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Prairie Island Nuclear Generating Plant
1717 Wakonade Dr. East • Welch MN 55089

July 24, 2001

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
Docket Nos. 50-306 License Nos. DPR-60

Prairie Island EOF Emergency Plan
Implementing Procedures - F8

EOF Emergency Response Plan Implementing Procedures

Furnished with this letter are the Prairie Island Nuclear Generating Plant EOF Emergency Plan Implementing Procedures F8. This revision includes the following procedures:

INDEXES: EOF Emergency Plant Implementing Procedures TOC

REVISIONS:

F8-3	Activation & Operation of the EOF	Rev 5
F8-5	Offsite Dose Assessment & Protective Action Recommendations	Rev 7

TEMPORARY CHANGE DELETIONS:

2001 0955 F8-5 Offsite Dose Assessment & Protective Action Recommendations

INSTRUCTIONS:

Please post changes in your copy of the Prairie Island Nuclear Generating Plant EOF Emergency Implementing Procedures. Procedures which have been superseded or deleted should be destroyed. Please sign and return the acknowledgment of this update to Bruce Loesch, Prairie Island Nuclear Generating Plant, 1717 Wakonade Drive East, Welch, MN 55089.

A045

If you have any questions, please contact Mel Agen at 651-388-1121 Extension 4240.

For Joel Sorensen

Joel P. Sorensen
Site Vice President
Prairie Island Nuclear Generating Plant

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Mfst Num: 2001 - 0509 Date : 07/23/01
FROM : Bruce Loesch/Mary Gadient Loc : Prairie Island
TO : UNDERWOOD, BETTY J
Copy Num: 515 Holder : US NRC DOC CONTROL DESK
SUBJECT : Revisions to CONTROLLED DOCUMENTS

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Procedure #	Rev	Title

Revisions:

F8-3	5	ACTIVATION & OPERATION OF THE EOF
F8-5	7	OFFSITE DOSE ASSESSMENT & PROTECTIVE ACTIO RECOMMENDATIONS

Temporary Change Deletions:

2001 0955 F8-5	OFFSITE DOSE ASSESSMENT & PROTECTIVE A RECOMMENDATIONS

UPDATING INSTRUCTIONS

Place this material in your Prairie Island Controlled Manual or File. Remove revised or cancelled material and recycle it. Sign and date this letter in the space provided below within ten working days and return to Bruce Loesch or Mary Gadient, Prairie Island Nuclear Plant, 1717 Wakonade Drive E., Welch, MN 55089.
Contact Bruce Loesch (ext 4664) or Mary Gadient (ext 4478) if you have any questions.

Received the material stated above and complied with the updating instructions

_____ Date _____

PRAIRIE ISLAND NUCLEAR GENERATING PLANT	Title: EOF Emerg Plan Implementing Procedures TOC Effective Date : 07/23/01
Approved By: Joyce Chitty /BJ BPS Supt	

Document #	Title	Rev
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F	ACTIVATION AND OPERATION OF THE EOF	NUMBER: F8-3
		REV: 5

REFERENCE USE
• *Procedure segments may be performed from memory.*
• *Use the procedure to verify segments are complete.*
• *Mark off steps within segment before continuing.*
• *Procedure should be available at the work location.*

O.C. REVIEW DATE:	OWNER:	EFFECTIVE DATE
070601 Sc	M. Werner	7-23-01

F	ACTIVATION AND OPERATION OF THE EOF	NUMBER: F8-3
		REV: 5

1.0 PURPOSE

The purpose of this instruction is to provide guidance for the startup of the Near-site Emergency Operations Facility (EOF). This instruction will contain information on EOF Ventilation System operation and startup of EOF Radiological Monitoring equipment. The EOF **SHALL** be activated during an Alert, a Site Area or General Emergency classification.

2.0 APPLICABILITY

This instruction is applicable to all EOF personnel.

3.0 PRECAUTIONS

All unnecessary personnel should be evacuated from the EOF portion of the Prairie Island Training Center (PITC) when the EOF is activated.

4.0 RESPONSIBILITIES

4.1 The Emergency Manager has the overall responsibility to ensure radiological safety for EOF personnel.

4.2 The EOF Coordinator has the responsibility to coordinate all activities of the EOF personnel, and to startup, operate, or shutdown the EOF Ventilation system.

4.3 The Radiation Protection Support Supervisor has the responsibility to ensure the CAM is operational, area radiation monitoring is established, and appropriate radiological surveys for radiation, contamination, and airborne radioactivity are conducted to verify habitability of the EOF.

4.4 The RPSS has the responsibility to keep the Emergency Manager informed of radiological conditions in the EOF and to make necessary recommendations to the Emergency Manager when the radiological safety of EOF personnel is jeopardized.

4.5 The EOF Security Force has the responsibility to establish and maintain access control for the EOF.

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5.0 PROCEDURE

5.1 Activation and Operation of the EOF

5.1.1 During the normal work hours, the EOF **SHALL** be activated whenever an Alert, Site Area, or General Emergency is declared, as announced over the public address system. The plant Shift Emergency Communicator will call the PITC switchboard, inform the receptionist of the emergency classification and request Emergency Response personnel to report to the EOF. All members of NGS and PITC having EOF responsibilities should report to the EOF.

5.1.2 During off-normal hours, the Emergency Director **SHALL** designate the Shift Emergency Communicator (SEC) to contact all Emergency Organization personnel, in accordance with F3-5. When notified, the NGS and PITC personnel contacted should report directly to the EOF.

5.1.3 Additional personnel notified and requested to report to the EOF as deemed necessary.

5.1.4 As the emergency proceeds from the initial phase (immediately following the emergency initiation) into the recovery phase, all Protective Actions for radiological hazards in the EOF **SHALL** be consistent with the Prairie Island Radiation Protection Program. Refer to F8-6 for specific EOF guidelines.

5.1.5 The EOF should remain activated until the emergency situation has been terminated or as directed by the Emergency Manager.

5.2 Establishment of Radiological Monitoring

5.2.1 Set up AM-2 for continuous monitoring of the EOF Area dose rates

A. Obtain the AM-2 from the EOF Equipment Locker, located in the receiving area.

B. Plug the AM-2 into an AC receptacle.

C. Verify the green power light is ON.

D. Let AM-2 electronic circuitry warm-up approximately 1 minute.

E. Source check the AM-2 with button source from the EOF Equipment Locker and verify an upsale reading of meter.

F. If the AM-2 fails (power loss, incorrect readings, etc.), the RPSS should direct additional radiation monitoring utilizing a portable survey meter.

5.2.2 Establish operation of the EOF Continuous Air Monitor (CAM)

A. The CAM is normally kept in the EOF Command Center in a hot standby condition with the electronics energized and the blower, chart recorder, and filter paper drive OFF.

B. Turn OFF the High Voltage switch.

C. Turn OFF the Master switch and unplug the cord.

D. Relocate the CAM immediately outside the Command Center, in the hallway, and plug the cord into an AC receptacle.

E. Turn ON the Master switch.

F. Turn ON the High Voltage switch.

G. Turn ON the switch to start the blower, chart recorder, and filter paper drive (Switch located next to chart).

H. Adjust the blower flow rate to 3 + or - 1 SCFM using the toggle switch located on the right side of CAM near the flow indicator.

I. Verify proper operation of the CAM (blower operating with proper flow, filter and strip chart operating, and meters are onscale, etc.)

J. If the CAM fails to operate properly, contact the RPSS for additional sampling.

5.2.3 Routinely monitor the AM-2 for direct radiation levels and the CAM for airborne particulate and iodine activity. Refer to F8-6, Radiological Monitoring and Control at the EOF for guidelines.

5.3 Activation of the EOF Ventilation System

The EOF ventilation emergency configuration is designed to recirculate the air within the EOF area of the PITC through HEPA filters with a 10% outside air damper position setting for fresh air make-up.

5.3.1 Precautions

A. Use the Ventilation HEPA Filter ONLY DURING AN ACTUAL EMERGENCY.

B. The ventilation system may become a radiological hazard during emergency operation.

5.3.2 Initial Conditions

A. All filters are installed.

B. There are two (2) possible sets of initial conditions:

1. Normal ventilation system running.

2. Normal ventilation system not running.

In either case, the establishment of the ventilation emergency configuration is the same.

5.3.3 Procedure to Establish Ventilation Emergency Configuration

A. ONLY DURING AN ACTUAL EMERGENCY - **OPEN** HEPA Filter Damper AND **CLOSE** HEPA Filter By-Pass Damper as follows:

1. Loosen the HEPA Filter Damper wing nuts on both sides of the filter housing located on the damper position indicators.

2. Position HEPA Filter Damper to the **OPEN** Position and tighten the wing nuts.

3. Loosen locking bolt on the HEPA Filter By-Pass Damper and reposition to the **CLOSED** position and tighten the locking bolt.

B. Place the control switch on the Robertshaw cabinet to "EMERGENCY".

C. Verify the "OCC/UNOCC/AUTO" three-position toggle switch in the Robertshaw cabinet is in the "OCC" position.

D. Observe the ventilation system operation and ensure the supply and return fans are operating as indicated by their RED lights located on the unit's electrical control cabinets on the West wall.

5.3.4 Routine Operation Checks

A. At least every eight (8) hours, check the filter D/P Manometer (located on the backside [South] of the filter cabinet). Acceptable D/P reading is <0.8"W.G.

B. Verify "Outside Air Damper" is OPEN at least 10% for fresh air make-up. This can be observed on the indicator located in the EOF labeled "S-1".

C. At least every eight (8) hours, check the EOF Magnehelic indicator for positive pressure indication. This can be observed on the indicator located in the EOF labeled "S-1".

NOTE:	1. **For extended emergency operation, the routine maintenance of ventilation equipment may be necessary, including the replacement of filter media.** 2. **Radiological precautions may be necessary for these activities.**

D. Contact facility maintenance personnel for any filter replacement.

5.3.5 Procedure to Return the Ventilation System to Normal Operation

A. Ensure the three-position toggle switch is in the "OCC" position in the Robertshaw cabinet.

B. Place the control switch to "NORMAL" on the Robertshaw Cabinet.

C. OPEN the HEPA By-Pass Damper and CLOSE the HEPA Filter Damper.

5.3.6 EOF Ventilation System References

A. Filters

Pre-Filter Pads	20"x24"x21"	Furnace Type Disposal Media
Bag Filters	20"x24"x21"	Dri-Pak Dry Cartridge Type
HEPA Filters	24"x24"x11 1/2"	Astrocele III with a minimum of 99.8% on 0.3 micron DOP particles.

B. Drawings

Schematic	SK-1 Robertshaw
Mechanical	NF-93231-16
Electrical	NF-93231-24

F8	OFFSITE DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATIONS	NUMBER: F8-5 REV: 7

REFERENCE USE

- ***Procedure segments may be performed from memory.***
- ***Use the procedure to verify segments are complete.***
- ***Mark off steps within segment before continuing.***
- ***Procedure should be available at the work location.***

O.C REVIEW DATE:	OWNER:	EFFECTIVE DATE
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F8	OFFSITE DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATIONS	NUMBER: F8-5
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1.0 PURPOSE

The purpose of this procedure is to provide guidance for assessing the consequences of a radioactive release and formulating Protective Action Recommendations (PARs) for the general public during the early and intermediate phases of a radiological emergency.

2.0 APPLICABILITY

This instruction **SHALL** apply to all Radiation Protection Support Supervisors (RPSS) and all Emergency Managers.

3.0 PRECAUTIONS

3.1 Declaration of a General Emergency requires immediate initial protective action recommendations (PARs) to offsite agencies. Under these circumstances, NO dose projections are required for formulating the initial offsite protective action recommendation.

3.2 Implementation of protective actions for offsite areas is the responsibility of the State of Minnesota and the State of Wisconsin. If it is determined, by the Emergency Manager, that immediate protective actions are required, and the State EOCs are not activated, the Emergency Manager **SHALL** authorize such recommendations to be made directly to the local authorities. Once the State EOCs are activated, all Protective Action Recommendations **SHALL** be made to the State EOCs.

3.3 It is the responsibility of the county and state agencies and the National Weather Service to notify members of the Prairie Island community of approved protective actions. Protective action notification is accomplished by the activation of the Public Alert and Notification System (PANS).

3.4 Offsite protective actions for the ingestion exposure pathway (ingestion of contaminated food and water) will be determined and implemented by the appropriate state authorities during the intermediate phase of an emergency.

4.0 RESPONSIBILITIES

4.1 Upon activation of the EOF, the Emergency Manager (EM) **SHALL** assume the non-delegatable authority and responsibility for issuing offsite Protective Action Recommendations from the Emergency Director.

4.2 The RPSS, once the EOF is activated, **SHALL** be responsible to promulgate Protective Action Recommendations (PARs) and **SHALL** channel all such recommendations through the EM for approval.

5.0 DISCUSSION

5.1 This procedure has several parts. The first four (4) parts are for use during the early phase of a declared emergency condition; the other parts (ground deposition, ingestion pathway and return) are for use during the intermediate phase.

5.2 Definitions – See Attachment 1.

6.0 PREREQUISITES

6.1 A General Emergency has been or will be declared.

6.2 A Site Area Emergency has been or will be declared and there is an actual or potential airborne radioactive release that meets or exceeds the PAGs.

6.3 An Alert or Site Area Emergency has been or will be declared and there is an actual or potential liquid radioactive release that meets or exceeds the PAGs.

7.0 PROCEDURE

7.1 General Emergency Protective Action Recommendations

7.1.1 If a General Emergency is declared, the RPSS **SHALL** refer to F3-8, Recommendations For Offsite Protective Actions, and formulate PARs in accordance with the F3-8 guidance contained in the section entitled "Protective Action Recommendation For a General Emergency".

7.1.2 The RPSS **SHALL** perform the duties and responsibilities as stipulated for the REC and route the particular forms to the Emergency Manager for review and approval prior to transmission to the Offsite agencies.

7.2 Site Area Emergency Protective Action Recommendations

7.2.1 **No** initial offsite Protective Action Recommendations for the general public are warranted during a Site Area Emergency unless the offsite dose projections exceed the established Protective Action Guides.

7.2.2 Potential Precautionary Shutdown of TI Casino

A. Precautionary recommendations may be warranted for the nearsite special population (Treasure Island (TI) Casino) under certain conditions.

B. After the declaration of a Site Area Emergency, the RPSS (or REC if EOF is not activated) should determine if a precautionary shutdown of TI Casino should be recommended according to the guidance of PINGP 585, Protective Action Recommendation Checklist.

7.2.3 Consideration should be given to Protective Action Recommendations for the general public during serious flooding conditions.

A. A recommendation to relocate people in areas with restricted egress due to flooding within a ten (10) mile radius of the plant should be made at the Site Area Emergency level if it is clear we are not to de-escalate from the SAE in less than 2 hours. This is to ensure that should the event escalate to a General Emergency, people are already relocated from areas where additional evacuation time would be required.

B. Each county sheriff's department is aware of those areas in which there are restrictions to normal evacuation routes.

7.3 Radioactive Plume Release Assessment

7.3.1 Plume Projected Dose

A. Run the dose projection model to obtain information on the magnitude of plume projected doses, the likely location of affected areas, and time-related aspects of the release. (This includes potential, as well as, actual releases.)

B. For potential releases, base the projections on the approximate releasable activity, considering the most probable release path, current as well as forecast weather conditions, a rapid release or a slow extended release.

C. Post the current dose projection results on the status board. If projections are based on potential or hypothetical cases, be careful to clearly label as such.

7.3.2 Deployment of Field Teams

A. Deploy field teams (refer to Table 2 for guidance) to perform measurements and collect samples (per EPIP F3-15) with the objective of defining affected areas and providing data for comparison to the results of the dose projection model. In the case of a potential release, field teams should be used to confirm that no releases are occurring.

NOTE:	**Two important pieces of data are the ratio of radioiodines to noble gases and the magnitude of any radioparticulates in the release. If data is not available through sampling ahead of the release point, field sampling should be initiated to supply the information.**

B. Keep field teams informed of the plant status and projected plume exposure rate levels. Ensure that survey team members are instructed to take appropriate protective actions.

C. Record field team measurements using EMERGENCY SAMPLE RESULTS LOG (PINGP 647). Field measurements may be posted on a status board for easy reference and plotting results on the area maps is recommended as an aid to defining affected areas.

D. Compare model results to field team measurements to establish the reliability of the model, including the thyroid and particulate dose projection components which are dependent on a good estimate of the radioiodine and particulate release terms.

NOTE: **If the dose assessment system is determined to be unreliable (e.g., field measurements greater than model results), stop the distribution of results and decision-making based on them. Consider the possibility of an unmonitored release. Options for dose assessment include adjusting the primary dose assessment system, switching to a back-up method, and using field measurements.**

E. When releases have substantially decreased, consider retrieval of the EMERGENCY TLDs, which are part of the Radiological Environmental Monitoring Program, to provide additional information on actual doses. Contact the REMP Coordinator/Administrator for guidance, and ensure radiological support is provided to persons entering contaminated areas for TLD retrieval.

7.3.3 Determine PARs in accordance with F3-8, Recommendations for Offsite Protective Actions, section entitled "Protective Action Recommendations Based On Offsite Dose Projections".

7.4 Liquid Release Assessment

7.4.1 Obtain sample analysis data on the liquid being released, either directly by having a survey team collect a sample for analysis (per EPIP F3-16), or indirectly from Plant RP personnel.

7.4.2 Determine the off-site radiological consequences of the release according to directions given to F3-8, Recommendations for Offsite Protective Actions.

7.4.3 Determine PARs in accordance with F3-8, Recommendations for Offsite Protective Actions.

7.5 Ground Deposition Assessment

7.5.1 Ground Deposition Projections (Relocation Projected Doses)

A. After the plume has dissipated and the release is terminated, ground deposition projections and field team measurements in contaminated areas may begin.

B. Run the appropriate dose projection model to obtain information on the potential magnitude of ground deposition and likely location (footprint) of ground contaminated areas.

C. Use the projected footprint and contamination magnitudes as a guide to determine where field team measurements may begin.

D. Determination of secondary evacuations or relocation of the public will be based on actual field team measurements and ground deposition projections and NOT solely on ground deposition projections.

E. As a backup to the computer ground deposition dose projection model, Figure 1 may be used to establish a very rough estimate of potential contaminated areas and their relative magnitudes. Carefully note the assumptions used for developing the ground deposition graph described in Table 1.

7.5.2 Deployment of Field Teams

A. Deploy field teams (refer to Table 2 for guidance) to obtain ambient dose rates and collect samples (per EPIP F3-15) in areas that are not evacuated, but with in the footprint. Within this region, concentrate first on areas suspected of having the highest deposition.

B. Priority should be given to initially performing dose rate surveys, with more detailed smear surveys to follow.

C. Target areas with dose rates above 0.1 mrem/hr or direct frisker readings above 20,000 cpm for collection of smear samples.

D. Enough dose rate surveys/smear samples should be obtained to have confidence that "hot spots" have not been overlooked. Ten survey points per square mile is suggested as a minimum in areas where roads will allow this to be practical.

E. Take care to ensure that areas not within the projected footprint are surveyed sufficiently to verify that the affected area has been identified completely.

F. Plot the field team results on a map. Compare them to the ground deposition projections, and direct follow-up surveys as appropriate to ensure the affected area is identified.

7.5.3 Relocation Protective Action Recommendations

A. As exposure rate data is obtained, calculate relocation projected doses using the conversion factor of 5000 mrem per mR/hr (i.e., 5000 mrem relocation projected dose per 1 mR/hr initial gamma exposure rate 1 meter above the ground).

NOTE:	**This conversion factor could be very conservative. The factor depends on the isotopic deposition. With actual isotopic data, a better conversion factor can be calculated using the data in Table 3.**

B. As smear samples are analyzed and isotopic data is obtained, use Table 3 to refine the relocation projected doses.

C. Plot the relocation projected doses on a map. (Consider using a dedicated map to avoid confusion.)

D. Determine PARs in accordance with Table 4, Relocation Protective Action Guide.

7.6 Ingestion Pathway Assessment

7.6.1 Field Team Deployment

A. Contract the Health Department of each affected state and see if they have sample collection needs of particular priority in which we could assist.

NOTE:	**Monticello NGP and Prairie Island NGP survey teams have the capability of performing dose rate, smear, liquid, soil/snow and air sampling and analysis. If there is a need for more sophisticated environmental samples have the REMP Administrator contact Teledyne Isotopes Midwest Laboratory and implement the letter of agreement. Once notified, Teledyne will dispatch a team to the affected site. They will also make their laboratories available for use should we need to send samples for analysis.**

B. Direct the field teams to obtain samples according to the State(s) needs or to collect samples to confirm the results of the State(s) survey team.

7.6.2 Ingestion Pathway Dose Assessment

A. Ingestion pathway dose assessment will not be performed by the PINGP. The plant will instead concentrate available resources on the collection, analysis, and transmittal of results to the States of smear, liquid, soil, and/or snow samples.

B. Ingestion pathway protective actions will be determined by the Minnesota Departments of Health and Agriculture and/or the Wisconsin equivalents.

7.7 Return Assessments

7.7.1 Field Team Deployments

A. As soon as resources allow, obtain dose rate surveys and smear samples per EPIP F3-15 in evacuated areas that are believed to be outside the contaminated areas or footprint.

B. As the priority for return to evacuated areas within the known footprint increases (per the State recommendation), obtain dose rate surveys and smear samples per EPIP F3-15.

7.7.2 Relocation Projected Dose

A. Use Table 3 and calculate relocation projected doses based on known (measured) ground deposition.

B. Plot the relocation projected doses on a map.

7.7.3 Return Recommendation

A. PINGP may recommend return of the general public to previously evacuated areas that are confirmed not contaminated.

B. PINGP will NOT make recommendations on the return of the general public to previously evacuated areas that have various levels of measured contamination. Appropriate state and local agencies will make these decisions based on contamination data and other social-economic considerations.

Figure 1 Ground Deposition Graph

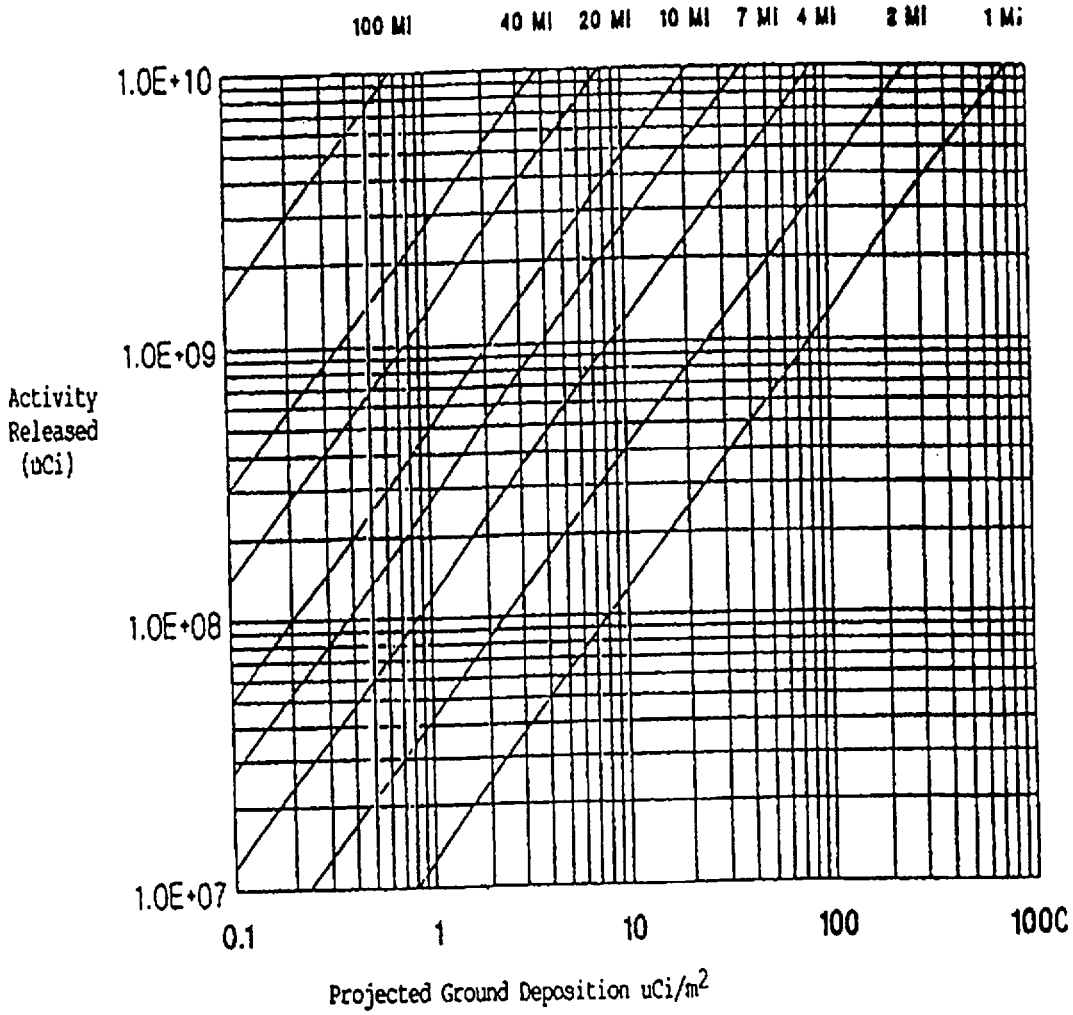

Table 1 Ground Deposition Graph Basis

The ground deposition graph was calculated using relations in R.G. 1.109 & R.G. 1.111. The following assumptions pertain to the graph:

1. Unstable (A,B,C) Pasquill stability class. This results in the highest depositions for elevated releases. For ground level releases, the stability class has little effect on calculated deposition rates. For a stable stability class, actual ground deposition could be zero out of many miles from the plant.

2. Elevated (100 meter) release height. For ground level releases, deposition rates will be slightly higher out to 20 miles, and somewhat less beyond 20 miles.

3. The plume is deposited uniformly within half-width of a sector arc (about 11 degrees), for constant wind directions. Actual plume widths for unstable stability classes are significantly wider than this. This assumption causes the projected area ground contamination to be at least as high as the highest (centerline) actual deposition that would occur under stable conditions for deposition i.a.w. a normal distribution with distance from the centerline.

NOTE:	**If several wind shifts occurred during the release, determine the approximate number of sectors into which the plume deposited material for each release period of interest. Divide this value by 0.5 and divide the result into the ground depositions predicted by the graph, to obtain an estimate of the degree the deposition was "diluted". For example, if the plume was spread out over 2 sectors, the ground deposition values obtained from the graph should be divided by 4.**

4. Wind speeds and stability classes vary often. The Van der Hoven study concludes there is a 50/50 chance of a significant wind shift within 2-4 hours at any given location. Therefore, the plume could be spread out more than the graph assumes and alter the resulting deposition. Rain showers could increase deposition greatly.

Table 2 Guidance On Field Team Deployment

The following is a discussion of strategy and some of the more important kinds of information which can be obtained through the use of field teams.

1. An approximation of the downwind and horizontal dimensions of a plume can be developed using the plume search technique. This information should be a high priority because of the limitations of the straight-line model used in MIDAS.

2. The maximum or centerline exposure rate from a plume, as measured at ground level, can be compared to dose projection results as a check on the accuracy of the model.

3. The isotopic mix of gaseous releases is only estimated by MIDAS. If samples for isotopic analysis are not or cannot be obtained from plant systems, field samples should be collected and analyzed to provide more accurate information on the release components.

4. If fuel integrity is good, radioiodines and radioparticulates should not be a problem. In order to remove any uncertainty or to assess the core status, the ratio of iodine to noble gas should be evaluated and used to update the default value (.0001) used by MIDAS. It may be necessary to re-evaluate this parameter several times in the course of an event.

5. Since the plume from a serious accident is essentially a quickly moving high radiation area, large doses can be received, or prevented, over relatively small time frames. Unlike the plume, the time available to effect evacuation due to ground shine should be much greater (e.g., a 5-rem dose due to Cs-134 initially exhibits an exposure rate of about 1 mR/hr). Therefore, plume surveys and plume dose projections are of higher priority.

6. At Prairie Island, consider that plume diversion may occur if the plume is traveling towards the bluffs (Wisconsin and/or Minnesota). Deploy the survey teams to conduct a plume search both beyond the bluffs and down the valley, where plume diversion is likely to occur.

7. Ground deposition surveys are generally lower priority than plume activities. However, if the release rate has substantially lowered and plume exposure rates are also low (e.g., less than 10 mrem/hr), some ground deposition surveys may be considered. Resources available for ground deposition surveys should be allocated first to areas affected by the plume which remain populated.

Table 3 Relocation Or Secondary Evacuation Dose Projection

Isotope	Ground shine Dose (mrem per uCi/m^2)	Inhalation Dose (mrem per uCi/m^2)	Relocation Projected Dose -TEDE (mrem per uCi/m^2)	Initial Exp. Rate (mR/hr per uCi/m^2)	Relocation Projected Dose - TEDE per Initial Exp. Rate (mrem per mR/hr)
Sr-90	- - - - -	11	11	- - - - -	- - - - -
Zr-95	34	- - - - -	34	0.0162	2100
Ru-103	7.4	- - - - -	7.4	0.0055	1300
Ru-106	14	1.4	15	0.0023	6700
I-131	1.3	- - - - -	1.3	0.0047	280
Cs-134	118	- - - - -	118	0.0183	6400
Cs-137	52	- - - - -	52	0.0073	7200
Ba-140	11	- - - - -	11	0.0279	390
Ce-144	3.3	1.4	4.7	0.0023	2000

NOTES:

1. Ground shine is the whole body dose (1 meter above the ground) received after a 1-year exposure to unit ground contamination (uCi/m^2) as measured at the beginning of the exposure period.

2. Inhalation is the committed effective dose received from the inhalation for 1 year of resuspended unit ground contamination (uCi/m^2) as measured at the beginning of the exposure period. A re-suspension rate of 1E-6/meter is assumed.

3. The Relocation Projected Dose - TEDE per Initial Exposure Rate column is the TEDE that would be received after a 1-year exposure to contamination that caused an initial unit exposure rate (mR/hr, i.e., gamma only) at 1 meter above the ground. (the effective mrem per mR/hr for a mixture would be equal to a weighted average of the values in this column, which is computed by multiplying the value in this column times the ratio of the individual isotope to the total.)

4. The projected doses pertain to adults. Infant projected doses are not more than two times higher than the adult doses (other than for iodine which does not contribute greatly to overall dose for infants or adults).

5. Doses could be significantly lowered due to shielding from homes, decontamination, etc.

TABLE 3 Relocation Or Secondary Evacuation Dose Projection (Cont'd)

6. Elimination of the source term due to weathering as well as radioactive decay is assumed.

7. The doses listed include the dose from radioactive daughters.

SECONDARY EVACUATION DOSE ASSESSMENT

Isotope	Smear (dpm)	Direct Frisk (cpm)	Ground Contam (uci/m^2)	Reloc Dose TEDE (mrem)	Initial Dose Rate (mrem/hr)
Ru-106	260,000	58,000	130	2000	0.30
Cs-134	34,000	7,400	17.0	2000	0.32
I-131	3,000,000	660,000	1,500	2000	7.2

Rules of Thumb

1. The most restrictive nuclide in terms of projected relocation dose per measured initial dose rate is Cs-137 (about 7000 mrem per mrem/hr). Cesium-134 is the most restrictive nuclide in terms of projected relocation dose per unit contamination (about 120 mrem per uCi/m^2).

2. Assuming a 10% smear collection efficiency, 10% counter efficiency, and 20 cm^2 area "seen" by the probe for a direct frisk, the following relationships were developed:

   a. Direct frisk $\mu Ci/m^2 = \frac{\text{net cpm}}{400}$

   Where net cpm is frisker count rate about 1□ from surface in question.

   b. Smear $\mu Ci/m^2 = \frac{\text{smear net cpm}}{200}$

   Where smear net cpm is frisker count rate of $100cm^2$ smear from a smooth surface.

3. Based on assumed radiological characteristics of releases from fuel melt accidents, gamma exposure rates in areas where the projected relocation dose is in the range of 1-5 rems would be between about 2 and 10 mR/hr during the first few days after shutdown following an SST-2 accident severity type. Ground deposition values in the range of 200-800 uCi/m^2 could also be expected.

Table 4 Relocation Protective Action Guide

PAGs For Intermediate Phase Relocation Projected Doses		
Relocation Projected Dose (mrem, TEDE[1])	**PINGP Recommended Protective Actions [2]**	**Comments**
TEDE < 2000 mrem	Apply simple dose reduction techniques.[3]	These protective actions should be taken to reduce doses to as low as practicable levels.
TEDE >= 2000 mrem	Relocate general public from affected areas not previously evacuated.[4]	Beta dose to skin may be up to 50 times higher.

NOTES:

1. **Total Effective Dose Equivalent from one year of exposure to ground contamination and inhalation of resuspended material.**
2. **Protective actions based on EPA 400-R-92-001, May 1992.**
3. **Simple dose reduction techniques include scrubbing and/or flushing hard surfaces, soaking or plowing soil, minor removal or soil from hot spots, and spending more time than usual indoors or in other low exposure rate areas.**
4. **Because of unanticipated local conditions and constraints known to state and local officials, WI and/or MN may choose to relocate general public from affected areas at a lower or higher doses than the PAG of 2000 mrem TEDE.**
5. **Significant unavoidable contribution to the total dose from ingestion of food and water could influence the state's relocation decision.**
6. **First priority should be given to cleanup of residences of pregnant women who may exceed a TEDE of 500 mrem from the first year of exposure.**
7. **It is an objective of these PAGs to assure that 1) doses in any single year after the first will NOT exceed 500 mrem, and 2) the cumulative dose over 50 years (including the 1st and 2nd years) will NOT exceed 5000 mrem.**

Attachment 1 Definitions Related To PARS

1.0 **Affected Area** is any area where radiation emanating from a plume or deposited material from the plume can be detected using field instruments. (Also known as the footprint.)

2.0 **Affected Sectors** refer to those sectors that are in a downwind direction from the plant. If the wind speed ≥5 mph, the affected sectors are the 2 sectors on either side of the downwind sector and the downwind sector. If the wind speed <5 mph, all sectors are affected sectors (because of meandering).

3.0 **Dose Terms:**

3.1 **Dose Equivalent (rem)** refers to the product of absorbed dose (rad) and the quality factor (i.e., rads X QF = rem).

3.2 **Effective Dose Equivalent (rem)** is the sum of the products of the dose equivalent (rem) to each organ and a weighting factor, where the weighting factor is the ratio of the stochastic risk arising from an organ or tissue to the total risk when the whole body is irradiated uniformly.

3.3 **Committed Dose Equivalent (rem)** refers to the dose equivalent to organs or tissues that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

3.4 **Committed Effective Dose Equivalent (rem) (CEDE)** refers to the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

3.5 **Deep Dose Equivalent (rem)** refers to the external whole body exposure due to external radiation from the radioactive plume or deposited radioactive material.

3.6 **Total Effective Dose Equivalent (rem) (TEDE)** refers to the sum of the deep dose equivalent and the committed effective dose equivalent (TEDE = Deep Dose Equivalent + CEDE).

3.7 **Thyroid Committed Dose Equivalent (rem) (Thyroid CDE)** refers to the committed dose equivalent to the thyroid due to the internally deposited radionuclides from inhalation.

Attachment 1- Definitions Related to PARs (Cont.)

4.0 Emergency Planning Zone (EPZ) is a defined area around the Prairie Island plant to facilitate emergency planning by state and local authorities, to assure that prompt and effective actions are taken to protect the public in the event of a release of radioactive material. It is defined for:

4.1 Plume Exposure Pathway (10 mile EPZ)

The 10 mile radius around the Prairie Island plant defined for the early phase plume exposure. The principal exposure sources from this pathway are:

4.1.1 External exposure from the radioactive plume (either overhead of submergence);

4.1.2 External exposure from the radionuclides deposited on the ground by the plume; and

4.1.3 Internal exposure from the inhaled radionuclides deposited in the body.

4.2 Ingestion Exposure Pathway (50 mile EPZ)

A 50 mile radius around the Prairie Island plant where the principal exposure would be from the ingestion of contaminated water or foods such as, milk or fresh vegetables.

5.0 Evacuation is the urgent removal of people from an area to avoid or reduce high-level, short-term exposure, usually from the plume or from deposited activity.

6.0 Geopolitical Subareas are subareas of the 10 mile EPZ defined by predetermined geographic and/or political boundaries. A map of the geopolitical subareas and a table for selecting the affected geopolitical subareas are shown in the "Emergency Notification Report Form," PINGP 577.

7.0 Keyhole Area is a subarea of the 10 mile EPZ defined by a 360 degree area surrounding the plant out to a distance of 2 or 5 miles and continuing in a downwind direction which should include 2 sectors on either side of the affected sector, out to a distance determined by the Protective Action Guides.

Attachment 1- Definitions Related to PARs (Cont.)

8.0 **Nuclear Incident Phases** relate to three time periods following the beginning of an nuclear incident. See Figure 2 for potential protective actions during the different emergency phases.

8.1 **Early Phase** or emergency phase is the period immediately following the beginning of the incident. There may be a threat of a radiological release or an actual ongoing radiological release to the environment. Immediate decisions concerning protective actions are required and usually based on plant conditions or offsite dose projections. This phase may last from hours to days.

8.2 **Intermediate Phase** is the period beginning after the source and releases have been brought under control. Based on environmental measurements, additional protective actions may be made. This phase may overlap the early and late phase and may last from weeks to many months.

8.3 **Late Phase** is the period beginning when offsite recovery action designed to reduce radiation levels in the environment to acceptable levels for unrestricted use are commenced. This period may extend from months to years.

9.0 **Projected Dose** refers to the future dose calculated for a specified time period on the basis of estimated or measured initial concentration of radionuclides or exposure rates and in the absence of protective actions.

9.1 **Plume Projected Dose** refers to future calculated doses from plume submersion, plume shine, plume inhalation and 4 days of ground deposition exposure.

9.2 **Relocation Projected Dose** refers to future calculated doses from one year of exposure to ground deposition groundshine and inhalation of resuspended material, but excluding internal dose from consuming contaminated foodstuffs.

9.3 **Ingestion Pathway Projected Dose** is the projected CEDE (ICRP-30) from consuming contaminated foodstuff.

Attachment 1- Definitions Related to PARs (Cont.)

10.0 **Protective Action** refers to an action taken to avoid or reduce radiation dose to members of the public.

11.0 **Protective Action Guide (PAG)** refers to a projected dose level that warrants protective actions.

12.0 **Public Alert and Notification System (PANS)** is used to alert the public within the 10 mile Emergency Planning Zone of an emergency condition at Prairie Island. Once alerted, the public should then turn to local commercial broadcast messages for specific protection action instructions. The PANS consists of the following:

12.1 Fixed sirens for 100% coverage throughout the 5 mile zone and in population centers in the 5-10 mile zone.

12.2 Emergency vehicles with sirens and public address in the 5-10 mile areas not covered by fixed sirens.

12.3 National Oceanic and Atmospheric Administration (NOAA) activated tone alert radios in institutional, educational, and commercial facilities.

12.4 The Emergency Alert System (EAS) which has access to television and radio stations within the area.

13.0 **Return** refers to people permanently reoccupying their normal residence within a previously evacuated area.

14.0 **Reentry** refers to temporary entry into an evacuated area under controlled conditions.

15.0 **Relocation** refers to removal or continued exclusion of people from contaminated areas to avoid chronic radiation exposure.

16.0 **Sheltering** refers to the use of a structure for radiation protection from an airborne plume and/or deposited radioactive material.

Figure 2 Exposure Pathways, Incident Phases, and Protective Actions

	POTENTIAL EXPOSURE PATHWAYS AND INCIDENT PHASES		PROTECTIVE ACTIONS
1.	External radiation from facility	EARLY	Sheltering Evacuation Control of access
2.	External radiation from plume	EARLY	Sheltering Evacuation Control of access
3.	Inhalation of activity in plume	EARLY	Sheltering Administration of stable iodine Evacuation Control of access
4.	Contamination of skin and clothes	INTERMEDIATE	Sheltering Evacuation Decontamination of persons
5.	External radiation from ground deposition of activity	LATE	Evacuation Relocation Decontamination of land and property
6.	Ingestion of contaminated food and water	LATE	Food and water controls
7.	Inhalation of resuspended activity	LATE	Relocation Decontamination of land and property

NOTE:

1. **Based on EPA 400-R-92-001, May 1992**
2. **The use of stored animal feed and uncontaminated water to limit the uptake of radionuclides by domestic animals in food chain can be applicable to any of the phases.**