/RP Coordinator shall determine if the correction factor shall be applied to dose projections.

[ ] 7.1.2.1 If correction factor is significant, the Radiological Control Manager or Chem/RP Coordinator may apply the CF to adjust the Iodine/Noble Gas ratio used by CNS-DOSE to verify PARs are adequate. See next section.

[ ] 7.2 APPLYING CORRECTION FACTOR TO CNS-DOSE

[ ] 7.2.1 Apply the correction factor to CNS-Dose using the "Field Adjust" OPTION of CNS-DOSE.

[ ] 7.2.1.1 At the MAIN CNS-DOSE screen, select option "Field Adjust".

[ ] 7.2.1.2 Enter the radius distance from CNS in miles at the prompt (1, 2, 5, and 10 are the only options).

[ ] 7.2.1.3 Enter the gross iodine concentration (in μCi/cc) obtained from the field at the prompt.

[ ] 7.2.1.4 After obtaining new Results from CNS-DOSE, compare new PARs to any PARs previously transmitted to off-site authorities.

[ ] a. If PARs have changed, notify the Emergency Director and, if PARs have become more severe, the Emergency Director shall initiate notification of new PARs to off-site authorities.

[ ] b. If PARs have not changed, periodically perform this portion of the procedure to compare field iodine concentrations with CNS-DOSE calculated iodine concentrations.

8. CORE DAMAGE ESTIMATE USING IN-CONTAINMENT HI-RANGE RADIATION MONITORS

[ ] <u>NOTE</u> 1 - Attachment 7 is only used for core damage estimates where the in-containment radiation monitors are exposed to coolant or steam (i.e., only for primary containment LOCA situations). For other accident sequences, utilize the Post-Accident Sampling System (PASS) and Core Damage Assessment Program (CORDAM).

[ ] <u>NOTE</u> 2 - The release from the core may bypass the containment, be retained in the primary system, or not be uniformly mixed. Therefore, a low containment radiation reading does not guarantee a lack of core damage. The levels of damage indicated by the value in Attachment 7 are considered minimum levels unless there are inconsistent monitor readings.

[ ] <u>NOTE</u> 3 - Inconsistent monitor readings may be due to the uneven mixing in containment (e.g., steam rising to the top of the dome). It may take hours for uniform mixing.

[ ] 8.1 The Chem/RP Coordinator or designee, shall perform following steps to determine an estimate of core damage, if decisions must be made which are based on core conditions and PASS results are not available.

[ ] 8.1.1 Obtain highest in-containment hi-range radiation monitor reading from RMA-RM-40A(B), DRYWELL RAD MONITOR, and record in Block 1 on Attachment 7.

[ ] 8.1.2 Complete the calculations on Attachment 7.

[ ] 8.1.3 Report results to the TSC Director.

Location or Receptor ID: ______________

(1) Noble Gas Release Rate from KAMAN or 5.7.16 (μCi/Sec)	(2) Release Path through SBGT? Yes = 0.01; No = 1	(3) Iodine/Noble Gas Ratio (from Table 1)	(4) Energy Factor (from Table 2)	(5) Wind Speed (mph) from PMIS or MET Defaults ERP = 13; Other = 8	(6) Wind Direction (° from)	(7) Stability Class Default = D	(8) Secondary Containment Bypassed? No = 0.5; Yes = 1

Conversion Factors (from Table 3)	
TEDE Noble Gas	(9)
TEDE Iodine	(10)
CDE Iodine	(11)

Mixing Factor (from Isopleths)
(12)

TEDE Dose Rate (13): ______________ (rem/hr)

$$\frac{[(Block\ 1)(Block\ 4)(Block\ 9)] + [(Block\ 1)(Block\ 2)(Block\ 3)(Block\ 8)(Block\ 10)]}{(Block\ 5)} \times (Block\ 12)$$

Duration (Hours) Default = 4 hrs
(14)

TEDE Dose (rem) (Block 13) x (Block 14)
(15)

CDE Dose Rate (16): ______________ (rem/hr)

$$\frac{[(Block\ 1)(Block\ 2)(Block\ 3)(Block\ 8)(Block\ 11)]}{(Block\ 5)} \times (Block\ 12)$$

CDE Dose (rem) (Block 14) x (Block 16)
(17)

Name/Time/Date: ______________ / ______ / ______

TABLE 1 - IODINE TO NOBLE GAS RATIO VS. TIME SINCE SHUTDOWN

TIME SINCE SHUTDOWN (hrs)	IODINE/NOBLE GAS RATIO	
	NON-DEGRADED CORE	DEGRADED CORE
t < 1	1.86 E-7	2.71 E-1
1 ≤ t < 2	1.86 E-7	3.57 E-1
2 ≤ t < 4	1.86 E-7	3.41 E-1
4 ≤ t < 10	1.86 E-7	2.81 E-1
10 ≤ t < 30	1.86 E-7	2.30 E-1
30 ≤ t < 100	1.86 E-7	1.65 E-1
100 ≤ t	1.86 E-7	1.40 E-1

TABLE 2 - ENERGY FACTORS

TIME SINCE SHUTDOWN (hrs)	ENERGY FACTOR (MeV/dis)
t < 1	0.75
1 ≤ t < 2	0.60
2 ≤ t < 4	0.40
4 ≤ t < 10	0.25
10 ≤ t < 30	0.15
30 ≤ t < 100	0.09
100 ≤ t	0.07

TABLE 3 - DOSE CONVERSION FACTORS

	NON-DEGRADED CORE	DEGRADED CORE
TEDE Noble Gas	1.48 E-3	9.19 E-4
TEDE Iodine	8.77 E-2	2.98 E-2
CDE Iodine	2.04 E 0	4.96 E-1

1. Effective Age is defined as time elapsed (hrs) since shutdown. For off-site locations, the effective age of the isotopic mixture may be obtained through summarizing following components:

[ ] 1.1 The effective age at the time of release onset.

[ ] 1.2 The transit time from the release point to the receptor site (refer to Section 2 below).

2. CALCULATION OF TRANSIT TIME FROM THE RELEASE POINT TO THE RECEPTOR LOCATION

[ ] 2.1 Estimate the downwind distance (miles) to the receptor location.

[ ] 2.2 Divide the distance in miles by the 100m meter level wind speed (mph) to determine the plume transit time.

(1) RECEPTOR SITE DOWNWIND DISTANCE (miles)	(2) 100 METER LEVEL WIND SPEED (mph)	(3) PLUME TRANSIT TIME (hrs) (1) ÷ (2)

3. DETERMINATION OF EFFECTIVE AGES AT RECEPTOR SITES

(1) EFFECTIVE AGE OF MIXTURE AT TIME OF RELEASE ONSET (hrs)	(2) TRANSIT TIME FROM RELEASE POINT TO RECEPTOR LOCATION (hrs)	(3) EFFECTIVE AGE OF ISOTOPIC MIXTURE AT RECEPTOR LOCATION (hrs) (1) + (2)

Name/Time/Date: ______________ / ______ / ______

(1) Noble Gas Release Rate from KAMAN or 5.7.16 (μCi/Sec)	(2) Release Path through SBGT? Yes = 0.01; No = 1	(3) Iodine/Noble Gas Ratio (from Table 1)	(4) Energy Factor (MeV/dis) (from Table 2)	(5) Wind Speed (mph) from PMIS or MET Defaults ERP = 13; Other = 8	(6) Stability Class Default = D	(7) Secondary Containment Bypassed? No = 0.5; Yes = 1

Conversion Factors (from Table 3)	
TEDE Noble Gas	(8)
TEDE Iodine	(9)
CDE Iodine	(10)

TEDE Sub-Calculation (11): ______________

$$\frac{[(Block\ 1)(Block\ 4)(Block\ 8)]+[(Block\ 1)(Block\ 2)(Block\ 3)(Block\ 7)(Block\ 9)]}{(Block\ 5)}$$

Mixing Factors (from Table 4)	
1 Mile	(12)
2 Mile	(12)
5 Mile	(12)
10 Mile	(12)

TEDE RATE (rem/hr) (Block 11 x Block 12)	
1 Mile	(13)
2 Mile	(13)
5 Mile	(13)
10 Mile	(13)

Duration (hours) Default = 4 hrs
(14)

TEDE Dose (rem) (Block 13 x Block 14)	
1 Mile	(15)
2 Mile	(15)
5 Mile	(15)
10 Mile	(15)

CDE Sub-Calculation (16): ______________

$$\frac{[(Block\ 1)(Block\ 2)(Block\ 3)(Block\ 7)(Block\ 10)]}{(Block\ 5)}$$

CDE Rate (rem/hr) (Block 16 x Block 12)	
1 Mile	(17)
2 Mile	(17)
5 Mile	(17)
10 Mile	(17)

CDE Dose (rem) (Block 14 x Block 17)	
1 Mile	(18)
2 Mile	(18)
5 Mile	(18)
10 Mile	(18)

Name/Time/Date: ______________ / ________ / ________

TABLE 1 - IODINE TO NOBLE GAS RATIO VS. TIME SINCE SHUTDOWN

TIME SINCE SHUTDOWN (hrs)	IODINE/NOBLE GAS RATIO	
	NON-DEGRADED CORE	DEGRADED CORE
t < 1	1.86 E-7	2.71 E-1
1 ≤ t < 2	1.86 E-7	3.57 E-1
2 ≤ t < 4	1.86 E-7	3.41 E-1
4 ≤ t < 10	1.86 E-7	2.81 E-1
10 ≤ t < 30	1.86 E-7	2.30 E-1
30 ≤ t < 100	1.86 E-7	1.65 E-1
100 ≤ t	1.86 E-7	1.40 E-1

TABLE 2 - ENERGY FACTORS

TIME SINCE SHUTDOWN (hrs)	ENERGY FACTOR (MeV/dis)
t < 1	0.75
1 ≤ t < 2	0.60
2 ≤ t < 4	0.40
4 ≤ t < 10	0.25
10 ≤ t < 30	0.15
30 ≤ t < 100	0.09
100 ≤ t	0.07

TABLE 3 - DOSE CONVERSION FACTORS

	NON-DEGRADED CORE	DEGRADED CORE
TEDE Noble Gas	1.48 E-3	9.19 E-4
TEDE Iodine	8.77 E-2	2.98 E-2
CDE Iodine	2.04 E 0	4.96 E-1

TABLE 4 - PLUME CENTERLINE X/Q'S (MIXING FACTORS)

RELEASE POINT	STABILITY CLASS	A	B	C	D	E	F	G
ERP (ELEVATED)	1 MILE	2.87E-6	6.04E-6	1.17E-5	8.35E-6	1.03E-6	2.35E-11	1.31E-23
	2 MILE	7.94E-7	1.78E-6	4.55E-6	8.21E-6	4.98E-6	8.12E-8	5.62E-13
	5 MILE	1.50E-7	3.42E-7	1.18E-6	3.77E-6	4.66E-6	1.09E-6	5.67E-9
	10 MILE	4.51E-8	1.03E-7	4.58E-7	1.82E-6	3.13E-6	1.44E-6	4.00E-8
OTHER THAN ERP (GROUND LEVEL)	1 MILE	3.01E-6	6.90E-6	1.73E-5	5.10E-5	1.09E-4	3.07E-4	7.67E-4
	2 MILE	8.03E-7	1.84E-6	5.15E-6	1.78E-5	3.86E-5	1.09E-4	2.71E-4
	5 MILE	1.50E-7	3.44E-7	1.21E-6	4.98E-6	1.25E-5	3.52E-5	8.81E-5
	10 MILE	4.51E-8	1.03E-7	4.63E-7	2.07E-6	6.43E-6	1.81E-5	4.52E-5

1. CORRECTION FACTOR DETERMINATIONS USING OFF-SITE SAMPLING DATA

(1) SAMPLE LOCATION	(2) SAMPLE TIME	(3) FIELD GROSS IODINE CONCENTRATION (μCi/cc)	(4) CNS-DOSE IODINE CONCENTRATION (μCi/cc	(5) CORRECTION FACTOR (CF) (3) ÷ (4)

Name/Time/Date: ______________________ / __________ / __________

3. Route completed form to Emergency Preparedness Department.

NOTE 1 - When the normal source of 100M/60M/10M meteorological data is not available, or is "unhealthy", use the next available "healthy" source in the order of preference of 100M, 60M, 10M.

NOTE 2 - If the user is not familiar with the use of PMIS, Attachment 6 is referred to for detailed instructions on access and selected use of PMIS.

NOTE 3 - The Turn-On-Code "VALUE" is used to display single point values and qualities.

NOTE 4 - The Turn-On-Code "MET" is used to display most meteorological point values and stability classes.

PMIS POINT ID	DESCRIPTION	ALTERNATE SOURCE
MET001	100M LVL SIGMA THETA (15 MIN AVE)	MET Chart Recorder
MET004	100M LVL TEMPERATURE	MET Chart Recorder
MET005	DELTA TEMPERATURE (100M-10M)	MET Chart Recorder
MET006	100M LVL WIND DIR. (15 MIN AVE)	MET Chart Recorder
MET007	100M LVL WIND SPEED (15 MIN AVE)	MET Chart Recorder
MET009	60M LVL SIGMA THETA (15 MIN AVE)	MET Chart Recorder
MET012	60M LVL TEMPERATURE	MET Chart Recorder
MET013	DELTA TEMPERATURE (100M-60M)	MET Chart Recorder
MET014	60M LVL WIND DIR. (15 MIN AVE)	MET Chart Recorder
MET015	60M LVL WIND SPEED (15 MIN AVE)	MET Chart Recorder
MET017	10M LVL SIGMA THETA (15 MIN AVE)	MET Chart Recorder
MET020	10M LVL TEMPERATURE	MET Chart Recorder
MET021	DELTA TEMPERATURE (60M-10M)	MET Chart Recorder
MET023	10M LVL WIND DIR. (15 MIN AVE)	MET Chart Recorder
MET024	10M LVL WIND SPEED (15 MIN AVE)	MET Chart Recorder
MET027	PRECIPITATION (15 MIN PERIOD)	MET Chart Recorder
MET028	10M TWR SIGMA THETA (15 MIN AVE)	MET Chart Recorder
MET029	10M TWR TEMPERATURE	MET Chart Recorder
MET030	10M TWR WIND DIR. (15 MIN AVE)	MET Chart Recorder
MET031	10M TWR WIND SPEED (15 MIN AVE)	MET Chart Recorder
N8000	RX BLDG EFFLUENT FLOW AVE	
N8001	TURB BLDG EFF HI RAD MON AVE	
N8002	TURB BLDG EFF NORM RAD MON AVE	
N8003	TURB BLDG FLOW AVE	
N8004	AOG & RW EFF HI RAD MON AVE	
N8005	AOG & RW EFF NORM RAD MON AVE	
N8006	RX BLDG EFF RAD MON AVE	
N8007	AOG & RW BLDG EFF FLOW AVE	
N8010	ERP HI RAD MON AVE	
N8011	ERP NORMAL RAD MON AVE	
N8012	ERP FLOW AVE	
N8013	SGT FLOW TO ERP AVE	

1. PLANT MANAGEMENT INFORMATION SYSTEM (PMIS)

1.1 The PMIS System (PMIS) is a set of programs and hardware provided by NPPD that make use of VMS functions and additional peripherals (Data Concentrators) which provides access to plant parameters.

2. PMIS COMPUTERS

2.1 PMIS computers share a common set of peripherals (disk drives, tape drives, terminals, etc.) and software.

3. VMS OPERATING SYSTEM

3.1 The VMS Operating System (VMS) is the host operating system for the PMIS computers. It is a set of programs that interface with the computer hardware and peripherals, and allows the computers to recognize and process commands.

4. PMIS MODES

4.1 PMIS has three operational modes, Primary, Primary/Backup, and Backup, and will operate on either computer in one of the three modes. A computer with PMIS operating in either the Primary or Primary/Backup Mode is referred to as the Primary System and the one with PMIS operating in the Backup Mode is referred to as the Backup System.

4.2 The Primary and Primary/Backup Modes provide full PMIS capabilities, consisting (in part) of data acquisition and conversion, data display, data archiving, alarm processing, self monitoring, and many other functions that perform specialized calculations and displays.

4.3 The Backup Mode monitors the Primary System, transfers information necessary to keep the Backup System files and tables up-to-date, and automatically changes to the Primary Mode when a loss of the Primary System is detected (referred to as a FAILOVER). Although many functions are available on the Backup System, their use is discouraged because the lack of real-time data results in the display of inaccurate information (CNS-DOSE is an exception).

5. PMIS ACCESS

5.1 Access to PMIS is gained through graphic display terminals, printer/plotters, and printers.

5.2 The terminals and printers are selectively connected to either computer through a switching device controlled by PMIS. At system start or during a FAILOVER, all terminals and printers are switched to the Primary System. However, the SWITCH position may be changed at any time after that.

6. SCREEN FORMAT

6.1 When a terminal is under control of PMIS (instead of VMS), the screen display will be in a standard format consisting of four areas, OCA, GGDA, SSA, and FKA.

6.2 The OCA (Operator Communication Area) consists of the top two (one and two lines on the screen. This area is generally used to prompt-for and receive user inputs and display advisory and warning messages. In addition, some displays that require only one or two lines of screen use the OCA for display. Also (though technically not part of the OCA), the current date and time (updated once a second) is displayed at the right side of the screen on lines 1 and 2.

6.3 The GGDA (General and Graphic Display Area) consists of lines 4 through 47 and is used for most displays. In addition, some displays (chiefly functions requiring significant editing) also prompt-for and receive user inputs in the GGDA.

6.4 The SSA (SPDS Status Area) consists of lines 45 through 48 and contain four boxes that represent (by color code) the status of the SPDS (Safety Parameter Display System), which is a software system that monitors selected plant parameters and determines overall plant safety status.

6.5 The FKA (Function Key Area) consists of the bottom two (50 and 51) lines of the screen. The FKA is used to indicate which of the definable function keys (left hand keypad) are enabled. It also indicates the status of the local hardcopy device (Versatec printer/plotter), which mode PMIS is in, the Plant Mode, and whether or not a PMIS "event" has occurred.

7. PRINTER/PLOTTER

7.1 The printer/plotter provides full screen reproduction. It is activated by pressing the green "HARD COPY" key on the right hand keypad. The single printer/plotter located in an area (Control Room, TSC, EOF, etc.) is shared by all terminals in the area regardless of which computer the terminal is connected to.

8. PRINTER

8.1 The printers are connected to a specific computer and are generally accessed when a "...PRINT..." option is selected and a "logical name" is entered.

9. LOGICAL NAME

9.1 Printers and terminals are usually referenced by "logical names", in the format of TT00, TT01, etc. (IDTs), and LA00, LA01, etc. (printers). The "logical name" for a device can usually be found on a tag on the device.

10. CONTROL-RESET

10.1 This is a command to perform a "hard reset" of the terminal and is accomplished by pressing the CTRL and RESET keys at the same time. It causes the screen to clear and resets the internal parameters to the default settings. This is basically a "master clear" and has the same effect as turning the power off and on.

11. IDE FIELD

11.1 User input to PMIS Programs is through an open IDE (Interactive Data Entry) field on the terminal. An open IDE field is denoted by a yellow box that appears in the OCA or GGDA area. Anything typed on the keyboard will be echoed in the box. Erasing or back-spacing is accomplished with the DEL key. All entries into an IDE field must be terminated by a carriage return (white RETURN key - "<CR>") unless the field is overfilled or a function key is pressed (the terminal automatically adds a carriage return in those cases).

12. TURN-ON-CODE

12.1 The Turn-On-Code (TOC) is the mechanism by which commands are issued to PMIS. This is a one to eight character code which is interpreted by PMIS and a corresponding command is issued.

13. PMIS DATABASE

13.1 All plant parameters (or additional data based on plant or PMIS parameters) that are processed by PMIS SYSTEM are defined in the PMIS DATABASE, which is a file that specifies the origin of the data, the frequency at which it is processed, the type of processing to be performed, etc. Each parameter is referred to as a "point" and is identified by a one to eight character name or POINT-ID (PID).

14. PMIS DATA PROCESSING

14.1 Some PMIS points are processed by scanning plant sensors (through the Data Concentrator) while others are calculated based on the values of previously processed points or PMIS parameters. All points values are then assigned a quality code stored in the Current Value Table (CVT).

14.2 Data in the CVT is considered to be "real-time" and representative of current plant and system conditions.

14.3 At regular intervals (and other special circumstances) point values are also stored in an Archive File, which provides ~ 24 hours of on-line historical information.

15. PMIS DATA ACCESS

15.1 All point values in the CVT and Archive File are accessed by the POINT-ID.

16. QUALITY CODES

16.1 The Quality Code, assigned when point values are assigned, represents the general status and "health" of the point, and determines how it is used by PMIS Programs. The following is a list of PMIS quality codes and related information.

CODE	DESCRIPTION	COLOR	HEALTH
UNK	Value unknown - not yet processed	White	Bad
DEL	Processing has been disabled	Magenta	Bad
INVL	Data concentrator error	Magenta	Bad
RDER	Data concentrator error	Magenta	Bad
OIC	Data concentrator error	Magenta	Bad
BAD	Outside instrument range	Magenta	Bad
STAG	Point failed stagnation check	Magenta	Bad
UDEF	Undefined (spare)	Magenta	Bad
REDU	Fails redundant point check	Magenta	Bad
HALM	Above high alarm limit	Red	Good
LALM	Below low alarm limit	Red	Good
HWRN	Above high warning limit	Yellow	Good
LWRN	Below low warning limit	Yellow	Good
ALM	State/Change-of-State alarm	Red	Good
SUB	Value has been substituted	Blue	Good
DALM	Alarm checking has been disabled	Green	Good
NCAL	Value cannot be calculated	White	Good
INHB	Alarm inhibited by cut-out point	Green	Good
GOOD	Passes all other checks	Green	Good

16.2 Not listed above is quality code OSUB (Operator Substituted), which is treated the same as SUB, and indicates that the value was substituted within that program. OSUB is not used in the CVT.

17. PMIS LOGIN

17.1 If the current date and time is displayed in the OCA and is being updated about once a second:

17.1.1 If "ENTER PASSWORD..." is displayed on line 2, press the RETURN key.

17.1.2 If "SELECT FUNC. KEY OR TURN ON CODE..." and an open IDE field is displayed on line 2, the IDT is logged into PMIS. No further action is necessary.

17.1.3 If a display is operating, press the CANC key.

17.1.4 If terminal does not respond or does not meet any of the above criteria, press XOFF key (so that the light in the key is on). The terminal should automatically be reset (screen clears and the bell sounds) after about 30 seconds, and either the "ENTER PASSWORD..." or "...TURN-ON-CODE..." prompt should be displayed. Refer to the applicable previous step for more instruction.

17.2 If the current date and time is NOT displayed or is displayed but is not being updated:

17.2.1 Perform a CONTROL-RESET, wait at least 10 seconds, and press the RETURN key. If the date and time appear and began updating, refer to the previous (date and time updating) step.

17.2.2 If a "$" is displayed at the left of the screen, enter "LO" and press the RETURN key. After the "...LOGGED OFF..." message is displayed, press the RETURN key again.

17.2.3 After "NPPDA::" or "NPPDB::" followed by "Username:" (on the next line) is displayed, enter "PMIS" and press the RETURN key. A welcome message followed by "PMIS LOGGED OUT..." will be displayed. Do not press any keys for 5 minutes or until the PMIS login display appears. When the "ENTER PASSWORD..." prompt is issued, refer to the previous (date and time updating) step and login to PMIS.

17.3 If neither of the above criteria is met or the specified sequence of events does not occur, contact the Nuclear Information Services (NIS) Department for assistance.

18. ACTIVATING A TURN-ON-CODE

18.1 If a display is currently operating in the area of the screen that the desired TOC requires, press the CANC key.

18.2 When "SELECT FUNC. KEY OR TURN ON CODE..." is displayed followed by an open IDE field, enter one of following:

18.2.1 A TOC (i.e., "GRPDSP" -- activates the Group Display Program. The program will then prompt the user for a display name).

18.2.2 A TOC followed by a space and optional text (i.e., "GRPDSP ARM1" -- activates the Group Display Program and displays the group "ARM1" without further user input. Note that optional text is recognized by only selected TOCs).

18.2.3 Press one of the programmable function keys on the right hand key pad or top row of function keys (i.e., blue "GROUP DISP" key -- functions the same as the first example).

18.3 Refer to the FKA for the function keys that are enabled and their descriptions. Use other options as provided by each program.

18.4 To exit a program, use the specified exit option (if provided) or press the CANC function key.

19. DETERMINING TO WHICH SYSTEM A TERMINAL IS CONNECTED

The PMIS System to which a terminal is connected is indicated by the "CONSOLE =..." on the bottom line of the FKA as follows:

CONSOLE = PRIMARY	--	Connected to the Primary System operating in the Primary Mode.
CONSOLE = PRIM/BAC	--	Connected to the Primary System operating in the Primary/Backup Mode.
CONSOLE = BACKUP	--	Connected to the Backup System.
CONSOLE = UNKNOWN	--	PMIS is in a transition or unknown state.

20. SWITCHING A DEVICE TO THE OTHER SYSTEM

20.1 On a terminal located in the same area as the device to be switched and connected to either PMIS System, activate the TOC "SWITCH".

20.2 A list of all devices that can be switched from that terminal will be displayed. Included will be their logical names, description, and the CPU to which the device is connected.

20.3 To switch a device, press function key F1 and then enter the logical name at the prompt.

20.4 If the device is a terminal, a RESET will be performed and it will be logged off PMIS.

20.5 If the device being switched is a terminal other than the one running SWITCH, both are connected to the same system and a TOC is currently active, a message will be displayed to that effect, and the user will be asked if it is to be switched anyway. If the answer is not YES, the device is not switched.

NOTE - This attachment is only used for core damage estimates where the in-containment radiation monitors are exposed to coolant or steam (i.e., only for primary containment LOCA situations). For other accidents sequences, utilize the Post-Accident Sampling System (PASS) and Core Damage Assessment Program (CORDAM).

(1) HIGHEST DRYWELL RAD MONITOR READING (RMA-RM-40A,B)	(2) 100% CORE MELT FACTOR	(3) CORE MELT FRACTION (1) ÷ (2)	(4) PERCENT CORE MELT (3) x 100	(5) PERCENT CLAD FAILURE (4) x 10
	2.44E+6			

Report the results of the core damage estimate (Blocks 4 and 5) to the TSC Director.

Name/Time/Date: ________________________ / __________ / __________

1. DISCUSSION

1.1 This procedure covers dose projection. Dose projection represents calculation of an accumulated dose at some time in the future if current conditions continue.

1.2 The CNS-DOSE Computer Program is a software application operated on the PMIS computers. It makes use of current meteorological and radiological data from PMIS and manually entered data to perform dose projection for the area surrounding CNS. CNS-DOSE is the primary method of dose projection.

1.2.1 The PMIS Computer System consists of two computers operating in a Primary and Backup Mode. Historical data may be obtained from either system; however, current data may be obtained only from the Primary System.

1.2.2 Personal unfamiliar with the operation of PMIS should reference procedures governing the operation of PMIS or refer to Attachment 6.

1.3 The manual dose projection methods in this procedure are intended to be used when CNS-DOSE is unavailable. Where possible, data used is from the same source as that used by the computer programs. The hand calculations are divided into two sections. Section 5 is intended to be used by the on-shift personnel for centerline dose projections. Section 6 is intended for dose assessment personnel in projecting non-centerline values.

1.4 The correlation methodology as described in Section 8 provides EOF dose assessment personnel with a means of correlating field team iodine concentration data with CNS-DOSE projected iodine concentration. Such a correlation is necessary to determine if initial Protective Action Recommendations (PARs) were adequate to protect the health and safety of the public.

1.5 Containment radiation level provides a measure of core damage, because it is an indication of the inventory of airborne fission products (i.e., noble gases, a fraction of the halogens, and a much smaller fraction of the particulates) released from the fuel to the containment (refer to NEDO-22215, Pages 1 and 2).

2. REFERENCES

2.1 CODES AND STANDARDS

2.1.1 NRC Regulatory Guide 1.109, Revision 1, October 1977, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I, Iodine Inhalation Dose Factors.

2.1.2 NRC Regulatory Guide 1.111, July 1977, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.

2.1.3 NRC Regulatory Guide 1.145, August 1979, Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants.

2.1.4 Health Physics Journal, November 1981, Noble Gas Dose Rate Conversion Factors.

2.1.5 ICRP 59, Working Breathing Rate.

2.1.6 EPA 400-R-92-001, May 1992, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents.

2.2 DRAWINGS (MAPS)

2.2.1 NPPD Drawing CNS-MI-102, Atmospheric Dispersion Model (EPM2) Special Receptor Points, 10 Mile Radius.

2.2.2 NPPD Drawing CNS-MI-03, Preselected Radiological Sampling and Monitoring Points in the Vicinity of Cooper Nuclear Station, 10 Mile Radius.

2.2.3 NPPD Drawing 2.2 (P3-A-45), Revision 1, Cooper Nuclear Station Site and Property Boundary, 1 Mile Radius.

2.2.4 Cooper Nuclear Station 50 Mile Emergency Planning Zone, Revision 2, 50 Mile Radius.

2.3 VENDOR MANUALS

2.3.1 General Electric Corporation, NEDO-22215, Procedures for the Determination of the Extent of Core Damage Under Accident Conditions.

2.3.2 CNS Number 0984, PMIS Operator's Manual - SAIC Document 502-85500107-72.

2.4 PROCEDURES

2.4.1 Emergency Plan Implementing Procedure 5.7.1, Emergency Classification.

2.4.2 Emergency Plan Implementing Procedure 5.7.16, Release Rate Determination.

2.4.3 Emergency Plan Implementing Procedure 5.7.20, Protective Action Recommendations.

2.5 MISCELLANEOUS

2.5.1 NRC Inspection Report 89-35.

2.5.2 © NRC Inspection Report 91-12, Emergency Preparedness Annual Inspection Report. Affects Section 7 and NOTE prior to Step 5.2.

2.5.3 NRC Inspection Report 92-14, Emergency Preparedness Annual Inspection Report.