Progress Energy

AUG 2 8 2003

SERIAL: BSEP 03-0129

10 CFR 50.54 (q)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62
REVISIONS TO PLANT EMERGENCY PROCEDURES

Ladies and Gentlemen:

In accordance with 10 CFR 50.54(q) and 10 CFR 50, Appendix E, Section V, Progress Energy Carolinas, Inc. is submitting revisions to Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, plant emergency procedures. Progress Energy Carolinas, Inc. has evaluated the revisions, in accordance with 10 CFR 50.54(q), and has determined that the changes do not decrease the effectiveness of the Radiological Emergency Response Plan; and the Plan, as changed, continues to meet the standards of 10 CFR 50.47(b) and the requirements of 10 CFR 50, Appendix E. A list of the revised procedures is provided as Enclosure 1. A summary of the revisions is provided in Enclosure 2. Enclosure 3 contains copies of the revised procedures.

There are no regulatory commitments being made in this submittal. Please refer any questions regarding this submittal to Mr. Gene Atkinson, Supervisor – Emergency Preparedness, at (910) 457-2056.

Sincerely,

Edward T. O'Neil
Manager – Support Services
Brunswick Steam Electric Plant

A045

Progress Energy Carolinas, Inc.
Brunswick Nuclear Plant
P.O. Box 10429
Southport, NC 28461

TG-T/tg-t

Enclosures:

1. List of Revised Plant Emergency Procedures
2. Summary of Revisions
3. Copies of Revised Procedures

cc (with enclosures):

U. S. Nuclear Regulatory Commission, Region II
ATTN: Mr. Luis A. Reyes, Regional Administrator
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303-8931

U. S. Nuclear Regulatory Commission
ATTN: NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

U. S. Nuclear Regulatory Commission **(Electronic Copy Only)**
ATTN: Ms. Brenda L. Mozafari (Mail Stop OWFN 8G9)
11555 Rockville Pike
Rockville, MD 20852-2738

Ms. Jo A. Sanford
Chair - North Carolina Utilities Commission
P.O. Box 29510
Raleigh, NC 27626-0510

List of Revised Plant Emergency Procedures

Procedure	Revision	Effective Date	Title
0ERP	62	07/31/03	Radiological Emergency Response Plan
0PEP-02.6.28	8	07/31/03	Off-Site Protective Action Recommendations
0PEP-03.5.5	5	07/31/03	Environmental Monitoring And Plume Tracking
0PEP-03.6.3	13	07/31/03	Estimate Of The Extent Of Core Damage Under Accident Conditions

Summary of Revisions

A. OERP, Radiological Emergency Response Plan, Revision 62:

1. Changed "CP&L" to "Progress Energy" and deleted "Carolina Power & Light Company" on cover page to reflect company name change.

2. Changed "Communications Manager" to "Communications Managers" in Section 3.5.7 to reflect NUREG-0654, Table B-1 required minimum staffing for Emergency Operations Facility (EOF).

3. Deleted "EOF Habitability Technician" and changed "TSC Habitability Technician" to "TSC/EOF Habitability Technician" in Figure 3.2-1, Brunswick Emergency Organization, to reflect the deletion of the EOF Habitability Technician and need for only one individual for habitability surveys, due to co-location of Technical Support Center and EOF.

4. Changed "accidents involving spills or leaks of contaminated liquids or gases from tanks housing radioactive materials" to "accidents involving spills or leaks of contaminated liquids or gases from systems housing radioactive materials" in Section 4.2.2.1 for clarification.

5. Reworded information describing the Post Accident Sampling System (PASS) and analysis of reactor and containment in Section 4.2.2.3. This change reflects the removal of PASS as the primary indicator of core damage and replacement with emphasis on existing instrumentation as the initial indicator of core damage with PASS remaining as an option. This change supports NRC approval of Technical Specification Amendments 226 and 253 for BNP Units 1 and 2 which eliminated the PASS requirement from Technical Specifications.

6. Added Brunswick Steam Electric Plant, Units 1 and 2 – Issuance of Amendments 226 and 253, Elimination of Requirements for Post-Accident Sampling System, as new reference in Section 8.15.

7. Revised Section 4.4.6; Figure 1.1-6, Population Totals; Figure 4.4-1, Evacuation Schedule and Warning; and Figure 4.4-2, Evacuation Times, to reflect revised evacuation time estimates for 10-Mile Emergency Planning Zone (EPZ).

8. Changed reference in Section 8.6 to reflect revised evacuation time estimate information.

9. Added additional portable survey equipment in Table 5.7-4, Typical Portable Survey Equipment, to reflect current status and corrected typographical errors.

10. Added SOER 02-1, Severe Weather, as new reference in Section 8.16 and added reference commitments in procedure, as appropriate.

B. 0PEP-02.6.28, Off-Site Protective Action Recommendations, Revision 8:

1. Changed "CP&L" to "Progress Energy" and deleted "Carolina Power & Light Company" on cover page to reflect company name change.

2. Changed reference from "Communications Manager" to "Communications Managers" throughout procedure to reflect NUREG-0654, Table B-1 required minimum staffing levels for EOF.

3. Added information in Section 5.4.1 to clarify time limit for notifying offsite agencies with a Protective Action Recommendation (PAR) at a General Emergency classification.

4. Updated Attachment 2, Evacuation Zones and Time Estimates/10 Mile EPZ Map, to reflect revised evacuation time estimates for 10-Mile EPZ.

5. Added guidance for establishing initial PARs in Section 6.1.

6. Added guidance to modify a PAR in Section 6.2.

7. Added guidance in Attachment 1, PAR Flowchart, for protective action recommendation decision-making as an enhancement.

C. 0PEP-03.5.5, Environmental Monitoring And Plume Tracking, Revision 5:

1. Changed "CP&L" to "Progress Energy" and deleted "Carolina Power & Light Company" on cover page to reflect company name change.

2. Added Brunswick Steam Electric Plant, Units 1 and 2 – Issuance of Amendments No. 226 and 253, Elimination of Requirements for Post-Accident Sampling System as new reference 2.9, and added reference commitments in procedure, as appropriate. This change follows approval of Amendments 226 and 253 which deleted PASS from the Brunswick Technical Specifications.

D. 0PEP-03.6.3, Estimate Of The Extent Of Core Damage Under Accident Conditions, Revision 13:

1. Incorporated PASS Technical Specification change. Procedure places primary focus on radiation levels in the containment as initial indicators of core damage; and the use of PASS is maintained in the procedure to permit a more precise determination of core damage from gas and liquid samples.

BSEP 03-0129
Enclosure 3

Copies of Revised Procedures

PLANT OPERATING MANUAL

VOLUME XIII

EMERGENCY RESPONSE PLAN

UNIT
0

(0ERP)

RADIOLOGICAL EMERGENCY RESPONSE PLAN (ERP)

REVISION 62

REVISION SUMMARY

Revision 62 of 0ERP includes changes incorporated from the annual review by Plant Nuclear Safety Committee (PNSC) members. Changes include:

- Changed "CP&L" to "Progress Energy" and deleted "Carolina Power & Light Company" on Cover Page to reflect company name change.
- Changed "Communications Manager" to "Communications Managers" in Section 3.5.7 to reflect NUREG-0654, Table B-1 required minimum staffing levels for the EOF.
- Deleted "EOF Habitability Technician" and changed "TSC Habitability Technician" to "TSC/EOF Habitability Technician" in Figure 3.2-1, Brunswick Emergency Organization, to reflect the deletion of the EOF Habitability Technician and need for only one individual for habitability surveys, due to co-location of TSC and EOF.
- Changed "accidents involving spills or leaks of contaminated liquids or gases from tanks housing radioactive materials" to "accidents involving spills or leaks of contaminated liquids or gases from systems housing radioactive materials" in Section 4.2.2.1 for clarification.
- Reworded information describing PASS and analysis of reactor and containment in Section 4.2.2.3. This change reflects the removal of PASS as the primary indicator of core damage and replacement with emphasis on existing instrumentation as initial indicator of core damage with PASS remaining as an option. This change supports NRC approval of Technical Specification Amendments 226 and 253 for BNP Units 1 and 2 which eliminated the PASS requirement from Technical Specifications.
- Added Brunswick Steam Electric Plant, Units 1 and 2 - Issuance of Amendments 226 and 253, Elimination of Requirements for Post-Accident Sampling System, as new reference in Section 8.15.
- Revised Section 4.4.6, Figure 1.1-6, Population Totals, Figure 4.4-1, Evacuation Schedule and Warning, and Figure 4.4-2, Evacuation Times to reflect revised evacuation time estimates for 10-Mile Emergency Planning Zone (EPZ).
- Changed reference in Section 8.6 to reflect revised evacuation time estimate information.
- Added additional portable survey equipment to Table 5.7-4, Typical Portable Survey Equipment, to reflect current status and corrected typographical errors.
- Added SOER 02-1, Severe Weather, as new reference in Section 8.16 and added reference commitments in procedure, as appropriate.

LIST OF EFFECTIVE PAGES

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CAROLINA POWER & LIGHT COMPANY
BRUNSWICK NUCLEAR PLANT (BNP)
RADIOLOGICAL EMERGENCY PLAN (ERP)

1.0 INTRODUCTION

The Emergency Program for the Brunswick Nuclear Plant consists of the Brunswick Radiological Emergency Plan and its implementing Plant Emergency Procedures. The Radiological Emergency Plan may also be referred to as the Emergency Response Plan (ERP) in other plant documents. Also included are the related radiological emergency plans and procedures of state and local organizations. The purpose of these programs is to provide for the protection of plant personnel and the general public and to prevent or mitigate property damage that could result from an emergency at the Brunswick Nuclear Plant. The combined emergency preparedness programs have the following objectives:

1. Effective coordination of emergency activities among all organizations having a response role.
2. Early warning and clear instructions to the population-at-risk in the event of a serious radiological emergency.
3. Continued assessment of actual or potential consequences both on site and off site.
4. Effective and timely implementation of emergency measures.
5. Continued maintenance of an adequate state of emergency preparedness. The Supervisor - Emergency Preparedness is the BNP Emergency Planning Coordinator. The BNP Emergency Plan and Procedures are contained in the Plant Operating Manual (POM), Volume 13, which consists of the following parts:

   Book 1, Radiological Emergency Plan (ERP)
   Book 2, Plant Emergency Procedures (PEP)

A list of procedures required to implement the plan can be found in Book 2.

1.1 GENERAL INFORMATION

1.1.1 Plant Site Description

The Brunswick plant site is located in the southeastern portion of North Carolina 2 1/2 miles north of Southport in Brunswick County, and 16 miles south of Wilmington, North Carolina, in adjacent New Hanover County. (See Fig. 1.1-1 and Fig. 1.1-2.) Approximate coordinates of the reactor buildings are latitude 33° 57'30" N and longitude 78° 00'30" W. The Brunswick Plant utilizes two General Electric Company boiling water reactors. The major structures of the Brunswick plant which contain radioactive materials are the Units 1 and 2 reactor buildings, the turbine building and radwaste building.

Figure 1.1-1 shows a site plan for the Brunswick plant and Figure 1.1-3 shows the location of the buildings at the site.

1.1.2 Plume Exposure Emergency Planning Zone

The plume exposure Emergency Planning Zone (EPZ) is defined to be the area within an approximate ten-mile radius of the Brunswick plant.

Principal exposure sources from plume exposure pathways are: (a) external exposure to gamma and beta radiation from the plume and deposited material and (b) exposure of internal organs to gamma and beta radiation from inhaled radioactive gases and/or radioactive particulates.

Figure 1.1-2 shows the ten-mile plume exposure EPZ in relation to the location of the Brunswick plant. The plume exposure EPZ includes portions of the North Carolina counties of Brunswick and New Hanover.

The prevailing winds around the Brunswick plant are from the southwest. Figure 1.1-4 presents wind roses for the Brunswick plant site.

1.1.3 Ingestion Exposure Emergency Planning Zone

The ingestion exposure EPZ is defined to be the area within a 50-mile radius of the Brunswick plant.

The principal exposure sources from ingestion pathways are contaminated water or food, such as milk or fresh vegetables. The time of potential exposure can range in length from hours to months.

Figure 1.1-5 shows the 50-mile ingestion exposure EPZ in relation to the location of the Brunswick plant. The ingestion exposure EPZ includes the North Carolina Counties of Bladen, Brunswick, Columbus, New Hanover, Onslow, Pender, and Sampson, and the South Carolina County of Horry.

The region within a 50-mile radius of the Brunswick plant site is predominantly rural, with less than one-half the land devoted to farming. The remainder of the region consists of undeveloped, non-utilized marshes and woodlands.

1.1.4 Demographic Information

Demographic information for the 10-mile Emergency Planning Zone is presented in Figure 1.1-6.

The information is presented by (1) local planning zones and (2) distance from plant at 0-2 miles, 2-5 miles, and 5-10 miles, based on the longitude and latitude of the plant site. Since some of the local planning zones extend beyond the 10-mile radius, the total population for the local planning zones is greater than the total population for the 0-10 mile radius.

1.2 SCOPE AND APPLICABILITY

This document describes the Brunswick Radiological Emergency Plan (Plan) which has been prepared in accordance with Section 50.47 and Appendix E, of Title 10, Part 50, of the Code of Federal Regulations. The Plan shall be implemented whenever an emergency situation is indicated as defined in Section 2.0 Emergency Classifications. Radiological emergencies can vary in severity from the occurrence of an abnormal event, such as a minor fire with no radiological health consequences, to nuclear accidents having substantial on-site and/or off-site consequences.

In addition to emergencies involving a release of radioactive materials, events such as security threats or breaches, fires, electrical system disturbances, and natural phenomena that have the potential for involving radioactive materials are included in the Plan. Other types of emergencies that do not have a potential for involving radioactive materials are not included in the Plan.

The activities and responsibilities of outside agencies providing an emergency response role at the Brunswick plant are summarized in Appendix C and in the state's Emergency Plan.

1.3 SUMMARY OF EMERGENCY PROGRAM

The Brunswick radiological emergency program consists of the Brunswick Radiological Emergency Plan and its implementing procedures. The Plan provides the basis for performing advance planning and for defining specific requirements and commitments to be implemented by other documents and procedures. The Brunswick plant procedures provide the detailed actions and instructions that will be required to implement the Plan in the event of an emergency. The Plan and its implementing procedures are briefly described below.

1.3.1 Concept of Operations

The Brunswick Radiological Emergency Plan describes the general nature of emergency response activities, the available emergency response resources and facilities, and the means for maintaining emergency preparedness. Specific plant implementing procedures have been developed (or existing ones modified) to describe in detail how involved plant and corporate personnel carry out their specific responsibilities as identified in the Plan.

1.3.1.1 Emergency Response Activities

The first step in responding to an emergency is recognizing and classifying the nature of the emergency. In order to standardize this process, the four emergency classifications described in NUREG-0654 are adopted for use in this plan. Each class of emergency (Unusual Event, Alert, Site Area Emergency, and General Emergency) encompasses a predefined set of increasingly severe circumstances, including plant conditions, instrument readings, and effectiveness of in-plant corrective actions, known as Emergency Action Levels. The process of properly classifying an emergency is important because the subsequent response activities are dependent on the severity of the emergency.

The next step is to notify (and activate as conditions warrant) the proper emergency organizations, both inside and outside Progress Energy. Proper integration of the efforts of the various response organizations is important to prevent omission or unnecessary duplication of key activities. Therefore, the emergency plan identifies in terms of information flow and communications links the interfaces between pertinent organizations, and identifies the role each is to perform. The emergency response measures to be taken by Progress Energy are discussed in detail in this Plan, while those taken by the state and local governments are summarized herein with details provided in the North Carolina State Emergency Plan.

Beyond the process of notification and activation of support groups, a variety of efforts must be made to assess and minimize the consequences of an emergency condition. These efforts include estimates of the radiation exposures that may occur to plant and off-site personnel if the emergency is not brought quickly under control. Such estimates can be used to initiate preplanned protective actions. The decisions on protective actions off site, such as taking shelter or evacuation, are the responsibility of state and local authorities. The Plan provides for technical assessments of the course and consequences of the emergency and the means for providing state and local agencies with adequate information upon which to make their decisions. Emergency response activities also include personnel accountability, search and rescue, first aid, personnel decontamination, fire fighting, and damage control.

The final step is to declare the emergency over and perform any necessary post-accident recovery activities. The Plan describes post-accident recovery provisions and identifies the transition from the emergency phase to the recovery phase.

1.3.1.2 Emergency Response Resources

The emergency response resources available to respond to an emergency consist of the personnel at Corporate Headquarters, at other Progress Energy facilities, and, in the longer term, at organizations involved in the nuclear industry. The first line of defense in responding to an emergency lies with the normal operating shift on duty when the emergency begins. Therefore, members of the Brunswick staff are assigned defined emergency response roles that are to be assumed whenever an emergency is declared. The overall management of the emergency is normally performed by the Shift Superintendent until relieved by the on-call Site Emergency Coordinator. Because of his overall knowledge, he is best able to bring the full resources of the plant to bear on controlling the emergency. On-site personnel have preassigned roles to support the Site Emergency Coordinator and to implement his directives. These roles, for the purpose of emergency planning, are cast in terms of emergency teams and assignments, each having a designated leader or primary person and alternate(s) assigned to it.

Each team and individual assignment carries with it specific emergency response duties and, where practical, each is provided with an on-shift person to perform those duties on an interim basis. This approach ensures under most conditions that an emergency response duty falls under some predesignated position and provides a smooth transition as additional people are called to the plant, since each one knows ahead of time what his area of responsibilities will be. The Site Emergency Coordinator will also have ready access to the Technical Support Center. This Emergency Facility is comprised of personnel who are knowledgeable of and responsible for engineering and management support. It will assemble shortly after an Alert, Site Area Emergency, or General Emergency is declared in order to assist the Site Emergency Coordinator and to carry out his directives.

Upon declaration of an Alert, Site Area Emergency, General Emergency, or at the discretion of the Site Emergency Coordinator, the Emergency Operations Facility will be activated and staffed by personnel under the direction of the Emergency Response Manager. The position of Emergency Response Manager is staffed by qualified senior plant management personnel. Once the Emergency Operations Facility has been fully activated, the Emergency Response Manager will be responsible for all off-site emergency response including radiological and environmental assessment, determination of recommended public protective actions, and coordination of emergency response activities with federal, state, and local agencies. The Emergency Response Manager will manage the corporate response activities, to relieve the Brunswick plant personnel of any activities that could hamper their response efforts, and to marshall the corporate resources needed to properly respond to the emergency.

Progress Energy has a staff of well-trained and experienced engineers, scientists, and technicians. These personnel represent a pool of technical expertise which can be called upon to provide additional support to the emergency response and recovery organizations. Progress Energy personnel will staff a near-site Joint Information Center to interface with the media and general public in order to effectively communicate to the public the nature of an emergency in progress. Available to assist the Brunswick plant in responding to an emergency are Progress Energy personnel assigned to the Shearon Harris and Robinson nuclear plants and the Corporate Offices.

In addition as outlined in Appendix C, Progress Energy has arranged for support from outside Progress Energy in the areas of fire fighting, rescue and medical assistance, as well as that support delineated in the state and local emergency plans. Assistance may also be available from the Nuclear Regulatory Commission, Federal Emergency Management Agency, Department of Energy, and General Electric. The industry resources identified by INPO are also available. Progress Energy is a signatory to the mutual assistance agreement developed by INPO for utilities in the nuclear power industry.

1.3.1.3 Emergency Response Facilities

Special provisions have been made to assure that ample space and proper equipment are available to effectively respond to the full range of possible emergencies.

The emergency facilities available include the Brunswick plant Control Room, Operational Support Center, Technical Support Center, Emergency Operations Facility, and Joint Information Center. Each of these facilities, as well as the North Carolina Emergency Operations Center, the Brunswick County Emergency Operations Center, and the New Hanover County Emergency Operations Center, are described in Section 5, Emergency Facilities and Equipment.

1.3.1.4 Emergency Response Plan Maintenance

The Plan, as described in Section 6, provides for maintenance of emergency preparedness by establishing the framework and requirements for training, drills and exercises, and periodic updating. Each Brunswick employee having an emergency response role is trained, and annually retrained, in his area of responsibility and also how his duties fit in with those of others. Each individual must know what is expected of him and what he should expect of others while responding to an emergency. A basic description of the required training for emergency assignment is provided in the Plan. The effectiveness of such training is gauged by the use of drills and exercises. Drills are supervised instruction periods aimed at developing, maintaining, and testing skills in a specific operation such as communications or radiation monitoring. An exercise tests the overall capability of the integrated plant, state, and local emergency organizations to properly respond to an emergency. The Plan sets forth the frequency and content of such drills and exercises and also establishes how lessons learned will be used to improve the Plan.

The Plan also delineates the requirements for reviewing, updating, and auditing the Plan and for performing maintenance on and taking inventories of emergency equipment and supplies. An Emergency Planning Coordinator is designated to be responsible for overseeing this process as outlined in Section 6.2.

1.4 BRUNSWICK PLANT EMERGENCY PROCEDURES

Plant Emergency Procedures (PEP's) are implementing procedures which define the specific (i.e., step-by-step) actions to be followed in order to recognize, assess, and correct an emergency condition and to mitigate its consequences. Procedures to implement the Plan have been developed or existing procedures modified to provide the following information:

I. Specific instructions to the plant operating staff for the implementation of the Plan.

2. Specific authorities and responsibilities of plant operating personnel.

3. A source of pertinent information, forms, and data to ensure prompt actions are taken and that proper notifications and communications are carried out.

4. A record of the completed actions.

5. The mechanism by which emergency preparedness will be maintained at all times.

1.5 DEFINITIONS

<u>Accident</u> - Any unforeseen, or unintentional occurrence or mishap resulting in, or potentially resulting in, physical injury or injury due to radiation exposure or excessive exposure to radioactive materials.

<u>Activated</u> - To formally put on active duty with the necessary personnel and equipment to carry out the function required.

Activating - Key personnel are responding as a mandatory step to make the facility operational within the required time.

Corrective Actions - Those emergency measures taken to lessen or terminate an emergency situation at or near the source of the problem, to prevent an uncontrolled release of radioactive material, or to reduce the magnitude of a release (e.g., equipment shutdown, fire fighting, repair, and damage control.)

Emergency Action Levels - Plant conditions used to determine the existence of an emergency and to classify its severity. The conditions include specific instrument readings (e.g., radiation release rates out of a building vent) that may be used as thresholds for initiating emergency measures such as initiating a notification procedure.

Emergency Classification - The characterization of emergency situations consisting of several groupings including the entire spectrum of possible radiological emergencies. The four classes of emergencies, listed in order of increasing severity (and decreasing probability), are (1) Unusual Event, (2) Alert, (3) Site Area Emergency, and (4) General Emergency.

Emergency Instructions - Specific procedures that provide step-by-step instructions to guide plant operations during potential or actual emergency situations.

Emergency Operations Centers - Designated facilities designed and equipped for effective coordination and control of emergency operations carried out within an organization's jurisdiction.

Emergency Operations Facility (EOF) - An on-site support facility for the management of overall licensee emergency response including coordination with federal, state, and local officials, coordination of off-site radiological and environmental assessment, and determination of recommended public protective actions. The EOF is located in the TSC/EOF/Training Building.

Emergency Planning Zones (EPZ) - A generic area defined about a nuclear plant to facilitate emergency planning off site. The plume exposure EPZ is described as an area with a 10-mile radius and the ingestion exposure EPZ is described as an area with a 50-mile radius in NUREG-0654. (See Figure 1.1-7)

Exclusion Area - Progress Energy-owned property that surrounds the reactor plants as defined in 10CFR100. The area is of such size that an individual located at any point on its boundary for two hours immediately following onset of the postulated fission product release would not exceed 25 rem whole body dose or 300 rem thyroid dose. This is the property boundary used for off-site dose projections. (See Figure 1.1-1)

Joint Information Center (JIC) - A nearsite facility equipped and staffed by Progress Energy, State, County, and Federal Agencies to coordinate the dissemination of information to the news media and general public during an emergency.

Ingestion Exposure Pathway - The potential exposure pathway to the public through consumption of radiologically contaminated water and foods such as milk or fresh vegetables. The basis for planning within the 50-mile EPZ.

Manning - A person is in the facility to respond to incoming calls.

Nuclear Incident - An event or series of events, either deliberate or accidental, leading to the release or potential release into the environment of radioactive materials in sufficient quantity to warrant consideration of protective actions.

Operational - The facility is executing its designed functions and tasks.

Operational Support Center (OSC) - The place to which emergency response support personnel report and standby in an emergency situation. The OSC is located in the Operations and Maintenance (O&M) Building.

Plume Exposure Pathway - The potential exposure pathway to the public through (a) whole body external exposure from the plume and from deposited materials, and (b) inhalation of radioactive materials. The basis for planning within the 10-mile EPZ.

Population-at-Risk - Those persons for whom protective actions are being or would be taken.

Projected Dose - An estimate of the potential radiation dose which affected population groups could receive.

Protected Area - The double-fenced security area with intrusion detection devices immediately surrounding the plant structures. (See Figure 1.1-3.)

Protective Action - An activity conducted in response to an incident or potential incident to avoid or reduce radiation dose to members of the public (sometimes referred to as protective measure).

Protective Action Guide (PAG) - The projected dose to reference man, or other identified individual, from an accidental release of radioactive material at which a specific protective action to reduce or avoid that dose is warranted.

Radiological Emergency - An off-normal situation that has or may have a radiological impact on the public health and safety.

Recovery Actions - Those actions taken after an emergency to restore the Brunswick plant and the surrounding environment as nearly as possible to its pre-emergency radiological condition.

Restricted Area - Any area, access to which is controlled by Progress Energy for purposes of protection of individuals from exposure to radiation and radioactive materials.

Severe Accident Management Guidelines (SAMGs) - Severe Accident Management Guidelines are entered when Emergency Operating Procedures (EOPs) are not able to maintain adequate core cooling.

Staffing - Key personnel are responding to the facilities as a proactive step to prepare for potential operational status.

State - The State of North Carolina.

Technical Support Center (TSC) - A center outside of the Control Room that supplies information on the status of the plant to those individuals who are knowledgeable or responsible for engineering and management support of reactor operations in the event of an emergency, and to those persons who are responsible for management of the emergency response. The TSC is located in the TSC/EOF/Training Building.

Unrestricted Area - Any area to which access is not controlled by the licensee for protecting individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

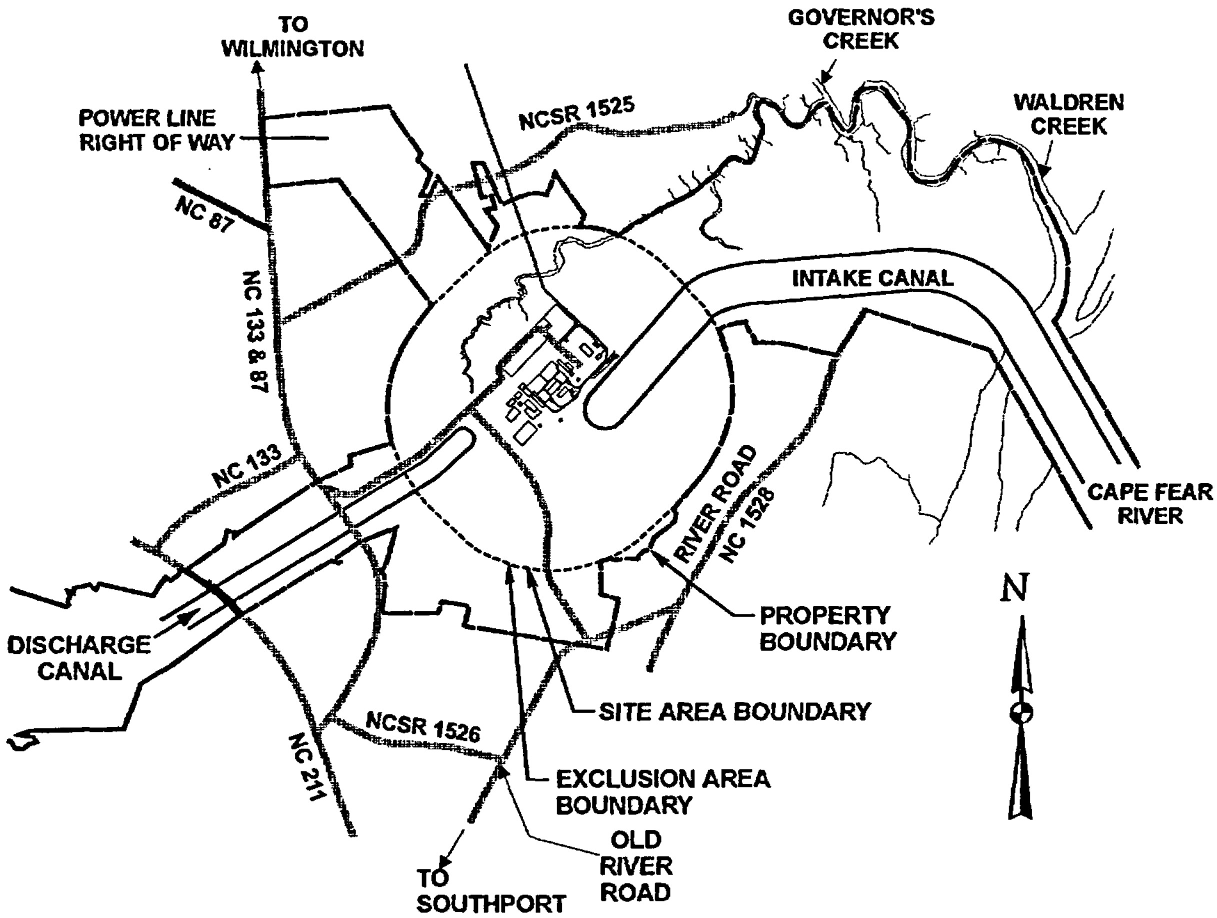


Figure 1.1-1 Brunswick Site Plan

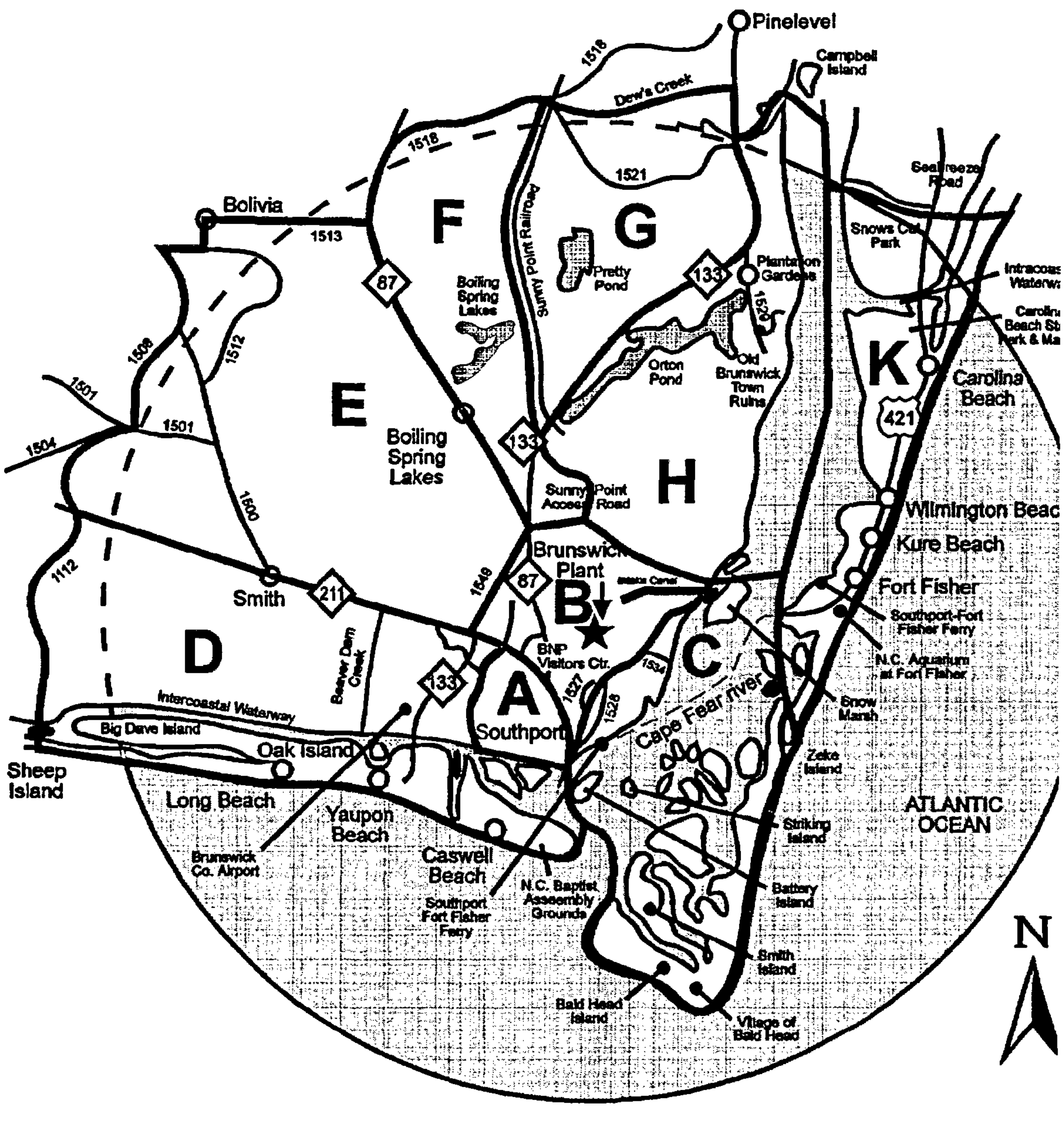


Figure 1.1-2 10-Mile Plume Exposure EPZ

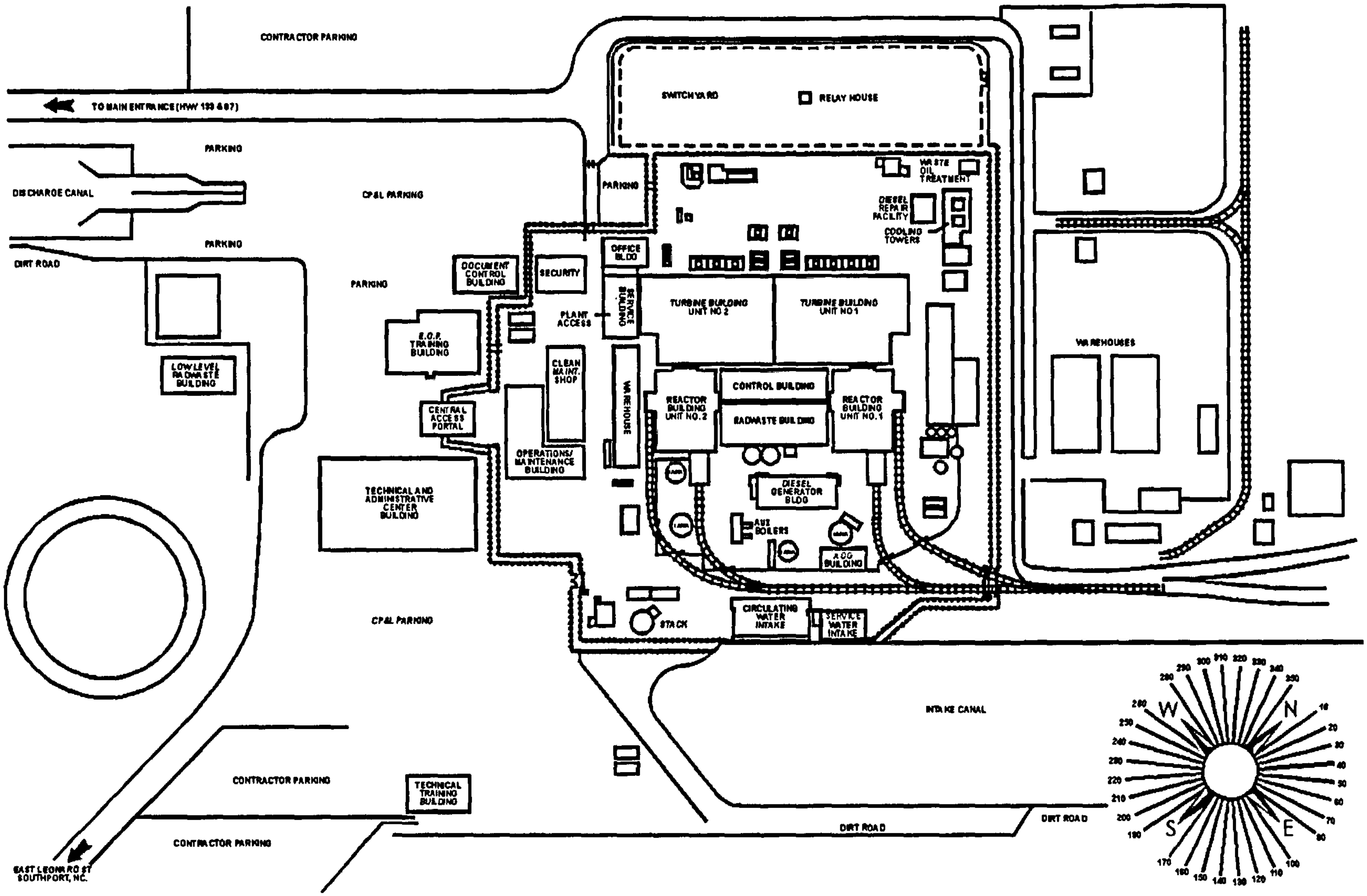
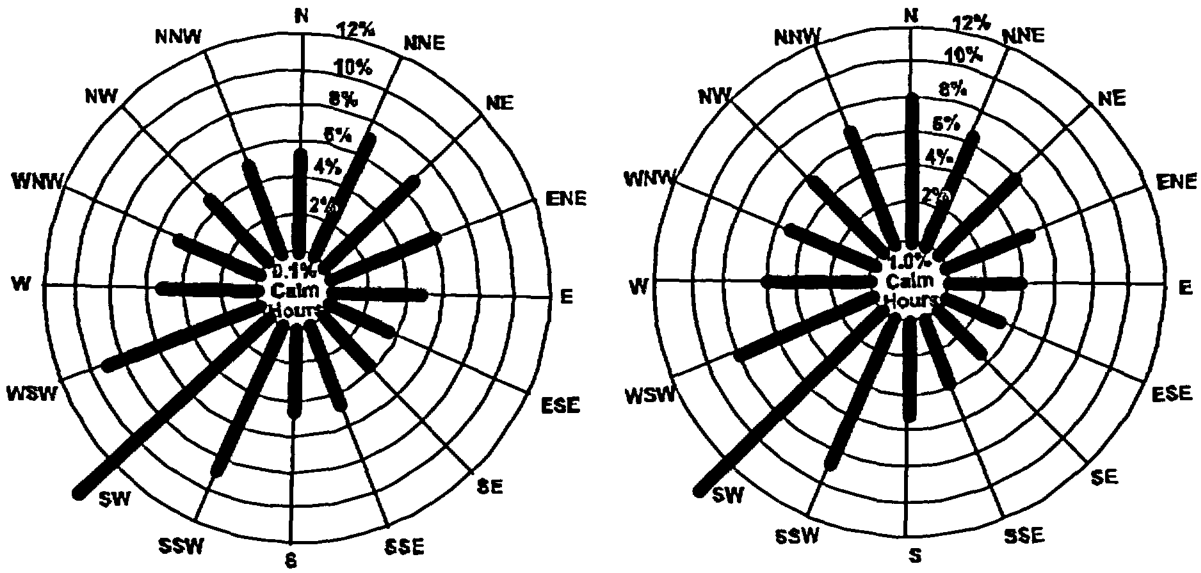


Figure 1.1-3 Brunswick Site Building and Onsite Emergency Facility Locations



Upper Level Wind** Rose**

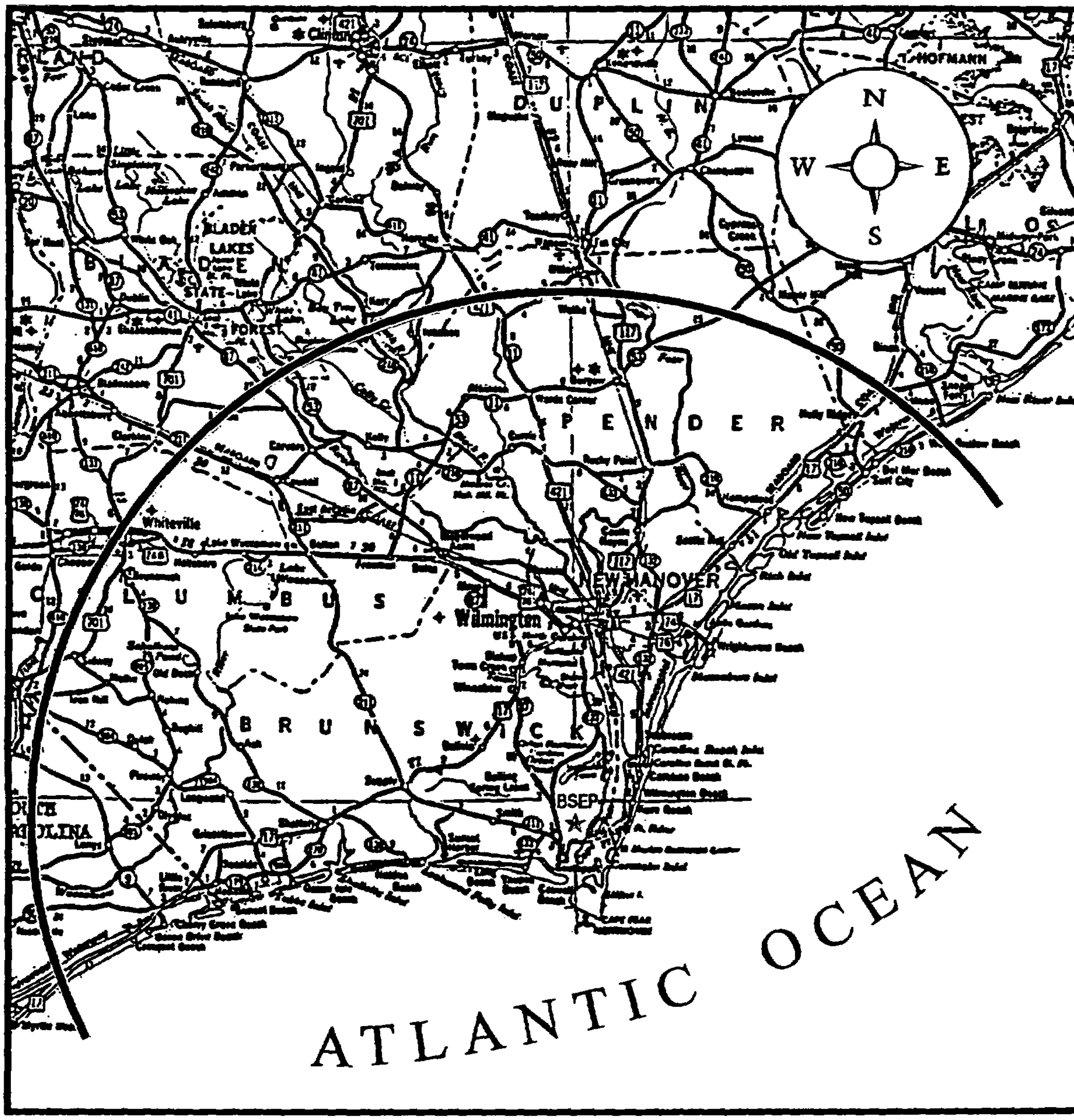
On-site Met Data 1976-1979
Upper Level Data = 343 foot AGL
Average Velocity = 15.16 mph
Data Recovery = 97.9%

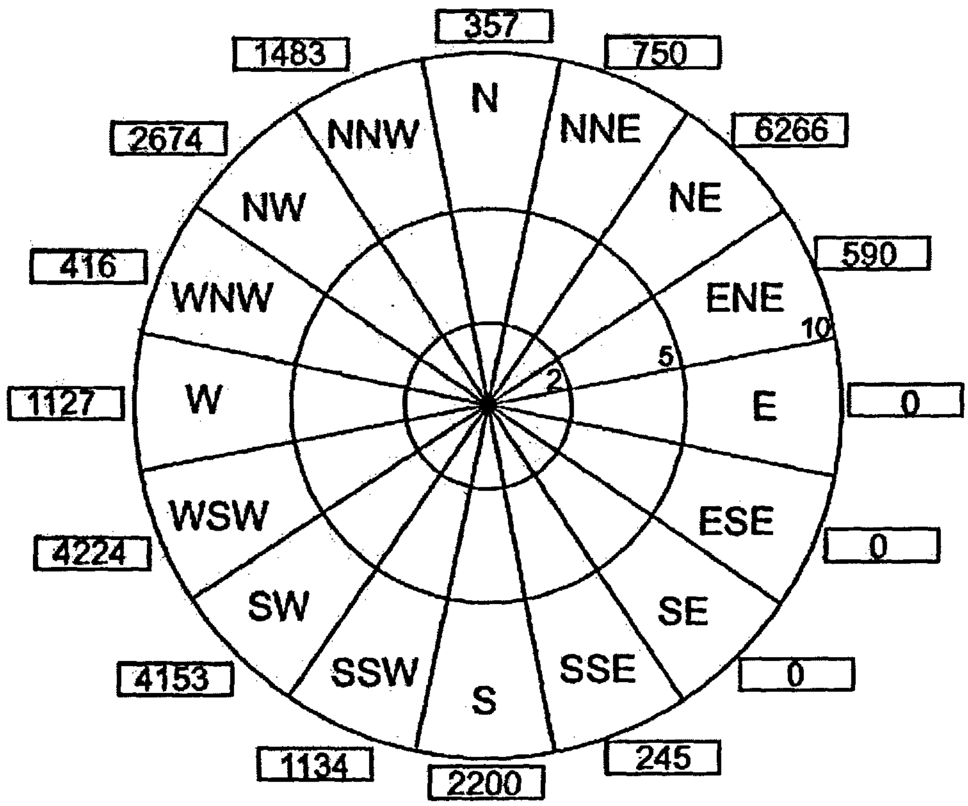
Lower Level Wind Rose

On-site Met Data 1976-1979
Lower Level Data = 38 foot AGL
Average Velocity = 8.54 mph
Data Recovery = 97.8%

Figure 1.1-4 Wind Roses

Figure 1.1-5 50-Mile Ingestion Exposure EPZ





POPULATION TOTALS			
RING MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-2	1074	0-2	1074
2-5	5697	0-5	6771
5-10	18848	0-10	25619

25619	Total Segment Population 0 to 10 miles

*LOCAL PLANNING ZONES	RES. POP.	PEAK POP.
A	1542	932
B	1609	16387
C	787	1335
D	9297	32422
E	2077	745
F	3193	1204
G	890	64
H	818	1073
K	6511	55517
TOTALS	26724	109679

*See Figure 1.1-2

BRUNSWICK SITE
PLUME EXPOSURE PATHWAY
10 Mile Emergency Planning Zone
Figure 1.1-6 Population Totals

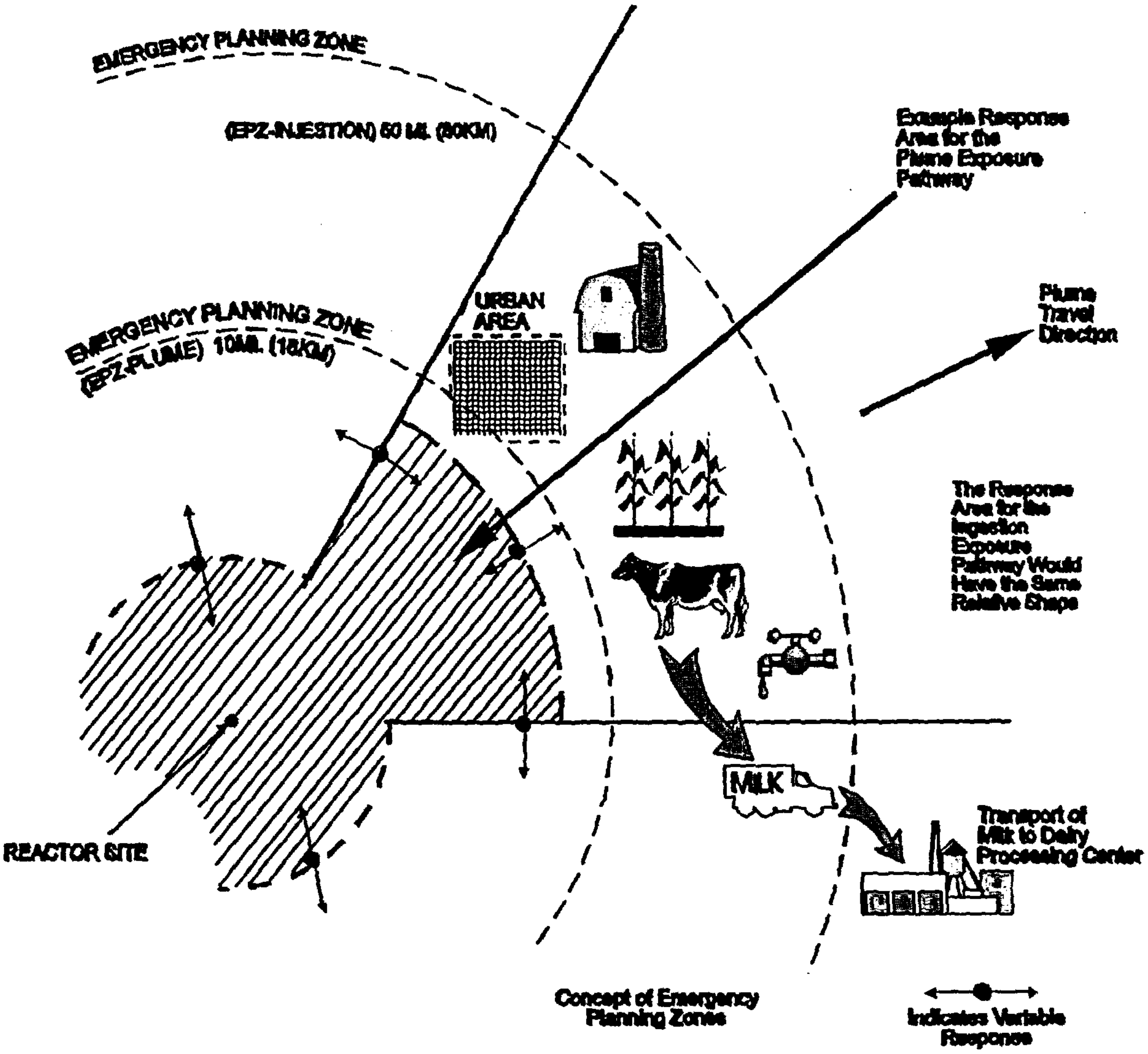


Figure 1.1-7 Concept of Emergency Planning Zones

2.0 EMERGENCY CLASSIFICATIONS

A key element of this Plan is a preplanned system of notifying and activating various emergency response organizations. This system, in accordance with NRC recommendations, uses graded levels of emergency response where the actions specified are organized according to the general severity of the emergency condition.

This section discusses the criteria for determining the level of the emergency condition. It also illustrates how a decision is made to declare that an emergency exists by providing example initiating conditions that could correspond to each emergency class. Section 3 in turn will discuss the plans for notification of off-site agencies and mobilization of emergency teams and how they may vary with the level of the emergency.

2.1 GENERAL CLASSIFICATION SYSTEM

The operating staff is provided formal training to recognize and respond in a logical manner to off-normal plant conditions. Plant abnormal and emergency instructions are designed to allow plant personnel to mitigate the consequences of and correct an off-normal condition as quickly as possible following its occurrence. The procedures identify the conditions requiring implementation of this Plan. Figure 2.0-I shows the basic response sequence that is followed during any off-normal condition.

The types of potential emergencies vary in probability and consequences. Accordingly, any system that categorizes emergencies must be both wide-ranged and flexible. This Plan adopts the NRC recommended standard of four general classes of emergencies and, as described below, includes the methods for determining the class in which a specific type of event should be placed.

There are three basic tests or criteria that must be considered in deciding which emergency class exists. These are:

1 Radioactivity release: Is a release occurring; and if so, what is its magnitude?

2. Core damage: If no release to the environment is occurring, has there been a release of fission products from the fuel? Do the radiation levels in the coolant system or primary containment pose a potential danger to the public?

3. Plant degradation: Has the plant responded to equipment failures or external events as designed? If the plant has not responded as expected, what is the prognosis for a safe recovery, or alternately that further degradation will occur (e.g., corrective action is not likely to be successful or cannot be accomplished before a major release occurs)?

The categorization of events and combinations of events according to one of the four emergency classes is implemented through Emergency Action Levels (EALs). These are specific sets of plant conditions, instrument readings, and events which, unless promptly corrected, coincide with the conditions associated with one of the four emergency classes.

EALs for the Brunswick Nuclear Plant are included as an attachment to the Radiological Emergency Response Plan and are provided in 0PEP-02.1, Initial Emergency Actions.

The EALs have been selected with a view towards ensuring that a reasonable time is available to diagnose the specific cause of the emergency and attempt immediate corrective actions.

Once an emergency is declared, assessments of core and containment conditions, projected releases, and resultant exposures are performed. The results, along with other plant status assessments, are reported to off-site agency officials who decide, based on these inputs, whether or not protective actions for the public are to be implemented. The relationship of dose assessment values to the Environmental Protection Agency (EPA) Protective Action Guides (PAGs), and the possibility of approaching or exceeding the PAGs, will specifically be reported. Section 4 describes the relationships between emergency classes, PAGs, and various emergency measures.

Each of the four emergency classes are discussed below.

2.2 UNUSUAL EVENT

Unusual events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant.

Determination of an Unusual Event (or any emergency condition) may be accomplished in one or more of the following ways:

- Observations/inspections
- Automatic alarms (e.g., Radiation and Process Monitoring Systems)
- Communications from others (e.g., warnings of severe natural phenomena by the National Weather Service)

As in all cases, the Site Emergency Coordinator will declare an Unusual Event in any circumstance where, in his judgment, the status of the plant warrants it. Initiating conditions are established as EALs for the determination of this class. Specific EALs for an Unusual Event are listed in 0PEP-02.1, Initial Emergency Actions.

An Unusual Event does not require the activation of the entire on-site emergency organization, but the Site Emergency Coordinator can direct that additional personnel come to the site to support shift workers. Off-site emergency organizations shall be notified as necessary for informational purposes and aid from off-site fire fighting, medical services, and security organizations can be requested. Notifications are discussed in Section 3.9, and emergency measures to be taken are described in Section 4. Specific emergency actions to be followed during an Unusual Event are contained in 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert Site Area Emergency, General Emergency.

2.3 ALERT

Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant.

Initiating conditions are established as EALs for determination of an Alert and are listed in 0PEP-02.1, Initial Emergency Actions. Additionally, the Site Emergency Coordinator will declare an Alert whenever he concludes that plant conditions so warrant.

Events in this class may reflect a significant degradation in the safety of the reactor. However, releases from such events will be small. Off-site mobilization and assessment actions will be initiated to ensure that emergency personnel are readily available to respond if situations become more serious and confirm that radiation levels in the environment do not require protective actions off-site. Notifications and activation of emergency organizations are discussed in Section 3.9, and the emergency measures to be taken are described in Section 4. Specific emergency actions to be followed during an Alert are contained in 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency.

2.4 SITE AREA EMERGENCY

Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public.

Initiating conditions are established as EALs for determination of the Site Area Emergency class and are listed in 0PEP-02.1, Initial Emergency Actions. Additionally, the Site Emergency Coordinator will declare a Site Area Emergency whenever he concludes that plant conditions so warrant.

The Site Area Emergency class includes Alert conditions where the plant personnel have been initially unsuccessful in restoring the facility to a safe shutdown condition. It also includes Alert conditions where subsequent additional malfunctions have occurred. The Site Area Emergency class is more severe than the Alert class because significant radiation releases may occur. However, most of the initiating conditions associated with the Site Area Emergency class do not result in an immediate release and may never result in a significant release if emergency repairs are successful.

Although immediate protective actions are not automatically required, declaration of a Site Area Emergency will set into motion all personnel on site and off site that would be required to perform actions up to and including the evacuation of a near-site area. If circumstances warrant, the process of public notification may begin as directed by the state plan. Section 3.9 discusses the planned process of notification and activation of emergency organizations. Emergency measures to be taken are described in Section 4. Specific emergency actions to be followed during a Site Area Emergency are contained in 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency.

2.5 GENERAL EMERGENCY

Events are in progress or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity.

Initiating conditions predictive of a major radiological release are established as Emergency Action Levels for determination of the General Emergency class and are listed in 0PEP-02.1, Initial Emergency Actions. Additionally, the Site Emergency Coordinator will declare a General Emergency whenever, in his judgment, conditions exist that warrant activation of emergency response efforts including off-site monitoring and prompt public notification.

The General Emergency class includes accident conditions that involve severe core damage or melting. Such conditions will result in major releases to the primary containment and extremely high levels of contamination in the reactor coolant. Releases to the environment may be kept low unless leak paths in the primary containment develop (as from containment failure or failures in pumps, valves and other equipment which circulate reactor coolant outside primary containment). If major releases do occur, it is probable that they will occur hours to days after the onset of the emergency and that off-site exposures will approach or exceed EPA recommended protective action guides unless protective measures are instituted. Notifications and activation of emergency organizations are discussed in Section 3.9. The emergency measures to be taken are described in Section 4. Specific emergency actions to be followed during a General Emergency are contained in 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency.

THE SHIFT SUPERINTENDENT LEARNS OF AN OFF-NORMAL CONDITION, DETERMINED BY INSTRUMENT READINGS OR OBSERVATION. SHIFT SUPERINTENDENT IMPLEMENTS 0PEP-02.1, WHICH FLOWS AS

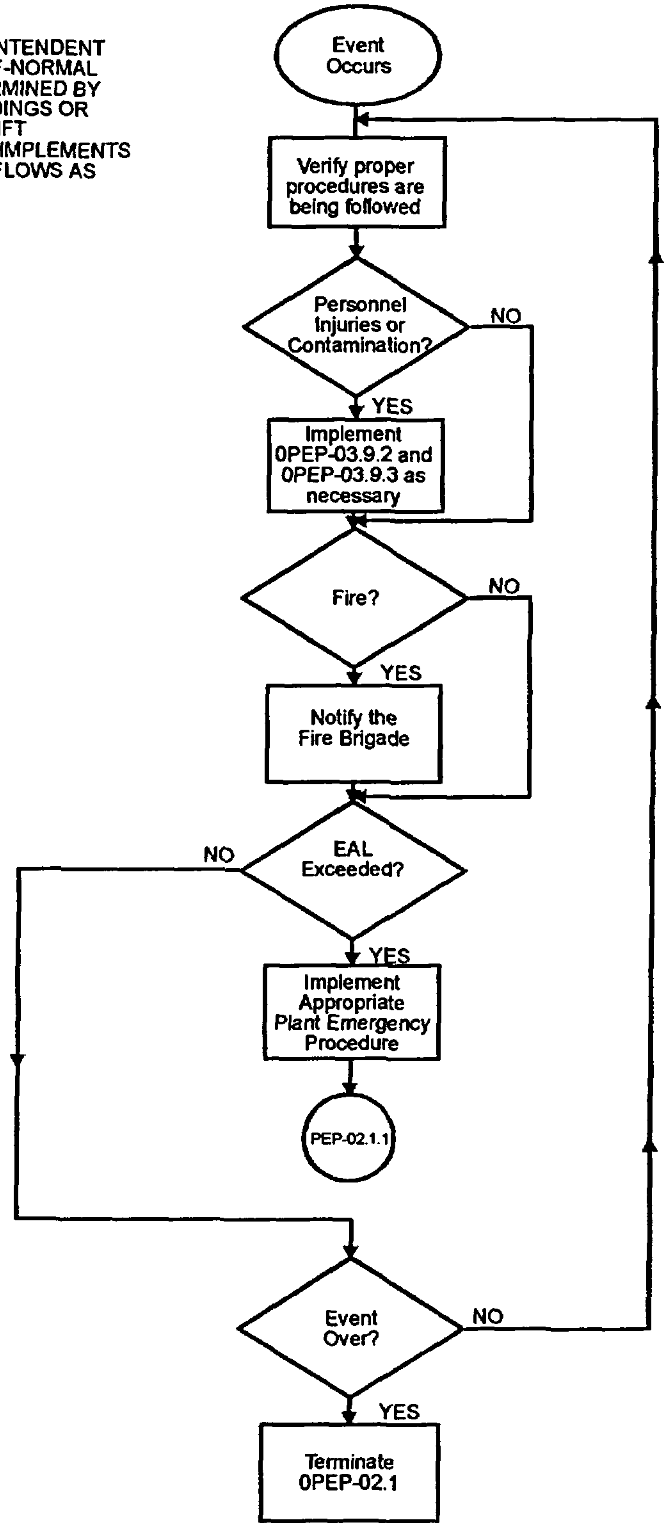


Figure 2.0-1
Response Sequence to Off-Normal Conditions

3.0 EMERGENCY RESPONSE ORGANIZATION

There are requirements for action in an emergency that go beyond those encountered during routine operations. To meet these extra demands and provide an effective response to the emergency, the Brunswick Radiological Emergency Plan employs an organizational concept that has four features.

1. Whenever the Plan is activated (i.e., an EAL is exceeded), a single individual is charged with the responsibility for and authority to direct all actions necessary to respond to the emergency

2. The primary responsibility of the individual in charge is to assure that all critical actions (emergency response functions) are carried out. Upon activation of the Plan, he is freed of all other responsibilities and thus able to devote his entire effort to managing the emergency response.

3. Specific individuals are assigned the responsibility of carrying out predefined critical actions.

4. There is a mechanism established to provide additional resources as necessary to respond to the emergency, which provides continuity of response on each critical action.

This concept of organization is compatible with and integrated into the normal mode of operation. There are a number of procedures to guide operators in responding to equipment malfunctions and instrument alarms. There are also procedures to maintain effective control over contamination and radiation exposures. Emergency procedures basically involve an extension of these existing plant procedures.

Organizational control of emergencies is accomplished in several steps. First, as is discussed in Section 2, conditions associated with the various emergency classes are clearly defined. Second, emergency response functions are specified with levels of action appropriate to each emergency class (e.g., notification, off-site radiation monitoring, etc.). Third, individuals are assigned to be responsible for carrying out each emergency response function, with the assignments to cover all phases of the emergency–from its initial declaration to the final recovery operations.

Finally, the position of Site Emergency Coordinator is established to be activated immediately on declaration of an emergency. To that individual is delegated the immediate and unilateral authority to act on behalf of the Company to manage and direct all emergency operations involving the facility. Upon activation of the EOF, the Emergency Response Manager assumes responsibility of overall emergency response and performs those requirements for all off-site related activities. The Site Emergency Coordinator maintains overall on-site emergency response responsibilities and reports to the Emergency Response Manager.

Initially the Site Emergency Coordinator would be the Operations Shift Superintendent who would act in that capacity until formally relieved by the designated On-Call Site Emergency Coordinator or alternate (qualified SECs are listed in EPL-001) in the Technical Support Center. In this manner, the individual usually in charge of activities in the Control Room is responsible for initiating the necessary emergency response, but the emergency response organization On-Call SEC is expected to assume management of the emergency response as soon as available to do so--in anticipation of the possible wide-ranging responsibilities associated with managing a major emergency.

This section of the plan delineates the various emergency actions and separates them into groups of related functions. These functions are then assigned to designated emergency response personnel who are responsible to the Site Emergency Coordinator for the performance of the activities required to fulfill those functions.

Upon the declaration of an emergency, specified on-shift personnel assume the responsibility for performing the required emergency response actions until properly relieved by another emergency response organization member qualified for the position. All emergency response organization members are trained as described in Section 6.1.1.

If necessary, the Site Emergency Coordinator will allocate available resources based on existing plant conditions. Where necessary, additional personnel will be notified and requested to augment on-site personnel.

A current call list of emergency response organization members is maintained in the Control Room and procedures are available to make this notification. Since many of the Brunswick plant management staff and substantial numbers of its support personnel live in the site vicinity (i.e., Southport and surrounding areas) additional assistance can be quickly provided.

3.1 NORMAL OPERATING ORGANIZATION

The greatest number of people on site occurs during day shift operations. The plant crew available to respond to an emergency provides a broad spectrum of specialties including operations, maintenance, engineering, radiochemistry, health physics, fire protection and security. The Plan, as will be discussed, utilizes the basic plant organizational structure and cadre of available manpower as the principal means of responding to an emergency condition. This is accomplished by assigning the management of various emergency response functions to individuals in accordance with their routine operational responsibilities. To illustrate, Radiological Emergency Teams will be directed by Environmental & Radiation Control, management personnel, who are the individuals responsible for directing day-to-day radiation control programs. In the event of an emergency, they report directly to the Site Emergency Coordinator and continue to be responsible for radiological matters.

There are, of course, times when the full complement of staff is unavailable, just as there are times when one or a few key supervisory officials are away from the plant. Therefore, the shift organization as described in the Administrative Controls section of the BNP Technical Specifications must be prepared to provide the initial response to an emergency. The following on-shift expertise will be maintained 24 hours per day:

Each operating shift will normally consist of a Shift Superintendent, two Senior Control Operators, four Control Operators, seven Auxiliary Operators, three Health Physics Technicians, one Chemistry Technician, and one Shift Technical Advisor (STA). Deviation from the normal shift complement is allowed as long as the minimum shift complement, as described in Technical Specification 5.2.2.c and UFSAR Table 13.1.2-1, is maintained and appropriate action is taken (see Figure 3.1-1).

As will be described below, the general approach is to assign all necessary emergency response functions to the individuals on site. Each individual, on declaration of an emergency, would be responsible for carrying out one or more emergency actions until additional personnel arrive on site. It should be noted that they are initially responsible under all circumstances, and remain so until relieved. This arrangement provides for a clear and uniform assignment of responsibility and provides a mechanism to assure that all important emergency response functions are dealt with from the very beginning of the accident.

3.2 ON-SITE EMERGENCY ORGANIZATION

The minimum on-site emergency organization for non-normal working hours, backshifts, and holidays for the Brunswick Plant is described above in Section 3.1. Compliance with the requirements of NUREG 0654 Table B-1 has been assured. Guidance for augmenting the emergency organization is found in the notification checklists of the plant emergency procedures. Individuals' names and roles in the emergency organization, phone numbers, and alternates are also described in the plant emergency procedures. EPL-001 lists the individuals and alternates qualified to fill the positions described for the TSC, OSC, and EOF.

The Company is committed to provide staffing to effectively contain any emergency which might occur at its nuclear facilities. Depending on the emergency at hand, personnel will be contacted with required expertise on a priority basis. Since a large portion of the Brunswick staff lives in the vicinity of the plant, additional personnel will be available for communications, on-site and off-site Radiological assessment, repair and corrective actions and technical support within a short period of time. Depending on weather conditions, 30-45 minutes should provide enough time to make the appropriate staff available to augment the on-site organization. The on-site organization will continue to be augmented such that within 60-75 minutes after notification, additional personnel will be added to provide the necessary support and will meet the intent of Table B-1 of NUREG 0654. Additional personnel will continue to supplement the plant emergency organization as necessary to meet the requirements of this Plan. Periodic drills will be conducted to determine that this augmentation schedule can be maintained.

As an aid toward assuring that critical emergency actions are given proper attention, the plant's emergency procedures provide for emergency response personnel established to carry out specific types of functions such as accident assessment and off-site notification. As discussed below, emergency response organization personnel have been selected with an aim toward making a smooth and rapid transition to the emergency mode of operation. The Emergency Response Organization is shown in Figures 3.2-1, 3.4-1, and 3.6-1.

The functions specifically assigned to each element of the Emergency Response Organization are intended to encompass all critical response functions, from command and control to communications. One function assigned to each is that of record keeping. Typical of the records to be maintained are the emergency communications, the radiation records, (i.e., surveys, projected dose calculations, personnel/population-at-risk evacuations, etc.), the sequence of events (i.e., the managerial decisions and essential occurrences that evolve throughout the emergency), and the security/accountability records (i.e., who is presently on each team or at each center and any security threats). The following sections describe the specific emergency assignments, which are in the Plan's implementing procedures. The Emergency Response Organization personnel telephone numbers are available in the Control Room. In all emergencies, the on-duty Shift Superintendent is authorized and qualified to implement the Plan and to classify the emergency condition.

3.2.1 Site Emergency Coordinator

As discussed in Section 3.1, direction and coordination of emergency actions on-site (and off-site until relieved by the Emergency Response Manager) are prime responsibilities of the Site Emergency Coordinator. The initial determination that an emergency exists will be made in the Control Room, based on measured plant parameters. Therefore, the Shift Superintendent is initially the Site Emergency Coordinator. If the Shift Superintendent becomes incapacitated for any reason, the Senior Control Operator of the unaffected unit will assume the responsibilities of the SEC. He will be in command of the on-site emergency organization until relieved by the designated On-Call Site Emergency Coordinator. The Shift Superintendent will be relieved by the first qualified SEC to arrive on site so that he may devote his attention to plant operations. The Shift Superintendent remains responsible for the decision making of Severe Accident Management Guidelines strategies.

Names and phone numbers of qualified Site Emergency Coordinators are available in EPL-001. He will also appoint an Emergency Communicator who will relay messages and maintain notification records throughout the emergency.

Any individual who may be required to serve, even temporarily, in the capacity of a Site Emergency Coordinator must be qualified and trained in accordance with the training program described in Section 6.1.1.

The primary responsibilities of the Site Emergency Coordinator include the following:

1. Coordinating and directing the combined activities of Brunswick personnel in the Control Room, Technical Support Center, Operational Support Center, and elsewhere on the site.

2. Classifying the emergency.

3. Notifying off-site plant, corporate, and local agency personnel, as well as on-site personnel, as delineated in the procedures which implement the Plan. (Upon activation of the Emergency Operations Facility, the Emergency Response Manager provides liaison between the Site Emergency Coordinator and all off-site agencies.)

4. Issuing instructions to emergency response personnel and assuring that the appropriate procedures are being followed.

5. Initiating protective actions to be taken on site, if required.

6. Determining the advisability of re-entry operations during or immediately following an emergency situation.

7. Directing health physics activities until the arrival at the site of the Radiological Control Director.

8. Assuring continuity of on-site resources.

9. Declaring the emergency over.

Until relieved by the Emergency Response Manager, the Site Emergency Coordinator may not delegate the responsibility to make the decision to notify and make recommendations to authorities responsible for off-site emergency measures. Further, while he may consult with others, he may not delegate the responsibility to upgrade or downgrade the emergency classification or to declare that the emergency has been terminated. He may delegate the responsibility to announce that the emergency has been terminated. He may delegate the responsibility and authority for mobilization of recovery efforts while that emergency still exists provided that such efforts in no way interfere with or detract from the response to the emergency. (Responsibility for mobilization of recovery efforts transfers to the Emergency Response Manager upon activation of the EOF.)

Other responsibilities may be delegated to other emergency organizational units as necessary for expeditiously carrying out the requirements of the Plan and procedures which implement the Plan.

3.2.2 Plant Operators

During an emergency, the Plant Operators (including the Shift Superintendent) are the nucleus of the initial effort to control the plant and take steps to protect the public.

The Plant Operators' primary responsibility is to carry out assigned actions necessary during an emergency to provide initial emergency response per established emergency instructions and perform initial calculations of projected off-site consequences. The Operators are responsible for implementing actions (including Severe Accident Management Guidelines) as directed by the Shift Superintendent. Specific emergency response duties of the Plant Operators are found in the Plant Emergency Procedures which implement the Plan and in other Operations procedures.

3.3 Technical Support Center

The Site Emergency Coordinator, as discussed above, is responsible for managing a wide range of activities at the plant. To assist the Site Emergency Coordinator in this effort and to implement his directives, a Technical Support Center has been established. The Technical Support Center consists of management-level personnel. Upon declaration of an Alert, Site Area Emergency, or General Emergency, the Technical Support Center will be notified to immediately assemble. The SEC and other TSC staff members perform monitoring and evaluations required for Severe Accident Management Guidelines, and provide advice and recommendations to the Shift Superintendent and Control Room Operators.

The various technical and administrative functions to be performed at the plant have been grouped into five categories similar to the organization for routine operations. These are as follows:

Plant Operations
NRC Communications
Radiological Control
Technical Assessment
Security

Directors are assigned to be responsible for activities within each category.

The Directors within the Technical Support Center may be relieved by designated qualified plant personnel (phone numbers are listed in EPL-001).

3.3.1 Plant Operations Director

The Plant Operations Director is responsible to the Site Emergency Coordinator for providing liaison with the Control Operators, Shift Superintendent, and Technical Support Center. He is responsible for providing technical and administrative assistance to the Control Operators. This position also performs monitoring and evaluations required for Severe Accident Management Guidelines. Responsibilities of this position are contained in 0PEP-02.6.26, Activation and Operation of the Technical Support Center.

3.3.2 Radiological Control Director

The Radiological Control Director is responsible to the Site Emergency Coordinator for managing the radiological monitoring and assessment aspects of the plant during an emergency; managing activities to control radiation exposure; providing technical and administrative direction to the Radiological Emergency Teams; and providing liaison with the Emergency Operations Facility and with the Radiological Control Manager. Responsibilities of this position are contained in 0PEP-02.6.26, Activation and Operation of the Technical Support Center.

3.3.3 Technical Assessment Director

The Technical Assessment Director is responsible to the Site Emergency Coordinator for providing technical and administrative direction to the Accident Assessment Team and for providing liaison with the Technical Analysis Manager after the EOF is activated. The Technical Assessment Director is responsible for performing the monitoring and evaluations required for Severe Accident Management Guidelines. Responsibilities of this position are contained in 0PEP-02.6.26, Activation and Operation of the Technical Support Center.

3.3.4 Security Director

The Security Force is composed of personnel qualified in security, personnel accountability, and evacuation procedures and practices.

The Security Director is responsible to the SEC for providing direction to the Security Force during a declared emergency and providing liaison with the state and local law enforcement agencies. Responsibilities of this position are contained in 0PEP-02.6.26, Activation and Operation of the Technical Support Center.

3.3.5 Communications Director

The Communications Director in the TSC reports to the Site Emergency Coordinator. He is responsible to make plant-wide announcements over the Public Address System, ensure NRC notifications are performed, and supervise the administrative staff. Responsibilities of this position are contained in 0PEP-02.6.26, Activation and Operation of the Technical Support Center and 0PEP-02.6.21, Emergency Communicator.

3.3.6 Radiological Control Communicator

The Radiological Control Communicator is responsible to the Radiological Control Director for expediting communications between the director and the Radiological Emergency Teams. The responsibilities and objectives of the Radiological Control Communicator are contained in 0PEP-02.6.26, Activation and Operation of the Technical Support Center.

3.3.7 Accident Assessment Team Leader

One of the principal groups housed within the Technical Support Center is the Accident Assessment Team. The specific responsibilities of the Accident Assessment Team are as follows:

A. Analyze mechanical, electrical, instrument and control problems and determine alternate solutions.

B. Analyze thermohydraulic and thermohydrodynamic problems and develop alternate courses of action to resolve them.

C. Analyze and evaluate accident conditions and develop guidance for the Site Emergency Coordinator and Operations personnel on protection of the core.

D. Perform monitoring and evaluations to support Severe Accident Management Guidelines.

The Accident Assessment Team Leader is responsible to the Technical Assessment Director and provides technical and administrative direction to the Accident Assessment Team.

3.4 Operational Support Center

3.4.1 Emergency Repair Director

The Emergency Repair Director is responsible to the Site Emergency Coordinator for the management of efforts to repair and maintain equipment during an emergency, install emergency structures, systems and components, and perform mitigation and cleanup activities during an emergency. These responsibilities include providing technical and administrative direction to any emergency repair team that may be formed during the emergency and to the Operational Support Center Mission Coordinator. Responsibilities of this position are contained in 0PEP-02.6.12, Activation and Operation of the Operational Support Center.

3.4.2 Operational Support Center Mission Coordinator

Upon the decision of the Site Emergency Coordinator to activate the Operational Support Center, an OSC Mission Coordinator will report to the Emergency Repair Director. This individual will direct the activities of the mechanical, electrical, and I&C personnel requested to report to the OSC. His responsibilities and objectives are contained in 0PEP-02.6.12, Activation and Operation of the Operational Support Center. He will coordinate OSC response activities with the E&RC and Operations Coordinators.

3.4.3 Operations Coordinator

Upon the decision of the Site Emergency Coordinator to activate the Operational Support Center, an Operations Coordinator will report to the Emergency Repair Director. This individual will coordinate the activities of operations and Fire Brigade personnel with the OSC Mission Coordinator and E&RC Coordinator. His responsibilities and objectives are contained in 0PEP-02.6.12, Activation and Operation of the Operational Support Center.

3.4.4 Environmental & Radiological Control (E&RC) Coordinator

Upon the decision of the Site Emergency Coordinator to activate the Operational Support Center, an E&RC Coordinator will report to the Emergency Repair Director. This individual will direct the activities of the radiological controls (HPs) and chemistry personnel requested to report to the OSC. He will coordinate OSC response activities with OSC Mission Coordinator and Operations Coordinator. His responsibilities and objectives are contained in 0PEP-02.6.12, Activation and Operation of the Operational Support Center.

3.4.5 Radiological Emergency Teams

The Radiological Emergency Teams consist of members of the Environmental & Radiation Control organization and of other plant or off-site personnel who have received necessary training. Members of the teams who have not completed such training may be assigned to tasks in which they assist a qualified team member under his direct guidance.

The general functions of the various Radiological Emergency Teams include:

1. Determine and report on-site radiological conditions.
2. Determine and report off-site radiological conditions.
3. Establish areas to which access should be controlled for the purpose of minimizing personnel exposures.
4. Issue protective equipment and personnel gear.
5. Personnel decontamination services.
6. Determine and maintain records of personnel exposure.

Radiological emergency teams are formed from the pool of available personnel who assemble in the Operational Support Center. These teams are in addition to the emergency repair teams that are formed from the pool of mechanics, electricians, and instrument technicians to perform repair missions in the plant.

The radiological emergency teams formed are determined by the radiological conditions that require their services. The following teams may be necessary:

1. Plant Monitoring - responsible for conducting in-plant and inside the protected area monitoring to include air sampling, direct radiation monitoring, and smear surveys to determine radiological conditions.

2. Post Accident Sample - responsible for obtaining and analyzing highly radioactive gas and/or liquid samples necessary for source term determination and core damage assessment.

3. Personnel Protection and Decontamination - responsible for monitoring and verifying that personnel and vehicles exiting the protected area and the site are free of radioactive contamination.

3.4.6 Fire Brigade

When conditions require activation of the emergency facilities, the on-shift Fire Brigade is incorporated into the Operational Support Center.

The Fire Brigade consists of a Shift Incident Commander and a minimum of four fire brigade members who provide fire brigade, first aid, search and rescue, chemical/hazardous materials response, and confined space entry services. Fire Brigade members will be the on-shift operators, or other personnel qualified as Fire Brigade members. The Fire Brigade, when incorporated into the OSC, functions as a team under the direction of the Operations Coordinator. The Fire Brigade is staffed on a 24-hour basis.

3.5 Emergency Operations Facility

The Emergency Operations Facility is activated by the On-Call Emergency Response Manager when he is notified by the Site Emergency Coordinator that an Alert or higher emergency condition exists at Brunswick. Guidance for activation and operation of the EOF is contained in 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility.

3.5.1 Emergency Response Manager

The Emergency Response Manager is responsible for providing liaison between the Site Emergency Coordinator and off-site support personnel (Corporate Headquarters, Joint Information Center, state and federal agencies) and marshalling off-site support as required to support the Site Emergency Coordinator. The responsibilities and objectives of this position are contained in 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility.

3.5.2 Administrative and Logistics Manager

The Administrative and Logistics Manager is responsible to the Emergency Response Manager for providing assistance to the Emergency Response Manager and site personnel in administrative, logistics, communications, and personnel support, as requested. The responsibilities and objectives of this position are contained in 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility.

3.5.3 Technical Analysis Manager

The Technical Analysis Manager is responsible to the Emergency Response Manager for coordinating technical information coming from the Technical Support Center, supplying the Emergency Response Manager with an assessment of the emergency, and providing interface for the Emergency Response Manager to consultants, regulatory agencies, architect-engineers, and General Electric. The responsibilities and objectives of this position are contained in 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility.

3.5.4 Radiological Control Manager

The Radiological Control Manager is responsible to the Emergency Response Manager for coordinating off-site radiological and environmental assessment and recommending to the Emergency Response Manager protective actions necessary to protect the public health and safety. The responsibilities and objectives of this position are contained in 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility.

3.5.5 Environmental Monitoring Team Leader

The Environmental Monitoring Team Leader is responsible to the Radiological Control Manager when the EOF is activated, for providing technical and administrative direction to the Environmental Monitoring Team. Two Environmental Monitoring Teams will be made available for deployment. If additional monitoring teams are needed, they may be requested from the Shearon Harris Plant or the H. B. Robinson Plant. The responsibilities and objectives of the environmental monitoring team are contained in 0PEP-02.6.6, Environmental Monitoring Team Leader.

3.5.6 Dose Projection Coordinator

The Dose Projection Coordinator is responsible to the Radiological Control Manager and provides technical and administrative direction to the Dose Projection Team when the EOF is activated. Responsibilities of the Dose Projection Team include radiological dose projections and source term determination, contained in 0PEP-03.4.7, Automation of Off-Site Dose Projection Procedures, and acquisition and distribution of meteorological data for dose assessment and environmental monitoring purposes. The responsibilities and objectives of the Dose Projection Team are contained in 0PEP-02.6.20, Dose Projection Coordinator.

3.5.7 Communications Managers

The Communications Managers report to the Emergency Response Manager. They function as liaison between the off-site organizations and agencies and the on-site emergency organization. Specifically, they relay messages between the ERM in the EOF, Technical Support Center, and the State Emergency Response Team, using the communication equipment discussed in Appendix A of this plan. The responsibilities of this position are contained in 0PEP-02.6.21, Emergency Communicator.

3.5.8 Assistant to the Emergency Response Manager (AERM)

The Assistant to the Emergency Response Manager is responsible to the Emergency Response Manager for coordination of information within the Emergency Operations Facility. Reporting to the Assistant AERM are County EOC Representatives (utility representative) that respond to the New Hanover and Brunswick County EOCs. The responsibilities of this position are contained in 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility.

3.6 Joint Information Center

The Joint Information Center is activated by the Emergency Response Manager when he is notified that a Site Area Emergency or General Emergency condition exists at Brunswick. Activation is discretionary for lesser emergency classifications. (Fig. 3.6-1)

3.6.1 Company Spokesperson

The Company Spokesperson is responsible to the Emergency Response Manager for the coordination of plant information with County, State, and Federal representatives for dissemination to the news media and general public. The responsibilities of this position are contained in 0PEP-02.6.29, Activation and Operation of the Joint Information Center (JIC).

3.6.2 JIC Director

The JIC Director is responsible to the Company Spokesperson as the primary interface with State, County, and Federal Public Information Coordinators and for the preparation and coordination of all news releases. The responsibilities of this position are contained in 0PEP-02.6.29, Activation and Operation of the Joint Information Center (JIC).

3.6.3 Company Technical Spokesperson

The Company Technical Spokesperson is responsible to the JIC Director for the acquisition, coordination, and interpretation of plant technical information disseminated to the news media and general public. The responsibilities of this position are contained in 0PEP-02.6.29, Activation and Operation of the Joint Information Center (JIC).

3.6.4 Administrative Coordinator

Administrative Coordinators are responsible to the JIC Director for initial JIC facility setup, and the coordination of logistical, security, and administrative duties. The responsibilities of this position are contained in 0PEP-02.6.29, Activation and Operation of the Joint Information Center (JIC).

3.6.5 Public Information Director

Public Information Directors are responsible to the JIC Director for monitoring and coordinating the flow of media and general public information in the Joint Information Center. The responsibilities of this position are contained in 0PEP-02.6.29, Activation and Operation of the Joint Information Center (JIC).

3.7 OFFSITE ORGANIZATION ASSISTANCE

Should conditions at the plant degrade to the extent that further on-site assistance is needed, assistance is available from Corporate personnel, contracted services, and certain locally available service groups, as described in the following subsections.

3.7.1 Contracted Services

A number of active outside contracts are maintained in order to ensure continuing access to qualified personnel when and if they are needed to supplement Progress Energy resources. These contracts provide the capability of obtaining, on an expedited basis, additional maintenance support personnel (such as mechanics, electricians, and I&C Technicians), other technical personnel (such as E&RC Technicians), and engineering and consulting services. For example, contracts are maintained with General Electric (the NSSS vendor and architect-engineer for the Brunswick plant).

General Electric will form a Technical Support Team upon request. The team will be composed of personnel with the appropriate technical disciplines, that can be dispatched to the plant site. General Electric will also establish dedicated telephone communications for data transmission until the arrival of the team.

The Institute of Nuclear Power Operations (INPO) serves as a clearinghouse for industry wide support during an emergency. When notified of an emergency situation at a nuclear plant, INPO will provide emergency response as requested. INPO will be able to provide the following emergency support functions:

a. Assistance to the affected utility in locating sources of emergency manpower and equipment.

b. Analysis of the operational aspects of the incident.

c. Dissemination to member utilities of information concerning the incident.

d. Organization of industry experts who could advise on technical matters.

If requested, one or more suitably qualified members of the INPO staff will report to the Emergency Response Manager and will assist in coordinating INPO's response to the emergency.

3.7.2 Local Services Support

The Brunswick Plant is equipped and staffed to cope with many types of emergency situations. However, if a fire or other type of incident occurs that requires outside assistance, such assistance is available as described in the following subsections.

3.7.2.1 Medical Assistance

Dosher Memorial Hospital has medical facilities immediately available for the treatment of contaminated and non-contaminated injured personnel.

New Hanover Regional Medical Center will serve as a backup for Dosher Memorial if necessary.

In addition, medical assistance is available on or off site from physicians in the Southport area, all of whom are on the staff of Dosher Memorial Hospital and who have agreed to provide medical assistance to contaminated patients. (See Appendix E, Medical Treatment and Assistance, for more details.)

3.7.2.2 Ambulance Service

The City of Southport Volunteer Rescue Squad has agreed to respond to all emergency calls from the plant, just as they respond to other calls from the Southport area. A copy of the response agreement with the City of Southport Rescue Squad is included in Appendix B.

3.7.2.3 Fire Assistance

Agencies with fire protection resources in the vicinity of Brunswick are as follows:

Southport Fire Department
Boiling Spring Lakes Fire Department
Yaupon Beach Volunteer Fire Department
Oak Island Emergency Services
Sunny Point Fire Department

The Southport Fire Department is the primary fire protection response agency for the Brunswick Plant and will coordinate assistance activities, if required, of the other above agencies. Copies of agreements with local fire departments are contained in Appendix B. In addition, the North Carolina Fire Protection Law makes provisions for volunteer fire departments to furnish fire protection in rural areas.

3.8 COORDINATION WITH PARTICIPATING GOVERNMENTAL AGENCIES

A summary of each governmental organization having major responsibilities for the planning and response to Brunswick Plant radiological emergencies is described below; comprehensive summary tables of emergency response organizations are included in Appendix C; and a detailed description of the authority, responsibilities, and duties of each organization is presented in their respective emergency plans. Each of these organizations having response duties is capable of providing such on a 24-hour-per-day basis.

3.8.1 State of North Carolina

3.8.1.1 Governor's Office

The Governor has the authority to direct and control the State Emergency Management Program. During a declared State of Disaster, he has the authority to utilize all available state resources reasonably necessary to cope with emergencies. His representatives coordinate as necessary with Progress Energy, the Governor of South Carolina, and with local government officials.

3.8.1.2 Department of Crime Control and Public Safety

The Department of Crime Control and Public Safety functions as the State of North Carolina Emergency Planning Coordinator. In that capacity the Department has overall management responsibility for North Carolina's radiological emergency response planning, development, and updating of North Carolina's emergency response plan, and coordination with Progress Energy. The Department coordinates emergency response activities for the State of North Carolina and other government response agencies.

3.8.1.3 Department of Environmental Health and Natural Resources, Division of Radiation Protection

The Radiation Protection Division, performs radiological field monitoring and laboratory analysis of field samples. This section is responsible for dose assessments and projections and personnel radiological monitoring outside the Brunswick site, and other functions as described in the State Emergency Plan.

3.8.2 Brunswick County

3.8.2.1 Emergency Management Agency

The Brunswick County Emergency Management Agency has overall responsibility for Brunswick County's radiological emergency response planning, development, and updating of Brunswick County's emergency response plan, and coordination between the county and Progress Energy and other local government response agencies. It functions as the lead county agency for radiological monitoring and decontamination activities as directed by the State of North Carolina's Division of Radiation Protection.

3.8.2.2 Brunswick County Sheriff's Department

The Sheriff's Department emergency response functions are:

A. Coordinate all local law enforcement and traffic control.

B. Operate the county warning point on a 24-hour basis.

C. Provide immediate assistance to facility management and local authorities during initial onset of the emergency.

D. Provide traffic control in support of evacuation.

E. Establish road blocks, re-route traffic around contaminated areas and report traffic problems to the County Emergency Operations Center.

F. Provide traffic control in the vicinity of shelter areas.

G. Provide assistance to municipal law enforcement agencies in warning and evacuating persons in designated zones.

H. Provide security for county property.

3.8.3 New Hanover County

3.8.3.1 Emergency Management Agency

The New Hanover County Emergency Management Agency has overall responsibility for New Hanover County's radiological emergency response planning, development, and updating of New Hanover County's emergency response plan, and coordination between the County, Progress Energy, and other local government response agencies. It functions as the lead county radiological response agency and provides any required radiological monitoring and decontamination activities as directed by the State of North Carolina's Division of Radiation Protection.

3.8.3.2 New Hanover County Sheriff's Department

The Sheriff's Department emergency response functions are:

A. Coordinate all local law enforcement and traffic control.

B. Operate the county warning point on a 24-hour basis.

C. Provide immediate assistance to facility management and local authorities during initial onset of the emergency.

D. Provide traffic control in support of evacuation.

E. Establish road blocks, re-route traffic around contaminated areas, and report traffic problems to the County Emergency Operations Center.

F. Provide traffic control in the vicinity of shelter areas.

G. Provide assistance to municipal law enforcement agencies in warning and evacuating persons in designated zones.

H. Provide security for county property.

3.8.4 Federal Agencies

3.8.4.1 Department of Energy, Savannah River Operations Office

The Savannah River Operations Office coordinates, under the Interagency Radiological Assistance Plan (IRAP), federal resources as required to: minimize accidental radiation exposure; minimize the spread of radioactive materials into the environment; and carry out countermeasures to control and eliminate radiation hazards. Upon request of the State of North Carolina, Department of Environmental Health and Natural Resources, Division of Radiation Protection, or the Nuclear Regulatory Commission (NRC); the Department of Energy will: provide equipment, supplies, and personnel to evaluate radiological hazards and to minimize radiation exposures; assist in carrying out emergency response operations and implementing protective actions; and provide an aerial radiological measuring system for mapping radioactive plumes. The Site Emergency Coordinator or Emergency Response Manager after activation of the Emergency Operations Facility may request this assistance via the NRC or the State. Resources available in the area to facilitate federal assistance include the New Hanover International Airport, located approximately twenty miles from the Brunswick Plant near Wilmington, North Carolina, which has two runways capable of supporting large commercial aircraft. Also located at the New Hanover International Airport is a National Guard Armory. This area could be used as a Federal Command Post meeting the requirements of IRAP.

3.8.4.2 Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency coordinates, through the Atlanta, Georgia Regional IV Office, federal response as required to supplement that provided by IRAP. A representative from FEMA Region IV will be present at the SERT to coordinate any federal response requested by the state.

3.8.4.3 Nuclear Regulatory Commission (NRC)

The Nuclear Regulatory Commission provides resident inspectors at Brunswick. At the request of Progress Energy, NRC provides additional technical advice, technical assistance, and personnel during and following a radiological emergency. The Director of Regulatory Operations will be notified of radiation incidents in accordance with 10CFR20.2202 and will conduct appropriate investigative activities.

3.8.4.4 U. S. Coast Guard (USCG)

The Coast Guard controls access of navigable waterways in the vicinity of the Brunswick Plant and provides public warning and notification as described in the State Emergency Plan.

3.8.4.5 Meteorological Service

Meteorological Services are under contract with Progress Energy to provide meteorological services during day to day and/or emergency operations.

3.8.4.6 Weather Service

The National Weather Service in Wilmington, North Carolina will provide meteorological information during emergency situations, if required. Data available will include existing and forecasted surface wind directions, wind speed with azimuth variability, and ambient surface air temperature.

3.8.5 Agreements

Appendix B presents copies of letters of agreement with agencies that would not normally be available for assistance through existing state or federal plans but will make certain services available.

3.9 NOTIFICATION AND ACTIVATION

Notification and activation of the on-site and off-site emergency response organizations is dependent upon the emergency classification and is listed in Table 3.5-1. Details of notification responsibilities, communications systems utilized to make the notifications, information required to be transferred to off-site agencies, and notification verification techniques are specifically described in the Plant Emergency Procedures (PEPs) and Appendix A of this Plan. Additional individuals and organizations who might be required to activate are contained in EPL-001.

Any time that an emergency is reclassified, the initial notification scheme will apply.

The State of North Carolina and the Counties of Brunswick and New Hanover are responsible for the process of notification of the public. The initial instructions to the public will consist of preestablished emergency messages which will be tailored to reflect whether the event is a Site Area Emergency or General Emergency classification. The following information is typical of that which would be provided in the initial message:

1. Identification of the agency issuing the information.

2. A statement that an emergency condition exists at the Brunswick Nuclear Plant.

3. Brief description of the type of emergency and the nature of the hazard.

4. Identification of the communities or geographical areas affected by the emergency.

5. Recommendations with regard to specific protective measures to be taken by residents of the affected areas. .

6. A statement concerning how the public will receive further. emergency information.

Prewritten emergency messages to be used for public notification are contained in the procedures of the State of North Carolina, and Brunswick and New Hanover Counties.

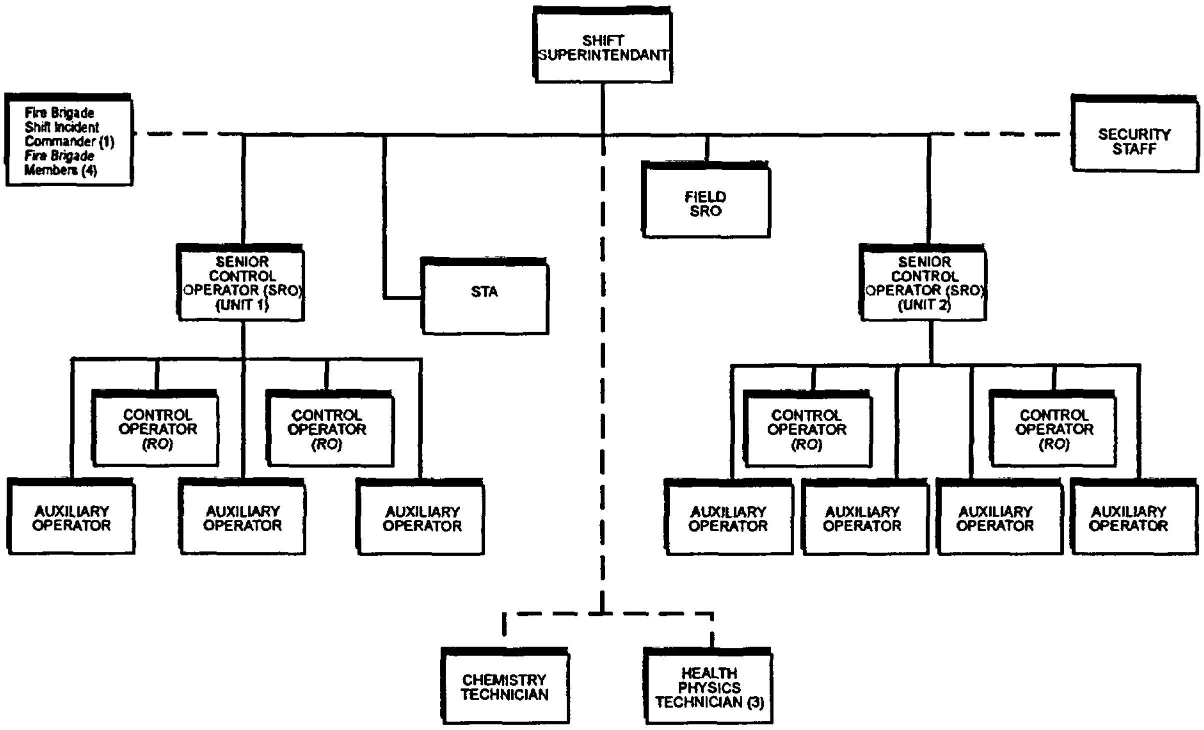


Figure 3.1-1 Brunswick Shift Organization

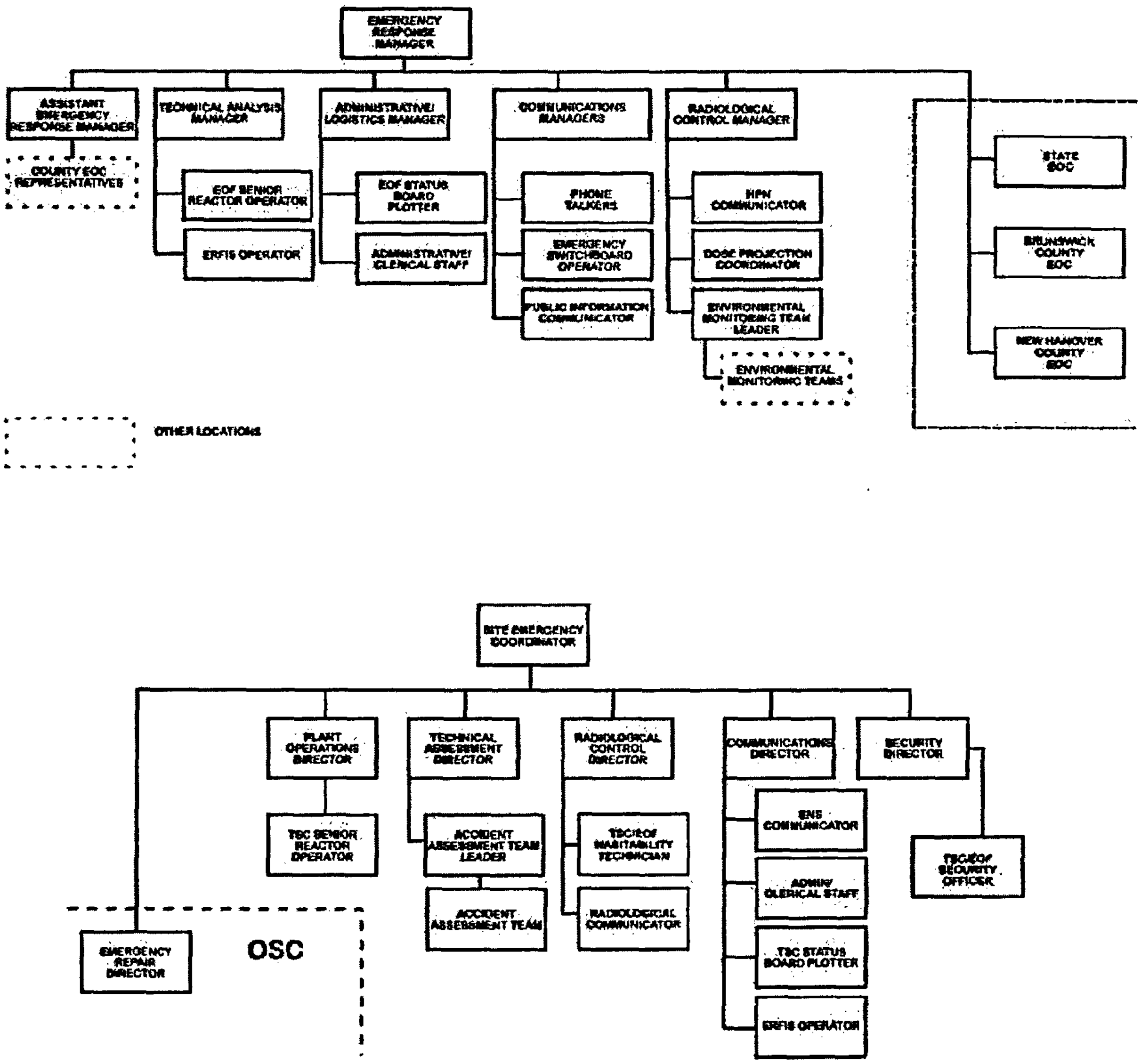
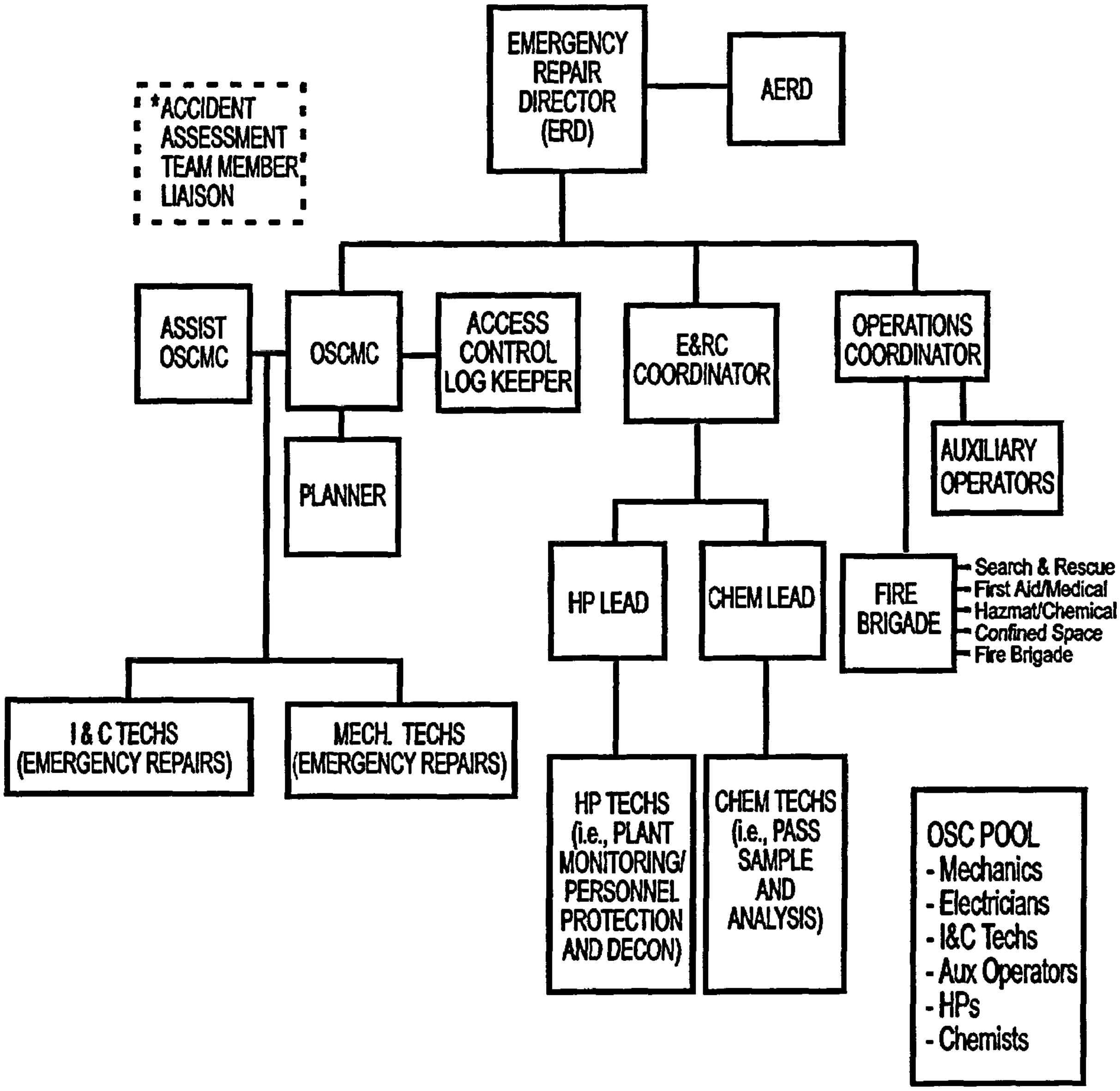


Figure 3.2-1 Brunswick Emergency Organization



*** REPORTS TO ACCIDENT ASSESSMENT TEAM LEADER IN TSC.**

Figure 3.4-1 Operational Support Center (OSC)

BRUNSWICK

TABLE 3.5-1

NOTIFICATION AND ACTIVATION OF PRINCIPAL EMERGENCY RESPONSE ORGANIZATIONS

Agency	Unusual Event	Alert	Site Emergency	General Emergency
On site: Progress Energy Plant Operators	Activate	Activate	Activate	Activate
Radiological Emergency Teams	(a),(c)	(a)	Activate	Activate
Technical Support Center	(a),(c)	Activate	Activate	Activate
Operational Support Center	(a),(c)	Activate	Activate	Activate
Emergency Operations Facility	(a),(c)	Activate	Activate	Activate
Corporate Headquarters	Notify(a)	Notify(a)	Activate	Activate
Fire Brigade	(a)	(a)	(a)	(a)
Off site:				
Joint Information Center	(a),(c)	(a),(c)	Activate	Activate
State of North Carolina	Notify	Notify(a)	Activate	Activate
Brunswick County	Notify	Notify(a)	Activate	Activate
New Hanover County	Notify	Notify(a)	Activate	Activate
USNRC	Notify	Notify	Activate	Activate
American Nuclear Insurers		Notify	Notify(a)	Activate
U. S. Coast Guard	(c)	(c)	Notify(a)	Activate
Dosher Memorial Hospital	(b)	(b)	(b)	(b)
Southport Volunteer Fire Department	(b)	(b)	(b)	(b)
Southport Volunteer Rescue Squad	(b)	(b)	(b)	(b)
General Electric	(c)	Notify(a)	Activate	Activate
INPO	(c)	Notify	Notify	Notify

(a)Mobilize, if deemed necessary.
(b)Request assistance, if required.
(c)Notify if deemed necessary.

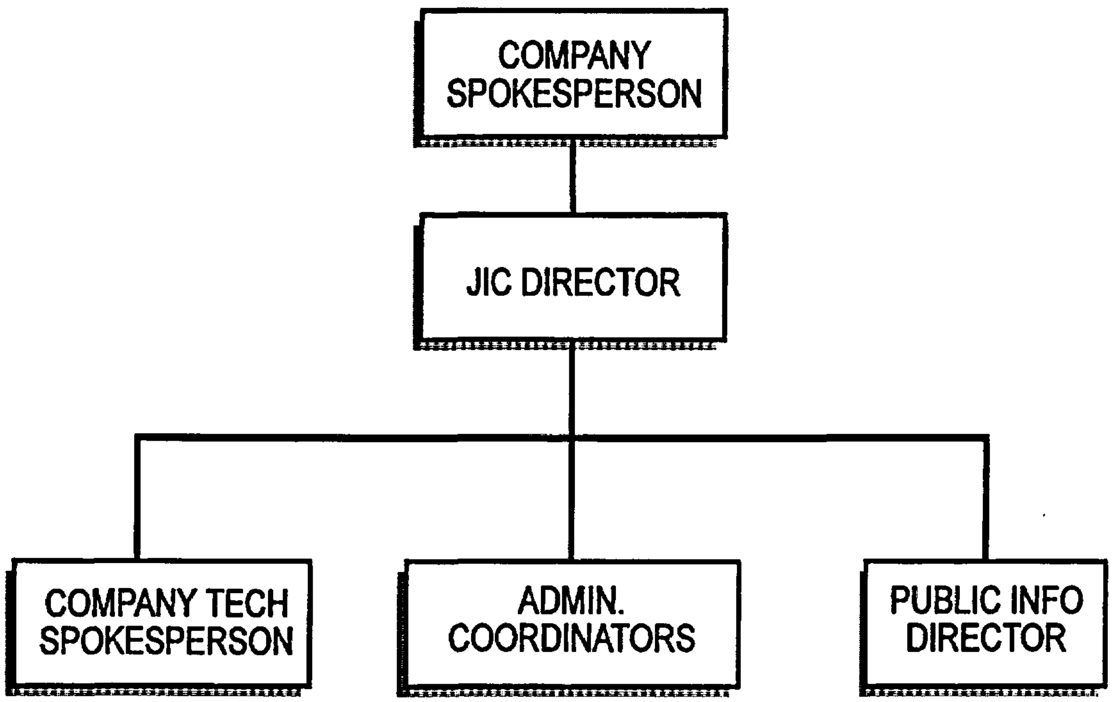


Figure 3.6-1 Joint Information Center (JIC)

4.0 EMERGENCY MEASURES

This section identifies the measures to be taken for each class of emergency described in Section 2. The measures presented in this section are used as the basis for the detailed Plant Emergency Procedures which define the specific actions to be taken for each emergency class. Emergency measures begin with the recognition and declaration of an emergency class, notification of the applicable agencies for that emergency class, and mobilization of the appropriate portions of the emergency organization. Subsequent measures include damage assessment, corrective actions, protective actions, and aid to affected personnel. Recovery activities are discussed in Section 7.

4.1 ACTIVATION OF EMERGENCY ORGANIZATIONS

4.1.1 General

The Plant Operating Manual contains Emergency Operating Procedures (EOPs). These are intended to aid the plant operators in responding to an accident. The EOPs identify actions which should automatically occur to safely terminate the accident and manual actions which should be taken to verify that the automatic actions have produced the desired results. The EOPs also provide, for the operator's use, guidelines which alert the operators to conditions where inadequate cooling of the core exists or where radioactivity releases may occur. Accordingly, if it should appear that any of the Emergency Action Levels are exceeded, as described in 0PEP-02.1, Initial Emergency Actions, the operators are instructed to activate the Emergency Plan.

The Shift Superintendent activates the Plan, assumes the Site Emergency Coordinator's responsibilities, initially classifies the emergency, and ensures that the required notifications are made. The Site Emergency Coordinator will activate portions of, or the entire emergency organization, as warranted for the emergency situation. A more detailed discussion of the methodology that is used in activating the emergency organizations during each class of emergency is provided below and in the Plant Emergency Procedures. Additional detail of the communications networks to be used for notification requirements, for information reporting, and for decision-making with respect to taking protective action on site and for the general public is contained in Appendix A of this plan and 0PEP-03.1.3, Use of Communication Equipment.

4.1.2 Unusual Event

The Shift Superintendent, when informed of conditions that meet emergencies that are classified as an Unusual Event, confirms that an Emergency Action Level has been exceeded and implements 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency. He then is responsible for assuming the role of the Site Emergency Coordinator and for notifying and activating those portions of the emergency organization as appropriate to the emergency class which then exists. The Site Emergency Coordinator can augment the on-site shift personnel by activating additional emergency personnel described in Section 3. Typical of the personnel that may be notified are E&RC, the Fire Brigade, and the Security Force.

4.1.3 Alert

Section 2 and 0PEP-02.1, Initial Emergency Actions, describe the types of emergencies that are classified as an Alert. Since the conditions in this emergency class indicate an actual or potential <u>substantial</u> degradation of the level of safety of the plant and has the potential for limited releases of radioactive material to the environment, off-site groups will be notified to standby so that if the emergency level is escalated, the essential off-site emergency organizational groups can be notified and readily mobilized to augment the on-site emergency groups.

Upon declaration of an Alert emergency classification the Shift Superintendent assumes the role of the Site Emergency Coordinator until relieved by a designated, qualified emergency response organization member. The transfer of Site Emergency Coordinator responsibilities from the Shift Superintendent occurs simultaneously with the activation of the Technical Support Center (TSC).

The Site Emergency Coordinator implements 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency, and notifies the appropriate individuals or groups.

The Site Emergency Coordinator initiates the activation of the Technical Support Center, Operational Support Center, and the Emergency Operations Facility (EOF). The radiological emergency teams will be activated, as appropriate.

The appropriate county and state emergency group leaders will be requested to remain in a readiness condition in case additional augmentation of support personnel is needed and alerting the population-at-risk is warranted.

A decision to go beyond the initial response associated with an Alert class would be based on further degradation of plant parameters, operational experience, or radiation releases that are projected to escalate beyond the Emergency Action Levels for an Alert.

4.1.4 Site Area Emergency

Section 2 and 0PEP-02.1, Initial Emergency Actions, describe the types of emergencies classified as a Site Area Emergency. The Site Emergency Coordinator, when classifying the emergency, takes appropriate predefined steps to correct the situation as described in 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency.

If not done earlier, the Shift Superintendent assumes the role of the Site Emergency Coordinator (SEC) until formally relieved. The SEC activates the necessary emergency organizations and directs that the essential emergency personnel be notified.

If they have not been previously requested to do so, the off-site groups will be mobilized as soon as possible; the Technical Support Center, Operational Support Center, and the Emergency Operations Facility will be activated. Radiation monitoring teams may be augmented to permit an expanded on-site and near site monitoring program.

The Joint Information Center will be activated for the purpose of providing information to the public.

If the plant parameters indicate possible further degradation of plant safety or projected radiation levels which exceed the recommended values, the emergency will be escalated to the General Emergency level.

4.1.5 General Emergency

Section 2 and 0PEP-02.1, Initial Emergency Actions, describe the types of emergencies classified as a General Emergency. The Site Emergency Coordinator upon classifying the situation as a General Emergency takes appropriate, predefined steps to respond to and correct the situation as described 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency. This includes arranging for personnel to be available, both on site and off site, to perform actions up to and including evacuation of the affected sectors of the 10-mile EPZ.

If not done earlier, the Shift Superintendent assumes the role of the Site Emergency Coordinator (SEC) until formally relieved. The SEC activates the necessary emergency organizations and directs that the essential emergency personnel be notified.

The activation and notification process should have begun well before a General Emergency is declared. Recommendations will be made for sheltering and/or evacuation in accordance with the guidelines in 0PEP-02.6.28, Off-Site Protective Action Recommendations.

4.2 ACCIDENT ASSESSMENT ACTIONS

4.2.1 General

Effective coordination and direction of all elements of the emergency organization require continuing accident assessment throughout an emergency situation. The process of accident assessment involves several different types of activities, in-plant and off-site, depending on the nature and severity of the emergency.

The magnitude of releases of radioactive material can be determined using effluent and process monitors, meteorological data and other sources of information. Additionally, an independent confirmation of the magnitude of the release can be obtained based on the measured dose rates in the environment. Given these measured releases or environmental levels and estimates of the amount of dispersion between the plant and the various points of interest, projected doses can be estimated for other locations. These doses can then be compared to Protective Action Guides. The various steps in this process are discussed in the following sections and in the Plant Emergency Procedures. In the absence of measurable off-site dose rates, protective action recommendations will be made based on the guidelines 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency.

4.2.2 Source Term Assessment

Source terms for assessment of off-site dose consequences to the public can be determined by using effluent and radiation monitor readings, evaluating plant conditions against predetermined scenarios, using analysis results of plant effluent samples, and by manually estimating curie inventories. A thorough discussion of source term development is provided in Appendix F.

4.2.2.1 Effluent and Radiation Readings

The most direct indication of a radiological emergency is a high reading in the effluent radiation monitors. The radiation monitoring system monitors the airborne gaseous and particulate activity released from the Reactor Building and Turbine Building. Additional channels of the radiation monitoring system also monitor the gaseous activity in the air ejectors, primary containment (drywell atmosphere) ventilation system, and main steam line monitors. These channels indicate, record, and alarm in the main control room. The radiation monitoring system gives early warning of a plant malfunction and warns plant personnel of increasing radiation activity which might result in a radiation health hazard. (See 0PEP-03.6.3 for procedures on source term assessments and estimates of core damage.)

These monitors are also the primary means of determining that an emergency exists for accidents involving spills or leaks of contaminated liquids or gases from systems housing radioactive materials. Such leaks could lead to a release to the environment. In such instances, the following types of emergency actions would take place:

1. The Shift Superintendent on duty would be notified.

2. Personnel from the affected plant area would be evacuated, if required.

3. Access to the plant area involved would be restricted.

4. All plant personnel directly involved would be monitored for contamination.

5. A determination would be made of the potential for an off-site release.

6. The Plant Emergency Procedures would be activated if an emergency is declared.

4.2.2.2 Potential Consequences Based on In-Plant Conditions

The source term can be estimated by evaluating the plant condition against a number of preselected scenarios that best describes the effectiveness of containment, cleanup systems, subcooled, or saturated conditions in the torus, and other relevant parameters. A more thorough discussion of the determination of source terms from plant conditions is described in Appendix F.

4.2.2.3 Post Accident Sampling and Analysis of Reactor and Containment

To aid in the assessment of core damage, area-type monitors utilizing ion chamber detectors are available to monitor radiation levels in the drywell. These monitors have a range of up to 10^7 Rem/hr. The range of monitoring equipment in various locations of the plant has also been extended (e.g., high range noble gas vent monitor and improved procedures for iodine analyses). This information can be used, together with the analyses of primary coolant system contamination levels, to develop an assessment of the types and quantities of various materials that have been released.

Additionally, capabilities have been provided to permit sampling for chemical and radioanalysis under a wide range of accident conditions. Samples can be taken from effluent streams such as the plant stack to determine total release quantity and radionuclide mix, or they can be taken from the RCS, drywell, and torus to determine radionuclide mix. The collection and analysis of samples can be performed without incurring radiation exposures to individuals in excess of 10CFR20.1201 limits.

The procedures for obtaining samples of gases and liquids during normal operation (such as a sample of primary coolant) can also be safely used during a wide spectrum of accident conditions. However, there are situations involving gross damage to the core where access to the sampling stations and handling of samples may be limited due to high radiation levels. Procedures have been developed and equipment has been installed at the sample panels to minimize the time required to obtain samples and to reduce the radiation levels during transport and analysis of samples. Beyond these measures, post accident sampling stations are located in the breezeway on the 20-foot level. This permits the collection of samples even if access to the Reactor Building is lost. This station can be used to safely withdraw samples of reactor coolant from the recirculation instrument racks in parallel with the jet pump flow indicator and to withdraw samples of water in the torus.

4.2.3 Dose Projection and Meteorological Systems

Once the source term is estimated, exposures to on-site and off-site individuals can be estimated as described in 0PEP-03.4.7, Automation of Off-Site Dose Projection Procedures. The technical basis for the methodology for performing dose projection is described in Appendix F. Prior to receipt of information from the emergency radiation monitoring teams, exposure rates at various locations on site and off site will be estimated from the airborne concentrations of radioactive material as calculated from plant radiation monitors and the atmospheric dispersion characteristics.

Meteorological measurements, specifically the change in temperature with height and wind velocity, are used to determine the atmospheric dispersion conditions. Normally, the plant computer will provide a readout of the stability condition, but alternate methods are available. Rapid evaluation of potential radiation levels of any downwind area can be made through the use of calculated dispersion factors and the calculated release rate of airborne radioactive material from the plant.

The Brunswick Nuclear Plant has an on-site meteorological station with a backup source of additional meteorological data to provide sufficient information for utilization in a dose assessment capability. This system is further described in Section 5.7.2.

Currently, the BNP staff has an automated dose projection capability as described in 0PEP-03.4.7, Automation of Dose Projection Procedures. By entering critical plant data and meteorological information obtained from the on-site meteorological station, dose projections can be made for various locations using the dose assessment program. This function has been designed and implemented to allow for the rapid determination of centerline doses for immediate use by plant personnel.

Additionally, contract meteorologists are to be contacted by plant personnel.

Meteorological data display is available for remote interrogation as part of the Emergency Response Facility Information System (ERFIS). This satisfies the NUREG 0654, Rev. 1 criteria for meteorological evaluation and remote interrogation.

4.2.4 Emergency Environmental Monitoring

The Site Emergency Coordinator is responsible for quickly evaluating meteorological conditions existing at the time of the incident and, where releases are or soon will be occurring, for dispatching monitoring teams to specified, predetermined downwind locations. The prime objective of the initial emergency off-site monitoring is to confirm or modify the initial projections of the consequences of any release of radioactive material into the environment.

The Environmental Monitoring Teams collect samples and survey data and transmit information to and/or receive instructions from the Radiological Control Manager of the EOF staff (or Radiological Control Director, if the EOF is not activated).

Calculational aids, site maps, and actual radiation survey data collected by off-site survey teams define affected areas and assess the extent and significance of the release. Information is required for decision making with as little delay as possible; therefore, the initial environmental surveys involve simple-to-perform measurements so that the dose assessments based on plant parameters can be quickly confirmed or modified. Subsequent environmental monitoring efforts will be aimed at further defining the off-site consequences including estimates of total population exposure and instituting an expanded program to enable prompt assessments of any subsequent releases from the plant. Progress Energy Environmental Monitoring Teams will coordinate expanded environmental monitoring efforts to assist the agencies identified in Section 3.8. Field monitoring equipment will have at least the capability to detect and measure radioiodine in the vicinity of the plant site as low as 5×10^{-8} $\mu Ci/cm^3$. The collected air sample can easily be measured by hand held survey meters, a simple test that can serve as an initial check of projected releases based on plant data and can confirm that significant quantities of elemental iodine have been released (the chemical form that would pose a health hazard). More detailed measurements (e.g., Sodium Iodide scintillation counters) can be quickly brought into service to provide the longer term higher capabilities to detect and measure very low levels of contamination in the environment, as would be planned for subsequent radiation monitoring efforts.

At least two environmental monitoring teams will initially be activated from the plant staff upon activation of the EOF by the Emergency Response Manager, if conditions warrant their deployment. Additional teams from the Harris Nuclear Plant and the Robinson Nuclear Plant may be requested, if needed.

4.2.5 Emergency Response Data System (ERDS)

The Emergency Response Data System will supply the NRC with selected ERFIS data points on a near real time basis. This function will be activated by the Control Room staff within an hour of the declaration of an Alert. The selected data points are transmitted via modem to the NRC at approximately 1-minute intervals. If the primary ERFIS system fails (failover) the backup ERFIS system will re-establish the ERDS link automatically through the communication port for ERDS.

4.3 CORRECTIVE ACTIONS

Corrective actions that may be taken to mitigate the circumstances of various levels and types of emergencies identified in this plan are given in the Plant Operating Manual. Generally, corrective actions include any actions that are taken to repair damaged equipment, to install emergency structures, systems, and components, or to reduce the releases of radioactivity.

In order to maintain proficiency in implementing the various procedures and plans, there are training and retraining programs which in some cases are augmented by periodic drills and exercises. A description of this specialized training is given in Section 6.1.1.

4.4 PROTECTIVE ACTIONS

Protective actions are defined for each emergency class. Protective actions must take into consideration the potential risks of implementing such measures versus the reduction of the radiological risk achieved by their use. Analyses of the spectrum of emergencies show that only those in the General Emergency class are expected to have consequences in excess of one Rem whole body (TEDE).

Protective action recommendation guidelines for the general public are described in 0PEP-02.6.28, Off-Site Protective Action Recommendations. Protective actions planned for on-site personnel are described in Section 4.4.2. Protective actions for the off-site population-at-risk are the responsibility of state and local agencies; however, representative actions at various dose levels are described in Section 4.4.7. The evaluation of Protective Action Guidelines for the intermediate phase and for ingestion pathways are the responsibility of the state.

4.4.1 Protective Action - Off Site

Notification of off-site agencies will take place when EALs are exceeded (see Section 3.9). Any incident that is projected to result in radiation doses to the general public in excess of the Protective Action Guidelines listed in 0PEP-02.6.28, Off-Site Protective Action Recommendations, requires the Site Emergency Coordinator to declare a General Emergency. The Emergency Response Manager will recommend to the state and counties protective measures for the public.

4.4.2 Protective Action - On Site

4.4.2.1 Warning and Notification

The on-site PA system and appropriate alarms will be used to alert/warn and notify on-site personnel of an emergency and necessary protective actions as described in 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, and General Emergency. In addition to the alarms, PEPs and security instructions provide guidance for on-site warning and notification. Such warning and notification will include persons at the Visitors Center and the recreation area. Outside the plant protected area, warning will be accomplished as described in Section 4.4.6 for the public.

4.4.2.2 Evacuation & Personnel Accountability

For emergencies requiring protective actions in accordance with 0PEP-03.8.2, Personnel Accountability and Evacuation, personnel will proceed by the safest, most direct route to the designated assembly locations or as directed by the Site Emergency Coordinator.

a. Shift operating personnel will assemble in the Control Room.

b. All personnel not specifically involved in responding to the emergency (non-essential) will assemble as directed.

c. All visitors will report to the Security Office at the protected area central access control point.

A personnel accountability check will be carried out in accordance with 0PEP-03.8.2, Personnel Accountability and Evacuation, and all personnel will return dosimeters and be checked for radioactive contamination. Contaminated and/or injured individuals will be directed to an area set aside for decontamination and/or medical aid as described in 0PEP-03.9.2, First Aid and Medical Care, and 0PEP-03.9.3, Transport of Contaminated Injured Personnel.

Search for missing persons and rescue will be performed as described in 0PEP-03.9.6, Search and Rescue.

On-site personnel will evacuate the area when directed using transportation that was employed to arrive at the site. Personnel without transportation will be identified during the assembly phase and provided transportation.

The secondary access road and the main plant access road will be used to depart from the site as advised, and evacuation from the 10-mile EPZ will be by way of evacuation routes identified in Figures 1.1-1, 1.1-2, and 4.4-1.

4.4.3 Control of Personnel Radiation Exposures

Although an emergency situation transcends the normal requirements for limiting exposures to ionizing radiation, guideline levels are established in 0PEP-03.7.7, Onsite Radiological Controls, for exposures that may be acceptable in emergencies. The maximum whole body (TEDE) dose received by any worker should not exceed established regulatory limits. Every reasonable effort will be used to ensure that an emergency is handled in such a manner that no worker exceeds these limits.

The administration of radioprotective drugs such as potassium iodide (KI) to Progress Energy personnel may also be useful in mitigating the consequences of inhalation of radioactive materials such as radioiodines during an emergency.

Procedures for the administration of radioprotective drugs to Progress Energy and vendor employees are described in 0PEP-03.7.6, Emergency Exposure Controls.

Decision making is based on conditions at the time of an emergency and should always consider the probable effects of an exposure prior to allowing any individual to be exposed to radiation levels exceeding the established occupational limits. The probable high radiation exposure effects are:

1. Up to 50 Rem EDE in 1 day - no physiological changes are likely to be observed.

2. 50 to 100 Rem EDE - no impairment likely but some physiological changes, including possible temporary blood changes, may occur. Medical observations would be required after exposure.

3. 100 to 300 Rem EDE - some physical impairment possible. Some lethal exposures possible.

The following subsections describe the criteria to be considered for life-saving and facility protection actions.

4.4.3.1 Exposure Control Under Emergency Conditions

Dose limit guidelines for workers in an emergency are taken from EPA 400-R-92-001, Manual of Protective Actions and Protective Action Guidelines for Nuclear Incidents, U. S. Environmental Protection Agency, May 1992. Much of the discussion in this section is taken in whole from that document.

In emergency situations, workers may receive exposure under a variety of circumstances in order to assure protection of others and of valuable property. These exposures will be justified if the maximum risks or costs to others that are avoided by their actions outweigh the risks to which the workers are subjected.

The Emergency Worker Dose Limit Guidelines are as follows:

Dose Limit (Rem TEDE)[1]	Activity	Condition
5	All	
10	Protecting valuable property	Lower dose not practicable
25	Lifesaving or protection of large populations	Lower dose not practicable
>25	Lifesaving or protection of large populations	Only on a voluntary basis to persons fully aware of the risks involved

Routine dose limits shall not be extended to emergency dose limits for declared pregnant individuals. As in the case of normal occupational exposure, doses received under emergency conditions should be maintained as low as reasonably achievable.

[1]Doses to the lens of the eye should be limited to three times the stated TEDE value and doses to any other organ (including skin and body extremities) should be limited to ten times the stated TEDE value.

In the context of these guidelines, exposure of workers that is incurred for the protection of large populations may be considered justified for situations in which the collective dose avoided by the emergency operation is significantly larger than that incurred by the workers involved.

Persons undertaking any emergency operation in which the dose will exceed 25 Rem TEDE should do so only on a voluntary basis and with full awareness of the risks involved, including the numerical levels of dose at which acute effects of radiation will be incurred and numerical estimates of the risk of delayed effect.

4.4.3.2 Exposures During Repair/Reentry Efforts

Each emergency worker entering a high radiation area shall wear dosimetry capable of measuring the expected exposure to be received.

Emergency teams that must enter areas where they might be expected to receive higher than normal doses will be fully briefed regarding their duties and actions and what they are to do while in the area. They will also be fully briefed as to expected dose rates, stay time, and other hazards. All such entries will include one Health Physics Technician, or other person adequately trained in health physics. All team members will use protective devices as specified by the Radiological Control Director. The team members will be instructed not to deviate from the planned route unless required by unanticipated conditions, such as rescue or performance of an operation that would minimize the emergency condition. If the monitored dose rates or stay times encountered during the entry exceed the limits set for the operation, the team will communicate with the OSC Mission Coordinator or will return to the area from where they were dispatched.

Once their operation has been completed, the team personnel will follow established monitoring and personnel decontamination procedures as specified by the Radiological Control Director.

4.4.4 Radioactive Contamination

4.4.4.1 On-Site Personnel

Radiation safety controls are established to contain the spread of loose surface radioactive contamination. Personnel leaving the contaminated areas are monitored to ensure that they or their clothing are not radioactively contaminated. Additionally, in the event of a site evacuation, no personnel will be allowed to leave the plant site until they have been checked for contamination. In addition to the decontamination area of the Service Building, additional areas can be set up inside the entrance to the TSC/EOF Building.

Contaminated clothing or personal articles will be decontaminated. Drinking water and food supplies will be monitored and, during an emergency, permitted only in specified clean areas. Contamination on personnel will be removed in accordance with established E&RC procedures. If normal decontamination procedures do not reduce contamination to acceptable levels, the case will be referred to a competent medical authority.

4.4.4.2 Equipment and Vehicles

Equipment and tools will be released for use outside of the contaminated areas only if loose surface radioactive contamination is within acceptable limits. All tools and items of equipment must be checked for contamination before being taken from a known contaminated area. If the item is found to be contaminated and decontamination is not practical, the item must remain in that area. In the event of a site evacuation, vehicles will be surveyed for contamination before they are allowed to leave the plant site. Contaminated vehicles will be decontaminated before being released. If the Low Level Radwaste Warehouse is not a suitable decontamination site due to radiological concerns, vehicles will be directed to an alternate area for decontamination. Brunswick County Emergency Management may provide assistance in this area.

4.4.5 Treatment of Injured and Contaminated Persons

Personnel showers and chemical decontamination agents are available on site and, except in cases of life-threatening/serious injury, established decontamination procedures will be employed on site prior to medical treatment. Decontamination showers and supplies are provided in the Service Building. Shower and sink drains in the Service Building are routed to the miscellaneous waste processing system where the liquid is processed and monitored prior to discharge.

Arrangements and facilities for medical treatment of injured plant personnel are described in detail in Appendix E - Medical Treatment and Assistance and in 0PEP-03.9.2, First Aid and Medical Care. Depending on the nature and severity of injury, injured personnel may be treated in-plant by individuals trained in first aid, treated in-plant by a physician, or transported to the hospital for treatment (see 0PEP-03.9.3, Transport of Contaminated Injured Personnel).

In cases of severe injury, lifesaving first aid or medical treatment will take precedence over personnel decontamination. In general, the order of medical treatment will be:

1. Care of severe physical injuries.

2. Personnel decontamination.

3. First aid to other injuries.

4. Definitive medical treatment and subsequent therapy as required.

Definitive medical treatment, therapy, and evaluation may include radioprotective drugs, urinary bio-assays or whole body counts on persons suspected of inhaling or ingesting a significant amount of radioactive material or may include surveillance and therapy for persons receiving a large whole body dose.

4.4.6 Public Warning and Notification

In the event of an emergency, the plant will notify designated emergency officials in Brunswick and New Hanover counties as well as state and federal officials in accordance with 0PEP-02.6.21, Emergency Communicator.

During the ALERT phase of an emergency, the appropriate county and state emergency group leaders will be requested to remain in a readiness condition to alert the population at risk if needed. The plant will recommend protective actions for the public upon declaration of a General Emergency.

Public warning when deemed necessary will be accomplished as described in the North Carolina Emergency Response Plan In Support of the BNP. Warning will be given by such methods as sirens supplemented by radio, television, sound trucks, bullhorns, and knocking on doors. The Coast Guard will be used in notifying people along the coast and other large bodies of water where appropriate and necessary.

Sirens mounted on utility poles have been installed by Progress Energy at 36 locations within a 10-mile radius of the Brunswick Nuclear Power Plant. Since the average ambient noise level throughout the EPZ is about 49dBA, the siren system is planned to provide a 59dBA minimum signal. The warning signal will be a 3-to-5-minute steady tone on the sirens.

Sirens will not be sited in the Sunny Point Army Terminal. Brunswick County will notify the terminal which will alert its personnel using on-site warning methods.

Sirens will not be sited in areas of no population. Large areas of Brunswick County consist of swamps and forests with no population. These areas include such tracks as the Orton Plantation, the western section of Boiling Springs Lakes, and some areas south of Route 211. These tracts are often owned by a few local individuals or lumber companies. Based on land use history, they show little promise of development. However, the warning system will be reviewed annually and upgraded when conditions warrant.

Activation of the sirens will be accomplished from the Brunswick and New Hanover Counties Emergency Operation Centers. The sirens in each county are independently controlled, but may be activated by Progress Energy with permission from the counties. A feedback system immediately alerts Progress Energy and both counties of any siren failure. The U.S. Coast Guard will perform the warning of people on bodies of water under their jurisdiction.

The population at risk in the 10-mile Emergency Planning Zone (EPZ) is subdivided into three general categories: resident (permanent) population, transient population, and special facility population as described in Brunswick Nuclear Power Plant Evacuation Time Estimates For The Plume Exposure Pathway Emergency Planning Zone, prepared by PBS&J, November 2002. The total resident population affected within the 10-mile EPZ is approximately 26,724. During the summer months, June through August, the daytime population of the EPZ is approximately 147,054 (see Figure 1.1-6). The population is concentrated along the coast and a relatively few inland roads.

4.4.7 Protective Actions - Off Site/Public

4.4.7.1 Public Education and Information

Occupants in the plume exposure pathway Emergency Planning Zone (EPZ) will be provided information prepared by Progress Energy in conjunction with the state and county agencies. This public education and information program is intended to ensure that members of the public are: (a) aware of the potential for an occurrence of a radiological emergency; (b) able to recognize a radiological emergency notification; and (c) knowledgeable of the proper, immediate actions to be taken upon notification.

This will be accomplished by: (1) distribution of the annual safety information calendar which contains educational information on emergency preparedness, sheltering, sirens, radiation, and telephone numbers of agencies to contact for more information; (2) availability of qualified personnel to address civic, religious, social and occupational organizations; and (3) distribution of news material to the media and numerous community and business newsletters.

Emergency information will be made available to transient populations through the distribution of safety information map brochures to commercial establishments in the 10-mile EPZ.

During an actual emergency, provisions will be established through the Joint Information Center to make available and distribute information to the news media. The Joint Information Center will also implement provisions for a number of telephones which members of the public, who hear rumors, can call for factual information.

The public education and information program is further described in Section 6.1.4.

4.4.7.2 General

For emergencies requiring protective actions for the general public in designated off-site areas, state agencies will determine the advisability of any necessary evacuation or sheltering. Local agencies will conduct the protective actions as warranted. Assembly points would vary depending on the severity of the incident and on the prevailing weather conditions. To assist in this effort, Progress Energy will provide up-to-date assessments of the condition of the plant and of the quantity and rate of release of radioactivity. Progress Energy will also assist by performing dose assessments which will be compared to the protective action guidelines.

The protective actions that Progress Energy recommends to the state will be based upon current meteorological data such as wind direction, speed and stability class, and other factors.

Releases affecting off-site areas may not be of the magnitude requiring evacuation, areas within the 10-mile EPZ that do not evacuate will be recommended to shelter.

Detailed procedures for public protective actions are contained in the North Carolina Emergency Response Plan in Support of BNP.

4.4.7.3 Evacuation

In the event that evacuation of the 10-mile EPZ is required, the evacuation routes shown in Figure 1.1-2 and Figure 4.4-1 will be used by on-site and off-site personnel.

The time required to evacuate personnel from the 10-mile EPZ varies depending on whether a part of the EPZ is to be evacuated or all of it, on the time of year such as winter or summer, etc., as illustrated in Figure 4.4-1 and on other factors as shown in Table 4.4-1.

It should be noted that the evacuation process in itself involves risk to the public. Risks resulting from evacuation are discussed in US EPA Report, EPA 400-R-92-00, Appendix C.

4.4.7.4 Shelter

All sectors that are not recommended to evacuate will be recommended to shelter. The state may consider sheltering for special populations or hazardous environmental conditions. Special populations may include institutionalized or infirm persons. Hazardous environmental conditions may include the presence of severe weather or competing disasters.

The local housing consists primarily of wood framed dwellings, 1 and 2 stories, that are over 10 years old. Very few houses have basements. There are a number of brick veneer dwellings of later construction and a fairly small even distribution of house trailers.

The term Protection Factor (PF) refers to a number used to express the relationship between the amount of gamma radiation that would be received by an unprotected person and the amount that would be received by a person in shelter. An occupant of a shelter with a PF of 40 would be exposed to l/40 (2.5 percent) of the dose or dose rate to which he would be exposed if his location were unprotected (Sheltered Dose = Unsheltered Dose ÷ PF).

Protection factors for various shielding materials are given in Figure 4.4-3 and for various structures and vehicles in Tables 4.4-2, 4.4-3, and 4.4-4.

4.4.7.5 Respiratory Protection

It is unlikely that effective public respiratory protection can be provided by improvised devices. This problem will be studied and provisions incorporated in this plan in the event satisfactory systems are found.

TABLE 4.4-1

FACTORS RELATED TO WARNING/EVACUATION TIME

1. Facility to Off-site Agencies Alert Phase

   a. Decision-making time
   b. Physical actions/calling time

2. Governmental Agencies to Public Alert Phase

   a. Decision-making time
   b. Physical actions/calling-alerting time

3. Public Alert and Notification Phase

   a. Hear signal
   b. Recognize signal
   c. Seek confirmation of signal meaning and validity
   d. Find confirmation of signal meaning
   e. Relate signal meaning to self
   f. Decide to act.

4. Movement Preparation Phase

   a. Time between deciding to act and departing location I
   b. Shutting off utilities I
   c. Packing bags I
   d. Deciding on destination and routes I
   e. Taking care of livestock, etc. I
   f. Collecting other family members I
   g. Loading the automobile and departing I

5. Movement/Travel Phase

   a. Movement time is a function of road distance to the boundary of the evacuation area, vehicle used for evacuation, and auto traffic conditions (traffic volumes, road capacity, weather conditions, etc.).
   b. Road capacity under emergency conditions per FEMA CPG-2-8-C are assumed to be 850 vehicles per hour (vph) per lane; under foul weather conditions 450-500 vph.
   c. Traffic volume is determined by: (1) dividing the EPZ population by the average number of persons per dwelling unit; or (2) obtaining statistical data on number of vehicles registered in the EPZ, or; (3) other.

6. Evacuation Verification Phase

   a. Marker Technique (NRC NUREG-0654)
      Auto check - Total road distances ÷ Ave. 15 mph
      Aircraft check
   b. Telephone poll: 0.5 min. per residence

TABLE 4.4-2
REPRESENTATIVE SHIELDING FACTORS FOR SURFACE DEPOSITED RADIONUCLIDES*

Structure or Location	Representative Shielding Factor[(a)]	Representative Range
1 m above ordinary ground	0.70	0.47-0.85
Cars on 50-ft. road:		
Road fully contaminated	0.5	0.4-0.7
Road 50% decontaminated	0.5	0.4-0.6
Road fully decontaminated	0.25	0.2-0.5
Trains	0.40	0.3-0.5
One- and two-story wood-frame house (no basement)	0.4[(b)]	0.2-0.5
One- and two-story block and brick house (no basement)	0.2[(b)]	0.04-0.40
House basement, one or two walls fully exposed:	0.1[(b)]	0.03-0.15
One story, less than 2 ft of basement, walls exposed	0.05[(b)]	0.03-0.07
Two stories, less than 2 ft. of basement, walls exposed	0.03[(b)]	0.02-0.05
Three- or four-story structures,		
5000 to 10,000 ft^2 per floor:		
First and second floors	0.05[(b)]	0.01-0.08
Basement	0.01[(b)]	0.001-0.07
Multistory structures, > 10,000		
ft^2 per floor:		
Upper floors	0.01[(b)]	0.001-0.02
Basement	0.005[(b)]	0.001-0.015

(a) The ratio of dose received inside the structure to the dose that would be received outside the structure.
(b) Away from doors and windows.
(c) Shielding Factor = Shielded Dose Rate / Unshielded Dose Rate

*From: SAND 77-1725, Public Protection Strategies for Potential Nuclear Accidents, Sandia Laboratory

TABLE 4.4-3
REPRESENTATIVE SHIELDING FACTORS FROM GAMMA CLOUD SOURCE

Structure or Location	Shielding Shielding Factor[a]	Representative Range
Outside	1.0	–
Vehicles	1.0	–
Wood-frame house[b] (no basement)	0.9	–
Basement of wood house	0.6	0.1 to 0.7[c]
Masonry house (no basement)	0.6	0.4 to 0.7[c]
Basement of masonry house	0.4	0.1 to 0.5[c]
Large office or industrial building	0.2	0.1 to 0.3[c,d]

(a) The ratio of the dose received inside the structure to the dose that would be received outside the structure.

(b) A wood frame house with brick or stone veneer is approximately equivalent to a masonry house for shielding purposes.

(c) This range is mainly due to different wall materials and different geometries.

(c) The shielding factor depends on where the personnel are located within the building (e.g., the basement or an inside room).

(d) Shielding Factor = Shielded Dose Rate / Unshielded Dose Rate

*From: SAND 77-1725, Public Protection Strategies For Potential Nuclear Reactor Accidents, Sandia Laboratory

TABLE 4.4-4
PF OF VARIOUS VEHICLES AND STRUCTURES

	Average PF
Aircraft Light (Cessna - 172 type)	1.25
Bus - Scenic Cruiser.	7
" - Commercial Type	1.7
" - School	1.6
Car - Passenger	1.6
Foxhole (3 ft. diameter x 4 ft. deep)	10.0
If an area 3 or 4 feet wide around the foxhole is kept free of fallout material, a protection factor of 100 or more is possible.	
House, Wood Frame (Cape Cod/Colonial Types)	
First Floor Center of House	2.0
Basement	10.0
Corner of Basement, Under Table with 8"	100.0
Concrete on top	100.0
House, Brick (Cape Cod/Colonial Type)	
First Floor Center of House	10.0
Basement	30.0
Locomotive, Heavy, Engineers Seat	3.3
Normal Living, Home and Work as Usual	2.0
Trucks	
1/4 Ton	1.3
3/4 Ton	1.4
2 1/2 Ton	1.7
4 to 7 Ton	2.0
Fire Truck, Drivers Side	2.9
Fire Truck, Standing Area in Back	1.7
Roadway Underpass	2 to 5
Urban Areas (In Open)	1.4
Woods	1.25

NOTE: Protection Factor (PF) = Unshielded Dose Rate ÷ Shielded Dose Rate. Above data pertains to deposited particulate radioactive material with gamma energy approx. 0.7 mev.

BNP EVACUATION SCHEDULE AND WARNING

EVACUATION SCHEDULE					POPULATION	
Zone	Warning Responsibility	Evacuation Routes	Evacuation Shelter	Warning time hrs/mins	Permanent	Peak Transient Seasonal
A	Southport Fire/Rescue Sunset Harbor Fire	NC 87 north, US 17 north, SR 1438 (Lanvale) north, right on SR 1437	Leland Middle School	0 + 39	1,542	932
B	Southport Fire/Rescue	NC 87 north, US 17 north, SR 1438 (Lanvale) north, right on SR 1437	North Brunswick High School Leland Middle School	0 + 18	1,609	16,387
C	Southport Fire/Rescue	NC 133 north, SR 1472 (old US 74/76) west, SR 1455 north	Lincoln Primary School	0 + 19	787	1,335
D	Oak Island Fire/Rescue/Police Yaupon Beach Fire	NC 211 west, US 17 south, NC 130 north	West Brunswick High School	0 + 32	9,297	32,422
E	Bolivia Fire	NC 87 north, US 17 north, SR 1438 (Lanvale) north, right on SR 1437 SR 1500 north, US 17 north, SR 1438 (Lanvale) north, right on SR 1437	North Brunswick High School	0 + 29	2,077	745
F	Boiling Springs Fire/Rescue Bolivia Fire	NC 87 north, US 17 north, SR 1438 (Lanvale) north, right on SR 1437	North Brunswick High School	0 + 41	3,193	1,204
G	Boiling Springs Fire/Rescue Town Creek Rescue	NC 133 north, SR 1437	North Brunswick High School	0 + 43	890	64
H	Southport Fire/Rescue	NC 133 north, SR 1472 (old US 74/76) west, SR 1455 north	Lincoln Primary School	0 + 30	818	1073
K	Carolina Beach Fire/Rescue Kure Beach Fire Federal Point Fire New Hanover County Sheriff	Dow Road, US 421 north, NC 132 north	Trask Coliseum, UNC-W Roland-Grise Jr. High School[5] Hoggard High School[5] Alderman Elementary School[5]	0 + 30	6,511	55,517

1. Bald Head Island authorities will warn the population in the Bald Head Island development.
2. If time is critical, after zones using NC 87 and NC 133 have cleared, two traffic lanes would be directed out of Zone D with one lane using NC 87 or NC 133 north.
3. Sunny Point Army Terminal, Orton Plantation, and Old Brunswick Town/Fort Anderson authorities will warn the population within their jurisdiction.
4. If time is critical, three lanes of traffic could be directed out of Zone K on US 421 north from the point where Dow Road intersects US 421.
5. These shelters are available only on days when school is not in session.

See also Figure 1.1-2, 10 Mile Plume Exposure EPZ.

Figure 4.4-1 Evacuation Schedule and Warning

EVACUATION TIMES - BRUNSWICK EPZ

Analysis Area	Local Planning Zones Evacuated	Evacuation Time (minutes)[a,b]
1	B	115-314
2	A,B,C	160-381
3	A,B,C,D	290-662
4	A,B,C,D,E	296-670
5	A,B,C,D,E,F,G,H	340-695
6	A,B,C,E,F,G,H,K	235-749
7	A,B,C,G,H,K	235-749
8	A,B,C,H,K	235-749
9	A,B,C,K	340-749
10	A,B,C,D,E,F,G,H,K	340-749

a This range of evacuation times covers four conditions:
Fair Weather - winter weekday, winter weeknight, summer weekday and summer weekend; and Adverse Weather - winter weekday and summer weekend.

b Evacuation time includes public alerting and notification (15 minutes), preparation for movement (15 minutes), and time to travel out of the local planning zone(s) being evacuated.

Figure 4.4-2 Evacuation Times

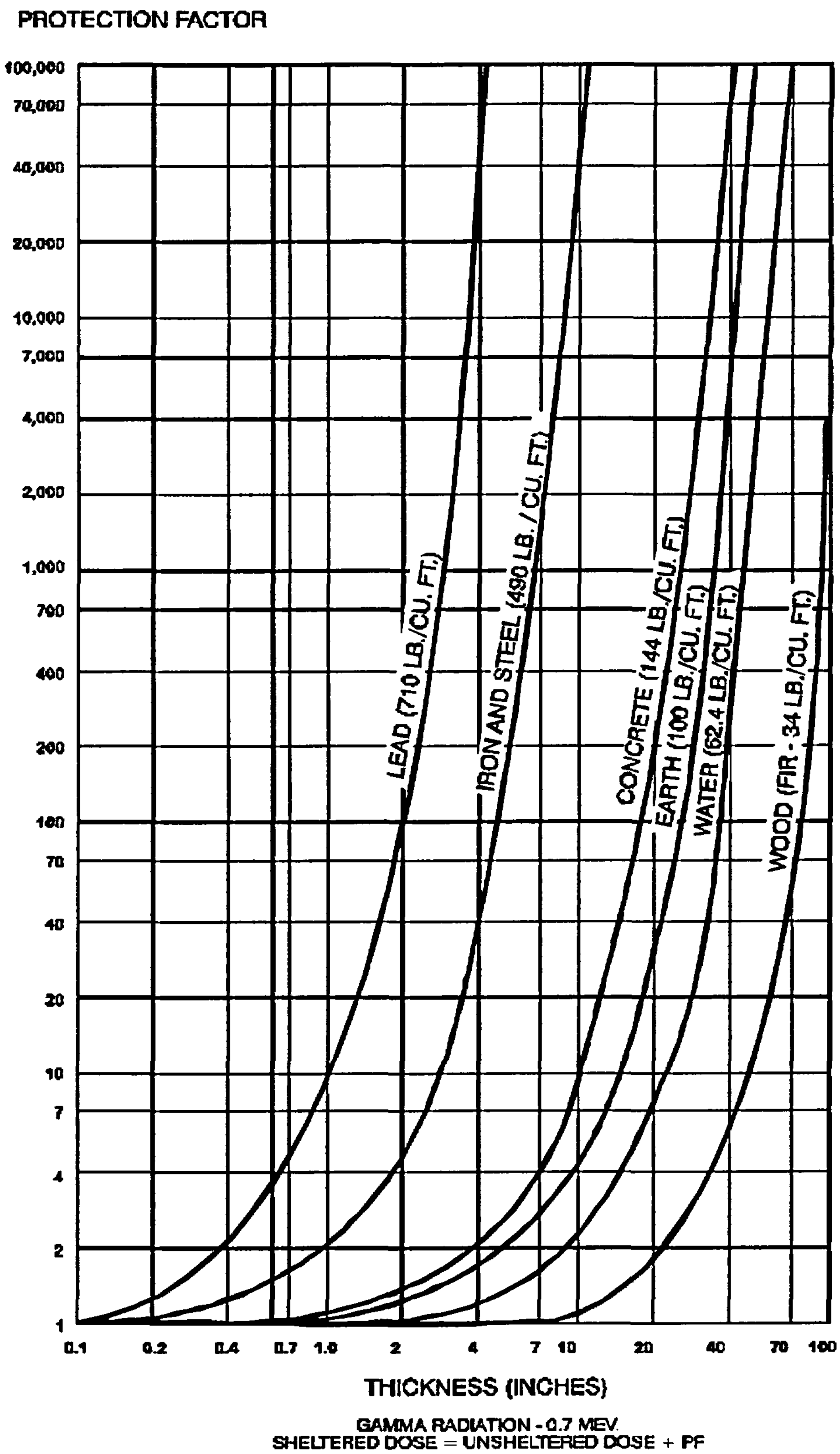


Fig. 4.4-3 Protection Factors of Shielding Materials

5.0 EMERGENCY FACILITIES AND EQUIPMENT

To facilitate efficient and effective control and coordination of the numerous actions required during emergency situations, several facilities have been designated as emergency centers for Brunswick. These facilities are linked by a comprehensive communications network to allow accurate and timely communications between the facilities, outside agencies, and the public. The communications network uses Bell systems, fiber optic, Progress Energy microwave net, data links, and radio to provide: (a) voice communication through normal telephone use, automatic ringdown between selected facilities, conference call capability, speaker phones and operator assistance where required; (b) radio communications between selected Progress Energy vehicles and appropriate fixed locations, as well as with state mobile units and fixed locations; (c) facsimile and computer local and wide area networks. (A detailed listing of the Brunswick emergency communications systems is presented as Appendix A.)

The purpose of emergency response facilities is to provide centralized locations for organized coordination and control of on-site and off-site activities during an emergency. Each emergency response organization must assure that a location is provided from where they may direct the activities for which they are responsible, while providing for coordination of activities with other organizations.

Facilities are needed to function as a center for the licensee's command and control functions of on-site operations, including coordination of all licensee activities, on site and off site. Also needed is a center for the analysis of plant effluent monitors, meteorological conditions, and off-site radiation measurements, and for off-site dose projections. As discussed in Section 3 additional facilities are needed where information regarding current and projected plant status needed by federal, state, and local authorities for implementation of off-site emergency plans can be transmitted, where key representatives of the agencies can meet and where the press can operate.

The above functions are carried out by the interaction of the Control Room, the Operational Support Center, the Technical Support Center, the Emergency Operations Facility, the Joint Information Center, and the State and Local Emergency Operations Centers. These centers are connected with a comprehensive, redundant communications network.

In the emergency facilities, decisions and responses are based upon approved procedures and controlled drawings. Uncontrolled drawings and other documents may be used for reference if identified with "FOR INFORMATION ONLY" or "FOR TRAINING USE ONLY." Material identified as "FOR INFORMATION ONLY" or "FOR TRAINING USE ONLY" will not be used in place of approved procedures or controlled drawings.

The functional capabilities of the Brunswick emergency facilities are presented in Table 5.0-2, and the physical locations of on-site emergency facilities are shown on Figure 1.1-3. Specific information about the facilities and equipment available for dealing with emergencies at Brunswick is presented in the following sections.

5.1 CONTROL ROOM

The function of the Control Room is plant control. All plant-related operations are directed from the Control Room. The Control Room is designed to meet habitability standards as described in the Brunswick UFSAR.

Nuclear plant instrumentation, including area and process radiation monitoring system instrumentation, is provided in the Control Room to give early warning of a potential emergency and provides for a continuing evaluation of the emergency situation. The Control Room contains the controls and instrumentation necessary for operation of the reactors and turbine generators under normal and emergency situations.

Additional equipment such as portable radiation survey instruments, readout of meteorological instrumentation and communication equipment is available in the Control Room. A supply of protective clothing, respiratory equipment, and self-contained breathing apparatus will also be maintained in the Control Room.

5.2 TECHNICAL SUPPORT CENTER

The Technical Support Center (TSC) provides a location to house personnel who are responsible for management and technical support of plant operations during emergency conditions. The TSC also functions to relieve the Control Operators of peripheral duties and communications not directly related to reactor system manipulations and preventing congestion in the Control Room. In the event of a loss of power, an auxiliary diesel generator is located near the building to supply an alternate source of power.

The TSC will be activated for an alert or higher classification. Activation for an unusual event is optional.

If it should become necessary to expedite travel between the TSC and Control Room, Security has provisions in place to provide direct access between the TSC and the protected area.

The TSC and EOF share a common building which has been designed to have the same habitability as the Control Room. The north wall is 18 inches thick and the other walls and roof are 14 inches thick. The ventilation system is described in Section 5.2.1.

5.2.1 TSC/EOF EMERGENCY VENTILATION SYSTEM

The EOF/TSC Building Ventilation System is equipped with two (2) filter systems (containing both HEPA and charcoal filters), one for each of the two ventilation intake locations (Mechanical Rooms 134 and 165). The TSC/EOF Building Ventilation System is equipped with two intake air monitors which are Eberline SRM-100 monitors with SPA-8 probes. The probes are installed in the intake air ducts where detection of a high level of radiation can automatically trigger the HVAC system to actuate emergency fans to direct intake air through the filter trains.

The intake air radiation monitors are provided with an audible local alarm that is located on the radiation monitor. When the alarm setpoint is reached, the monitor will energize its associated radiation monitor relay, which will automatically activate an emergency fan to redirect the intake air through the associated filtering system.

5.2.2 TSC/EOF EMERGENCY CONTAMINATED DRAIN SYSTEM

During an emergency, contaminated drainage could occur at the decontamination shower. An emergency drain system is provided to isolate potential contaminated drainage which can be collected in a 1,000 gallon holding tank. For normal operating conditions, all drainage would be collected by the sanitary drain lines. The holding tank is located underground on the west side of the building. Manually operated valves allow the rerouting of potentially contaminated liquid to the 1,000 gallon holding tank.

5.3 OPERATIONAL SUPPORT CENTER

The purpose of the Operational Support Center (OSC) is to minimize congestion in the Control Room during emergencies by providing a location, separate from the Control Room, where plant maintenance, operations, E&RC, and other plant emergency support personnel will assemble and stand by to assist as needed. The Operational Support Center is located in the O&M Building.

When the OSC is activated, dosimetry, respiratory protection, radiation survey equipment, and RWPs will be provided. In the event of a personnel contamination, decontamination will be performed in the area normally designated for this purpose. In the event the OSC is evacuated, a backup can also be provided in the Simulator. The Simulator is within the habitability envelope of the TSC/EOF.

5.4 EMERGENCY OPERATIONS FACILITY

The Emergency Operations Facility (EOF), located on site provides space for management of overall emergency response including coordination with federal, state, and local officials, coordination of off-site radiological and environmental assessment, and determination of recommended public protective actions. The EOF is activated at an alert or higher level. The EOF is in the same habitability envelope as the TSC.

If radiological conditions prevent EOF personnel from traveling to the EOF for activation, the Brunswick County Complex in Bolivia, N.C. will serve as a meeting place for personnel until radiological conditions permit travel to the facility. The Brunswick County Complex may also be used as an alternate reporting location for TSC, OSC, and EOF personnel in the event of a security threat, and function as an alternate EOF, until safe movement of personnel to the plant is assured.

5.5 JOINT INFORMATION CENTER

The Joint Information Center (JIC), located in the Brunswick Community College Complex near Bolivia, N.C., will serve as the primary location for the accumulation of accurate and current information regarding emergency conditions, and dissemination of information to news media and the general public. The JIC Communications Network has back-up capability for telephone and radio functions. Work stations are provided for Company personnel and a media briefing room is available. Telephones are provided for use by news media personnel. The center also contains work space and phones for public information personnel from the state, counties, NRC and industry-related organizations. Additional information can be found in 0PEP-02.6.29, Activation and Operation of the Joint Information Center (JIC).

5.6 OFF-SITE EMERGENCY FACILITIES

5.6.1 North Carolina Emergency Operations Center

The North Carolina Emergency Operations Center (EOC) is located in Raleigh, North Carolina. When necessary, it will be activated and staffed to assist in coordinating emergency operations in support of the Brunswick Nuclear Plant.

5.6.2 Brunswick County Emergency Operations Center

The Brunswick County Emergency Operations Center is located in the Brunswick County Administration Complex in Bolivia, North Carolina, about fifteen miles from the Brunswick site. It provides a location where Brunswick County authorities can direct off-site activities in Brunswick County. If radiological conditions prevent EOF personnel from traveling to the EOF for activation, the Brunswick County Complex in Bolivia, N.C. will serve as a meeting place for personnel until radiological conditions permit travel to the facility. This facility presently has direct communications links with the Brunswick Nuclear Plant TSC and EOF, and will allow free interchange of information between government officials and those persons located in the TSC and EOF responsible for dose projection and management decision making. The Brunswick County Complex may also be used as an alternate reporting location for TSC, OSC, and EOF personnel in the event of a security threat, and function as an alternate EOF, until safe movement of personnel to the plant is assured.

5.6.3 New Hanover County Emergency Operations Center

The New Hanover County Emergency Operations Center is located in the New Hanover County Law Enforcement Center in Wilmington, North Carolina, about 20 miles from the Brunswick site. It provides a location where New Hanover County authorities can direct off-site activities in New Hanover County. This facility presently has direct communications links with the Brunswick Nuclear Plant TSC and EOF, and will allow free interchange of information between government officials and those persons located in the TSC and EOF responsible for dose projection and management decision making.

5.7 ASSESSMENT CAPABILITIES

5.7.1 General

The instrumentation and control systems monitor, provide indication and recording, and automatically regulate the variables necessary for safe and orderly operation of the plant. These systems provide the operators with the information and controls needed to start up, operate at power, and shut down the plant. They further provide means to cope with all abnormal operating conditions. Plant control and display of information from these various systems are centralized in the Control Room at locations convenient to the operator. This instrumentation, in conjunction with projected off-site doses, provides the basis for initiation of protective actions.

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5.7.2 Meteorological Instrumentation and Procedures

The Brunswick Nuclear Plant has a permanent meteorological monitoring station located on-site for display and recording of wind speed, wind direction, and temperature differences for use in making off-site dose projections, etc. Meteorological information is presented in the Control Room by means of the plant computer system. The meteorological parameters measured on the tower at the 10-meter and 100-meter levels above ground are listed in Table 5.7-1. In addition, barometric pressure, solar radiation, precipitation and dew point temperature data are recorded at the station to provide supplemental information on local meteorological conditions. This information is remotely interrogatable using a computer or other data access terminal.

The meteorological sensors used at the BNP meteorological monitoring station are calibrated at least twice during an annual calendar year (approximately six months between calibrations). Meteorological sensors which are removed from service are replaced with a recalibrated unit having met original equipment manufacturer specifications. Between calibrations, an electronic verification of system performance will be made and, if necessary, adjustments to the system will be performed. This electronic verification shall be performed at least once between calibrations. BNP personnel will make periodic visits to the monitoring station to assure that components are functioning as anticipated. Further checks of the data are made by remote interrogation of the monitoring station by a meteorological service provider, where the data is reviewed by the meteorological staff to determine system performance and the acceptability of the reported information. Historical records and data will be maintained with the Environmental Unit for effluent reporting.

The meteorological instrumentation which Progress Energy uses at the BNP meteorological monitoring station meets the requirements of NRC Regulatory Guide 1.23 (Rev. 0) and provides the meteorological parameters to the locations specified within NRC Regulatory Guide 1.97 (Rev. 2), Table 1 and Table 2. As specified within Section 8.2 of the Supplement Number 1 to NUREG-0737, Progress Energy maintains telephone numbers for voice communications to the nearest National Weather Service, first order observation station (Wilmington, NC) for twenty-four hour per day access to this backup meteorological information should the on-site system fail. This backup source of meteorological data is the closest location which can provide reliable representative meteorological information for the BNP site.

Should the on-site meteorological data collection system exhibit suspect information, loss of data due to computer or instrument failure, or plant personnel require additional technical assistance, meteorologists are available to provide needed expertise. Meteorologists can independently access on-site meteorological data, contact the National Weather Service to obtain additional synoptic scale weather data and compile a site specific atmospheric diffusion assessment for BNP site.

5.7.3 Seismic Monitoring

The Brunswick Seismic Monitoring System senses and records earthquake ground motion received in two areas of the Reactor Building.

The system is comprised of the following components:

1. Two peak shock recorders - remote sensing devices.
2. One multichannel accelograph - Model SMA-3.
3. One magnetic tape play-back unit - Model SMP-1.

The peak shock recorders measure and record the acceleration of the structure, primarily the concrete floors adjacent to the Reactor Building equipment drain tank and at the refueling elevation. Earthquakes produce low frequency accelerations which, when detected by the remote sensing devices, will be recorded at the remote location as well as by the accelograph located in the electronic equipment room. The Seismic Monitoring System remains in a standby condition until an earthquake causes the remote unit(s) to activate the recording circuits and tape transports.

The peak shock recorder senses and permanently records the information defining a response spectrum. It also provides signals for immediate remote indication that specific preset response accelerations have been exceeded.

A considerable array of seismometers is located in the region. A central point of contact to obtain information about a seismic event is the National Earthquake Information Center in Golden, Colorado.

5.7.4 Radiological Monitors

The radiation monitoring system is available to give early warning of a possible emergency and provides for a continuing evaluation of the emergency situation in the Control Room. Radiation monitoring instruments are located at selected areas within the facility to detect, measure, and record radiation levels. In the event the radiation level should increase above a preset level, an alarm is initiated in the Control Room. Certain radiation monitoring instruments also alarm locally in selected areas of the facility. The radiation monitoring system is divided into four subsystems:

1. Process radiation monitoring system monitors various fluid streams in operating systems.

2. Area radiation monitors that monitor radiation levels at various locations within the operating area that can be read in the Control Room.

3. Continuous air monitors measure airborne particulate and/or airborne iodine activities at various locations within the operating areas.

4. Radiation monitoring equipment with readouts in various plant locations and the HP office.

The types, ranges, and locations of monitors are listed in Tables 5.7-2 to 5.7-4. Typical portable radiation monitors are listed in Table 5.7-4. The radiation monitors are designed to permit monitoring of activity releases during a broad spectrum of postulated emergency situations.

The locations of the off-site and on-site environmental monitoring stations, and the location of the emergency TLD monitoring stations are contained in plant Environmental and Radiation Control Procedures.

5.7.5 Process Monitors

Instrumentation used to monitor vital plant parameters is described in Section 7 of the Brunswick FSAR. This instrumentation is continuously monitored in the Control Room. Essential process monitoring (Critical Plant Variables) will also be available in the Technical Support Center.

5.7.6 Laboratory Facilities

Support of the radiation monitoring and analysis effort is provided by an on-site laboratory. The on-site laboratory includes equipment for chemical analyses and for analysis of radioactivity.

The wet chemistry equipment is used to perform a variety of analyses (pH, conductivity, boron content of reactor coolant, etc.). It is also used to perform radiochemical analyses (preparation of samples to permit analysis of the radioactivity content).

Equipment used to analyze the type and amount of radioactivity in filters, smears, etc., is located adjacent to the chemistry lab. This includes a multichannel analyzer (Ge-Li) used to determine the isotopic content in a sample, a liquid scintillation counter for tritium analyses, and gas proportional counter for gross alpha, and gross beta activity.

Much of this equipment is rack mounted; some is readily portable. Additional facilities for counting and analyses of Brunswick samples can be provided by laboratory facilities at the Harris Nuclear Plant, including the Harris Energy and Environmental Center (HEEC) located near New Hill, North Carolina, and by the Robinson Nuclear Plant located in Hartsville, South Carolina.

As described in the State of North Carolina Radiological Emergency Response Plan, the Division of Radiation Protection maintains a mobile radiological laboratory.

The NRC mobile laboratory may be made available for site and general emergencies. Parking space for the mobile laboratory is reserved on the southeast corner of the fabrication shop (old firehouse). The building is located on the north side of the plant, west of the Rad Material Container Storage Building. A 120 VAC receptacle box is mounted on the east exterior wall and is reserved for the mobile laboratory. The Radiological Control Director shall coordinate setting up of the mobile laboratory.

5.7.7 Dose Projection

The magnitude of releases of radioactive material can be determined from effluent and process monitors based on 0PEP-03.4.7, Automation of Off-Site Dose Projection Procedures. Additionally, an independent confirmation of the magnitude of a release can be obtained by environmental monitoring as described in 0PEP-02.6.6, Environmental Monitoring Team Leader and 0PEP-03.5.5, Environmental Monitoring and Plume Tracking. Given a source term, or the duration and rate of release to the environment, and meteorological data previously described, the Control Room can make the initial dose projections and is capable of performing this function on a 24-hour-per-day basis. After activation of the EOF, the Radiological Control Manager described in Section 3.5.4 is responsible to the Emergency Response Manager for determining dose projections from readily available data. 0PEP-03.4.7, Automation of Dose Projection Procedures, describe computer programs which automate dose projection calculations when used in conjunction with the BNP meteorological systems.

5.8 FIRE DETECTION

The Fire Detection System is designed to quickly detect visible or invisible smoke (or other products of combustion) and/or heat in designated areas of the plant.

The Fire Detection System consists primarily of fire detectors, control panel units, and annunciator panels. A fire signal initiated by a detector flows through a control panel unit to an annunciator panel. The control panel unit is located in the same building as the detector. The annunciator panel is located in the Control Room.

The types and number of detectors have been selected in accordance with the combustible materials and electrical equipment present in the area and the physical surroundings of each area. Ionization detectors sense the presence of products of combustion before they are visible in the form of smoke. Thermal detectors are sensitive to both temperature and the rate of rise of increasing temperature. SD-41 provides a description of detector types, numbers, and locations.

5.9 PROTECTIVE FACILITIES AND EQUIPMENT

0PEP-04.6, Radiological Emergency Kit Inventories, lists emergency equipment that is available for the various Brunswick emergency facilities.

Complete personnel decontamination facilities are included in the Service Building. These facilities include two decontamination showers. Alternate means for decontamination are also available.

5.10 FIRST AID AND MEDICAL FACILITIES

First Aid is located on the first floor of the O&M Building. First aid kits and supplies are also placed at various locations throughout the plant.

Off-site medical facilities which have agreed to accept personnel are described in Appendix E, Medical Treatment and Assistance.

5.11 DAMAGE CONTROL EQUIPMENT AND SUPPLIES

In the event of an emergency, certain immediate repairs may be necessary to minimize the further release of radioactivity and also insure the protection of plant equipment. Damage control equipment and supplies that would be used to effect repair would depend on the nature of the repairs to be performed.

Damage control equipment and supplies are located in the stockroom and the maintenance shops.

5.12 OFF-SITE ENVIRONMENTAL MONITORING EQUIPMENT AND SUPPLIES

In the event of an emergency, the plant has the capability to deploy two off-site environmental monitoring teams as described in 0PEP-02.6.6, Environmental Monitoring Team Leader. Two environmental monitoring kits with the necessary equipment and supplies for off-site radiological monitoring are designated for use in the event of an emergency. Transportation for off-site environmental monitoring teams will be supplied by plant vehicles and other Company trucks as available or private autos at the site.

TABLE 5.0-2

FUNCTIONAL OBJECTIVES OF EMERGENCY FACILITIES

Facility Name	Location	Functional Objectives
Technical Support Center (TSC)	Brunswick TSC/EOF/Training Building	1) Assembly location for technical personnel to provide engineering and management support of plant operations following an accident. 2) Direction and coordination of overall plant emergency activities.
Operational Support Center (OSC)	Brunswick Operations and Maintenance Building	1) Reporting place for emergency support personnel. 2) Dispatching location of personnel to support actions as directed by the Site Emergency Coordinator.
Joint Information Center	Located in Brunswick Community College Complex, Bolivia, NC	1) Provide immediate access to accurate emergency related information generated by all involved agencies by media representatives. 2) Provide equipment for document reproduction, telecopying, communications, and television electrical connections.
Emergency Operations Facility (EOF)	Brunswick TSC/EOF/Training Building	1) Provide working space and communication links for the Emergency Response Manager and his staff. 2) Provide primary interface point for Progress Energy and off-site support personnel (Federal and State). 3) Provide point of coordination for off-site radiological and environmental assessment.
New Hanover County Emergency Operations Center (EOC)	Wilmington, North Carolina	1) Direction and coordination of New Hanover County emergency and protective response actions.
Brunswick County Emergency Operations Center (EOC)	Bolivia, North Carolina	1) Direction and coordination of Brunswick County emergency and protective response actions.
North Carolina State Emergency Operations Center (EOC)	Raleigh, North Carolina	1) Direction and coordination of Brunswick and New Hanover County emergency and protective response actions.

TABLE 5.7-1

ON-SITE METEOROLOGICAL INSTRUMENTATION

Approximate Height Above Tower Base (ft)	Recorded Parameter	Instrument
344	Windspeed, direction and direction variance	Threshold less than 1 mph.
35	Windspeed, direction, and direction variance	Threshold less than 1 mph.
344	Temperature difference relative to 35 ft elevation	Resistance thermobulb in aspirated radiation shield at 344 and 35 ft elevation.
35	Ambient temperature	Resistance thermobulb in aspirated radiation shield at 35 ft elevation.

TABLE 5.7-2
AREA RADIATION MONITORING SYSTEM
CHANNEL IDENTIFICATION & METER RANGES

Channel	Range (mRem/hr)	Designation	Detector Location (Bldg.)
1-1	0.01 - 100	Control Room Operating Area	Control
1-2	0.01 - 100	U-2 Electronic Equipment Room *	Control
1-3	0.01 - 100	U-1 Electronic Equipment Room *	Control
1-4	0.01 - 100	Stack Filter House	Stack
1-5	0.01 - 100	Service Bldg. Radiochemical Lab.	Service
1-6	0.01 - 100	Service Bldg. Personnel Decon Equipment Room	Service
1-7	0.1 - 10^3	Hot Machine Shop	Service
1-8	0.01 - 100	Service Bldg. Equipment Room East/West Corridor	Service
1-9	0.01 - 100	U-1 Turb. Hall Control Access Corridor	Turbine
1-10	0.01 - 100	U-1 FW Heater Bay Access Corridor	Turbine
1-11	0.01 - 100	U-1 Turb. Bldg. Sampling Station	Turbine
1-12	0.1 - 10^3	U-1 Turb. W Moist Sep. Drain Tanks	Turbine
1-13	0.1 - 10^3	U-1 Turb. E Moist Sep. Drain Tanks	Turbine
1-14	0.1 - 10^3	U-1 Turb. Rotor Washdown Area	Turbine
1-15	0.1 - 10^3	1A Core Spray Pump Room ESS I	Reactor
1-16	0.1 - 10^3	1B Core Spray Pump Room ESS II	Reactor

* Detectors are located in mechanical equipment room (Control Building ventilation air intake plenum)

TABLE 5.7-2 (Cont'd)
AREA RADIATION MONITORING SYSTEM
CHANNEL IDENTIFICATION & METER RANGES

Channel	Range (mRem/hr)	Designation	Detector Location (Bldg.)
1-17	0.1 - 10^3	1A RHR System Hx and Pump Room ESS I	Reactor
1-18	0.1 - 10^3	1B RHR System HX and Pump Room ESS II	Reactor
1-19	0.01 - 100	U-1 Rx Bldg. Airlock Area EL 20 ft.	Reactor
1-20	0.01 - 100	U-1 Drywell Entrance	Reactor
1-21	1.0 - 10^4	U-1 TIP Room	Reactor
1-22	0.01 - 100	U-1 Decontam. Room EL 20 ft.	Reactor
1-23	0.01 - 100	U-1 Equipment Entry EL 20 ft.	Reactor
1-24	0.01 - 100	U-1 Rx Bldg. Sampling Station	Reactor
1-25	0.01 - 100	U-1 Rx Bldg. Air Lock EL 50', 8"	Reactor
1-26	0.01 - 100	U-1 New Fuel Vault EL 98', 9"	Reactor
1-27	0.01 - 100	U-1 North of Fuel Storage Pool	Reactor
1-28	10^2 - 10^6	U-1 Between Rx and Fuel Pool EL 117 ft., 4 in.	Reactor
1-29	0.01 - 100	U-1 Cask Wash Area Refuel Floor	Reactor
1-30	0.01 - 100	U-1 Spent Fuel Pool Cooling System	Reactor

TABLE 5.7-2 (Cont'd)
AREA RADIATION MONITORING SYSTEM
CHANNEL IDENTIFICATION & METER RANGES

Channel	Range (mRem/hr)	Designation	Detector Location (Bldg.)
2-1	0.1 - 10^3	Radwaste Bldg. EL 3 ft. N MCC and Sump Area	Radwaste
2-2	0.1 - 10^3	Radwaste Bldg. EL 3 ft. S MCC and Sump Area	Radwaste
2-3	0.1 - 10^3	U-2 Cond Filter - Demin Aisle	Radwaste
2-4	0.1 - 10^3	U-1 Cond Filter - Demin Aisle	Radwaste
2-5	0.01 - 100	Radwaste Control Room	Radwaste
2-6	0.01 - 100	Radwaste Sampling Station	Radwaste
2-7	0.01 - 100	Radwaste Drum Capping Station	Radwaste
2-8	1.0 - 10^4	Radwaste Drum Storage	Radwaste
2-9	0.01 - 100	U-2 Turb. Hall Access Corridor	Turbine
2-10	0.01 - 100	U-2 FW Heater Bay Access Corridor	Turbine
2-11	0.01 - 100	U-2 Turb. Bldg. Sampling Station	Turbine
2-12	0.1 - 10^3	U-2 Turb. W Moist Sep Drain Tanks	Turbine
2-13	0.1 - 10^3	U-2 Turb. E Moist Sep Drain Tanks	Turbine
2-14	0.1 - 10^3	U-2 Turb. Rotor Washdown Area	Turbine
2-15	0.1 - 10^3	2A Core Spray Pump Room ESS I	Reactor
2-16	0.1 - 10^3	2B Core Spray Pump Room ESS II	Reactor

TABLE 5.7-2 (Cont'd)
AREA RADIATION MONITORING SYSTEM
CHANNEL IDENTIFICATION & METER RANGES

Channel	Range (mRem/hr)	Designation	Detector Location (Bldg.)
2-17	0.1 - 10^3	2A RHR System Hx and Pump Room ESS I	Reactor
2-18	0.1 - 10^3	2B RHR System Hx and Pump Room ESS II	Reactor
2-19	0.01 - 100	U-2 Rx Bldg. Airlock Area EL 20 ft.	Reactor
2-20	0.01 - 100	U-2 Drywell Entrance	Reactor
2-21	1.0 - 10^4	U-2 TIP Room	Reactor
2-22	0.01 - 100	U-2 Decontam. Room EL 20 ft.	Reactor
2-23	0.01 - 100	U-2 Equipment Entry EL 20 ft.	Reactor
2-24	0.01 - 100	U-2 Rx Bldg. Sampling Station	Reactor
2-25	0.01 - 100	U-2 Rx Bldg. Airlock EL 50 ft.	Reactor
2-26	0.01 - 100	U-2 Inside New Fuel Vault EL 98 ft. 8 in.	Reactor
2-27	0.01 - 100	U-2 North of Fuel Storage Pool	Reactor
2-28	10^2 - 10^6	U-2 Between Rx and Fuel Pool EL 117 ft. 4 in.	Reactor
2-29	0.01 - 100	U-2 Cask Wash Area Refuel Floor	Reactor
2-30	0.01 - 100	U-2 Spent Fuel Pool Cooling System	Reactor

TABLE 5.7-3

PROCESS RADIATION MONITORING SYSTEM
CHANNEL IDENTIFICATION & METER RANGES

Channel	Supplier	Range
Main Steam Line Radiation Monitors	GE	1-10^6 mRem/hr
Channel A (D12-RM-K603A)		
Channel B (D12-RM-K603B)		
Channel C (D12-RM-K603C)		
Channel D (D12-RM-K603D)		
Condenser Off-Gas Radiation Monitors	GE	
Log Channel A (D12-RM-K601A)		1-10^6 mRem/hr
Log Channel B (D12-RM-K601B)		
Linear Channel (D12-RM-K602)		
Main Stack Radiation Monitors	General Atomics	10^{-7}-10^5 µCi/cc (Xe equivalent)
Liquid Process Radiation Monitors	GE	
Radwaste Effluent (D12-RM-K604)		10^{-1}-10^6 cps
Service Water Discharge (D12-RM-K605)		
Reactor Bldg Closed Cooling Water (D12-RM-K606)		
Storm Drain Collector Basin (2-DST-RM-5361)	General Atomics	10^1-10^7 cpm
Reactor Bldg Ventilation Radiation Monitors		
Channel A (D12-RM-K609A)	GE	0.01-100 mRem/hr
Channel B (D12-RM-K609B)	GE	
Gaseous Analyzer Radiation Monitors		
Reactor Building Roof Vent (CAC-AQH-1264)	NMC	10-10^6 cpm
Turbine Building Vent (D12-RM-23)	General Atomics	10^{-7}-10^5 µCi/cc (Xe equivalent)
Drywell Primary Containment Atmosphere (CAC-AQH-1260, 1262)	NMC	

TABLE 5.7-3 (Cont'd)

AOG Charcoal Adsorber System Effluent (AOG-R1-103)	General Atomics	10^{1}-10^{7} cpm
Hardened Wetwell Vent	General Atomics (Sorrento)	10^{-4}-10^{5} µCi/cc

TABLE 5.7-4

TYPICAL PORTABLE SURVEY EQUIPMENT

Type	Range	Type Of Radiation Measured
Teletector	0.1 mRem/hr-1000 Rem/hr	γ
Eberline RM-14 Radiation Monitor	0 - 50,000 cpm	β,γ
Ludlum Model 177	0 - 500,000 cpm	β,γ
R07	1 mr/hr - 20,000 R/hr	β,γ
AMP-100	1 mr/hr - 1000R/hr	γ
AMP-200	100 mr/hr - 18K R/hr	γ
R02	0 - 5000 mr/hr	β,γ
R02A	0 mr/hr - 50 R/hr	β,γ
R020	0 mr/hr - 50 R/hr	β,γ
BICRON Micro Rem	0 - 200,000 μr/hr	γ
ASP-1 With Neutron Ball	0 - 100 Rem/hr	n
Ludlum Model 12 With Neutron Ball	0 - 10 Rem/hr	n
E530N	0 mrem/hr - 20 R/hr	γ

6.0 MAINTAINING EMERGENCY PREPAREDNESS

Emergency preparedness at Brunswick will be maintained by (a) preparing the emergency organization members and the public for proper emergency response actions through training, drills and exercises, and public education programs (Section 6.1); (b) periodic review and update of the Brunswick Radiological Emergency Plan and its implementation procedures (Section 6.2); (c) periodic inventory and calibration of emergency equipment and instrumentation (Section 6.3); and (d) cognizance of the Plant Nuclear Safety Committee over safety-related issues (Section 6.4).

The Supervisor - Emergency Preparedness is the Emergency Planning Coordinator and is responsible for maintaining Emergency Preparedness at the Brunswick Nuclear Plant, as outlined in Section 6.1.3.

Each periodic requirement in this section and elsewhere in the plan and plant emergency procedures shall be performed within the specified time below:

a. Annually - At least once per 366 days

b. Monthly - At least once per 31 days

c. Quarterly - At least once per 92 days

d. Semiannually - At least once per 184 days

For the above intervals, a maximum allowable extension is permitted subject to the following restrictions:

- The maximum allowable extension shall not exceed 25% of the specified interval.
- The combined time interval for any three consecutive intervals shall not exceed 3.25 times the specified interval.

This definition for periodic requirements applies to all intervals in the emergency plan and plant emergency procedures except for the evaluated exercise which is conducted once every two calendar years, and off-site training which is conducted once per calendar year.

6.1 ORGANIZATIONAL PREPAREDNESS

Organizational preparedness is maintained through an integrated training program that includes general orientation of all persons at the site and detailed training of individuals and groups required to perform specific functions and actions during an emergency condition. The training program provides initial training and annual retraining of the emergency response organization. Significant changes in the content of this Plan and procedures which implement this Plan are distributed by memorandum to the appropriate plant groups.

6.1.1 Training

The primary objectives of the training program are to:

1. Familiarize appropriate individuals with the Plan and the procedures that implement the Plan.

2. Instruct assigned individuals and their alternates in their duties and responsibilities.

3. When appropriate, train on significant changes in the scope or contents of the Plan or procedures which implement the Plan.

4. Provide annual refresher training and retesting to ensure that Emergency Plan personnel are familiar with their duties and responsibilities assigned by the Plan and procedures which implement the Plan.

Each individual, other than escorted personnel, is provided with initial orientation training on the notification and instruction methods used at the Brunswick plant in the event of an emergency.

Each badged individual, other than escorted personnel, also receives initial orientation on the basic principles of radiological safety including the effects of radiation and the theory and use of radiation detection devices. Appropriate actions for escorted individuals shall be the responsibility of the escort.

The Emergency Plan Training Program described in 0PEP-04.3 assures training of those individuals who may be called to respond to an emergency at the Brunswick plant by providing initial training and annual refresher training and retesting on the scope and content of the Plan and procedures which implement the Plan.

The Emergency Plan Training Program provides training for the following groups of personnel to perform the specific tasks assigned to them in the emergency organization.

Site Emergency Coordinator
TSC Staff Personnel
Security Personnel
Fire Brigade Personnel
Dose Projection Personnel
Radiological Emergency Teams
Emergency Communicators
EOF Personnel
OSC Personnel
JIC Personnel
Plant Operators
Off-site groups who may be requested to assist in an emergency.

Training of off-site organizations is described in their radiological emergency plans. Training by Progress Energy for hospital, ambulance, rescue, police, and fire personnel will include the procedures for notification, basic radiation protection, and their expected roles. For those local services support organizations who may enter the site, training by Progress Energy will also include site access procedures and the identity (by position and title) of the individual in the Brunswick organization who will control the organization's support activities. Progress Energy will assist these off-site organizations in performing their radiological emergency response training as related to the Brunswick plant.

Progress Energy, and the public information officials from the state and local governments will jointly make available an annual program to acquaint the news media with the company, state and county emergency plans and procedures. The program also includes information concerning radiation, nuclear plant operations and official points of contact for release of public information.

Severe Accident Management training and drills will be conducted in accordance with Severe Accident Management Program and Training Procedures.

6.1.2 Drills and Exercises

This section describes provisions for conducting periodic drills and exercises to test the adequacy of the Plan and implementing procedures, emergency equipment, and the preparation and training of emergency personnel.

Each exercise scenario will include the following:

1. The basic objective(s) of the exercise.

2. The date(s), time period, place(s), and participating organizations.

3. The simulated events.

4. A time schedule of real and simulated initiating events.

5. A narrative summary describing the conduct of the exercises to include such things as simulated casualties, off-site fire or police department assistance, rescue of personnel, use of protective clothing, deployment of radiological monitoring teams, and public information activities.

6. Arrangements for qualified observers.

6.1.2.1 Drills

Emergency drills are supervised instruction periods aimed at testing, developing and maintaining skills, and to ensure that adequate emergency response capabilities are maintained during the interval between evaluated exercises. Periodic drills will be conducted, in addition to the evaluated exercise as follows:

1. General: At least one drill shall be conducted during the interval between evaluated exercises involving a combination of some of the principal functional areas of the organization's onsite emergency response capabilities. The principal functional areas of emergency response include activities such as

management and coordination of emergency response, accident assessment, protective action decision making, and plant system repair and corrective actions. During these drills, activation of all of the emergency response facilities (Technical Support Center (TSC), Operations Support Center (OSC), and the Emergency Operations Facility (EOF)) is not necessary. Participants have the opportunity to consider accident management strategies, supervised instruction is permitted, and participants have the opportunity to resolve problems (success paths) rather than have controllers intervene. The drills focus on onsite training objectives.

2. Communications Drills: A system to test the readiness of the communications network between the plant and state and county governments within the ten-mile EPZ and the NRC will be conducted monthly. Communications between the plant, federal emergency response organizations, and states within the 50-mile EPZ will be tested quarterly. Communications between the plant and state and local emergency operation centers and field assessment teams shall be conducted annually.

3. Fire Drills: Fire drills will be conducted in accordance with the Fire Protection Program.

4. Medical Emergency Drills: Medical emergency drills involving a simulated contaminated individual will be conducted annually. The actual off-site portions of these drills may be conducted once per calendar year.

5. Radiological Monitoring Drills: Radiological monitoring drills will be conducted annually. These drills will include collection of the appropriate sample media both on site and off site as the drill scenario requires.

6. In-Plant Radiation Protection Drills: Radiation protection drills, including response to and analysis of simulated elevated airborne and liquid samples and direct radiation measurements will be conducted semiannually. This may be held in conjunction with the Radiological Monitoring Drills.

7. Augmentation drills: Augmentation drills requiring travel to the site shall be conducted once every 24 months.

8. SAMG drills: Severe Accident Management Guideline table-top and/or inter-facility mini-drills will be conducted periodically and will involve a combination of some of the principal functional areas of the organization's onsite emergency response capabilities similar to that described in General drills (6.1.2.1.1) above.

The above drills will be evaluated by a drill observer (communication drills will not require an observer). The degree of participation by outside agencies in conducting these drills may vary and their action may actually be simulated. Any state or local government located within the plume exposure pathway EPZ will be allowed to participate in the drills when requested by such State or local government.

6.1.2.2 Exercises

An exercise is an event that tests the integrated capability of major response organizations. An emergency exercise will be conducted once every two calendar years and will be based on a scenario which is ultimately declared at least as a Site Area Emergency. The scenario will be varied from exercise to exercise such that all elements of the plant, county, and state plans and emergency organizations are tested within a 6-year period. Each organization should make provisions to start an exercise between 6:00 p.m. and 4:00 a.m. Every sixth year, the exercise will be expanded to allow involvement of the federal response organizations in addition to the state and local organizations. Advance knowledge of the scenarios and the times of the exercises will be kept to a minimum to ensure a realistic participation by those involved.

Each exercise scenario will include a list of performance objectives and a description of the expected responses. Specific tasks to be evaluated are:

1. Condition recognition and reporting
2. Assessment
3. Off-site notification, including Progress Energy off-site personne
4. Off-site response
5. Site response coordination, including logistics, center manning, information gathering and analysis, and coordination with off-site agencies
6. Corrective actions
7. Protective actions
8. Record keeping
9. Monitoring
10. Plant operation

Qualified observers from Progress Energy, federal, state, or local governments will observe and critique each exercise. A critique will be scheduled at the conclusion of each exercise to evaluate the ability of all participating organizations to respond. The critique will be held as soon as possible after the exercise. A formal written evaluation of the exercise will be prepared by the Emergency Planning Coordinator, or his designee, following the critique.

Exercise controllers, observers, and participants (if appropriate) will prepare written descriptions of the actions they observed and will comment as to how the part of the exercise they observed matched the performance criteria. The Emergency Planning Coordinator or his designee will determine the corrective actions necessary and the schedules for performing them and will evaluate the corrective actions taken.

Remedial exercises will be required if the emergency plan is not satisfactorily tested during the biennial exercise, such that NRC, in consultation with FEMA, cannot find reasonable assurance that adequate protective measures can be taken in the event of a radiological emergency. The extent of State and local participation in remedial exercises must be sufficient to show that appropriate corrective measures have been taken regarding the elements of the plan not properly tested in the previous exercises.

6.1.3 Emergency Planning Coordinator

The Supervisor - Emergency Preparedness is the Brunswick Emergency Planning Coordinator. He is responsible for coordinating on-site and off-site radiological emergency response planning. Specific responsibilities include the following:

1. Interfacing with federal, state, county, and local planners.

2. Revising and updating the Plan in response to new federal regulations, modifications identified during exercises and drills, and changes in hardware and personnel.

3. Coordinating the evaluated exercise and the periodic drills.

4. Identifying off-site training needs of state and local emergency support personnel and arranging for training to meet the identified needs.

5. Identifying corrective actions needed following an exercise, assigning responsibility for implementing these actions, specifying a schedule for completion of these actions, and evaluating the adequacy of the actions taken. These corrective actions can be tracked by means of the Corrective Action Program.

6. Maintaining and negotiating agreements with state and county response agencies, federal assistance agencies, and medical and fire support agencies.

6.1.4 Public Education

The North Carolina Department of Crime Control and Public Safety has overall responsibility for maintaining a continuing disaster preparedness public education program. Such a program, prepared by the State of North Carolina, with the cooperation of local governments and Progress Energy, is intended to ensure that members of the public are:

(1) Aware of the potential threat of a radiological emergency;

(2) Able to recognize radiological emergency notification; and

(3) Knowledgeable of the proper, immediate actions (e.g., return to home, close windows, and tune to an Emergency Alert System station) to be taken.

A program of this type includes education on protective actions to be taken if shelter is prescribed, and the general procedures to follow if an evacuation is required. It also includes general educational information on radiation and how to learn more about emergency preparedness.

Additional information concerning public education can be found in Section 4.4.7.

6.2 REVIEW AND UPDATE OF THE PLAN AND IMPLEMENTATION PROCEDURES

The Plan and its implementation procedures are intended to provide for continuous emergency preparedness. In addition to the training, drills, and exercises, regular reviews and audits are performed. The reviews and audits are described in the following sections.

6.2.1 Plan Updates

The Emergency Planning Coordinator is responsible for coordinating the updating of the Plan and implementing procedures. He schedules an annual review of the Plan by the Plant Nuclear Safety Committee (see Section 6.4). Any proposed changes to the Plan due to regulatory revisions, experiences of drills and exercises, or other requirements are approved by the Supervisor - Emergency Preparedness. Approved changes to the Plan will be distributed to organizations and individuals with responsibility for implementation of the Plan. Phone listings in emergency procedures shall be updated quarterly, if required.

6.2.2 Independent Review

In addition to the reviews conducted at the plant, the Nuclear Assessment Section will conduct an independent review of the Plan either:

At intervals not to exceed 12 months or,

As necessary, based on an assessment by the licensee against performance indicators, and as soon as reasonably practicable after a change occurs in personnel, procedures, equipment, or facilities that potentially could adversely affect emergency preparedness, but no longer than 12 months after the change. In any case, all elements of the emergency preparedness program must be reviewed at least once every 24 months.

The review will include an evaluation for adequacy of interfaces with State and local governments and of drills, exercises, capabilities, and procedures. The results of the review, along with recommendations for improvements, will be documented, reported to the Corporate office and plant management, and retained for a period of five years. The part of the review involving the evaluation for adequacy of interface with the State and local governments will be available to the appropriate State and local governments. Corrective actions deemed necessary from the review will be implemented similar to the description in Section 6.1.3.5 of this Plan and the site Corrective Action Program.

6.2.3 Off-Site Agreements and Plans

Emergency response plans and agreements with supporting organizations will be reviewed and certified to be current on an annual basis and updated, if necessary. Changes will be incorporated in the annual revision of the Plan.

6.3 MAINTENANCE AND INVENTORY OF EMERGENCY EQUIPMENT AND SUPPLIES

To ensure that equipment and supplies are maintained in a readiness state, periodic maintenance and inventories are performed as described in the following sections.

6.3.1 Emergency Equipment and Supplies

A listing of emergency equipment and supplies to be inventoried is included in 0PEP-04.6. This listing provides information on location and availability of emergency equipment and supplies.

An inventory of emergency equipment and supplies is held in accordance with 0PEP-04.6. During this inventory, radiation monitoring equipment is checked to verify that required calibration and location are in accordance with the inventory lists. Respiratory protection equipment, maintained for emergency purposes, is also inspected and inventoried.

6.3.2 Medical Equipment and Supplies

At least twice each year and after use in an emergency, the contents of emergency medical equipment and supplies located in the First Aid Office is to be inventoried, inspected, replaced, replenished and/or resterilized as necessary. Company personnel inspect and inventory emergency medical supplies required to support a medical emergency at the plant.

6.4 PLANT NUCLEAR SAFETY COMMITTEE

The Plant Nuclear Safety Committee (PNSC) is a standing committee comprised of Brunswick plant personnel that provides timely and continuing review of plant operations to assist the Plant General Manager in maintaining cognizance of plant activities, with particular emphasis on safety-related matters.

The PNSC reviews all changes to the plant, or its documentation, that involve unreviewed safety questions. In addition, the PNSC reviews plant operations to detect any potential safety hazards. Each plant supervisor will monitor the activities within his areas of responsibility to detect unsafe practices, trends, or hazards. Also, the PNSC investigates and reports on Technical Specification violations or other situations involving safety.

7.0 RECOVERY

7.1 GENERAL

Once the Site Emergency Coordinator has declared that the emergency condition has passed, steps will be taken to recover from the incident. The Emergency Response Manager will advise appropriate organizations that recovery activities are initiated and that the Recovery Organization as shown in Figure 7.2.1 will be assembled in the EOF. All recovery actions will be preplanned in order to minimize radiation exposure or other hazards to recovery personnel. Recovery activities are classified as described in Section 7.3.

The overall goals of the recovery effort are to assess the radiological consequences of the emergency and perform cleanup and repair operations necessary to restore normal access to the affected areas or identify and restrict access to those areas that must be controlled. This effort includes marshaling of the Corporate resources and interfacing with outside agencies.

7.2 RECOVERY ORGANIZATION

The recovery organization consists of the Recovery Manager, managers of support functions who are responsible to the Recovery Manager, and supporting personnel. This organization may be modified during the recovery process to better respond to the conditions at the plant. Recovery activities will be directed from the Recovery Center.

The Recovery Center at Brunswick will be established in the existing TSC/EOF/Training Building. Provisions have been made for expansion into the BNP Technical and Administration Center (TAC Building), if required to support an extensive recovery effort.

Activation of the recovery organization will be initiated by the Vice President - Brunswick Nuclear Plant (or his alternate) after consultation with the Plant General Manager (or his alternate). The recovery organization will then be established at Brunswick to provide for recovery of the facility. The recovery organization may begin to develop plans for recovery of the facility while the emergency is still in progress. However, these efforts will not be permitted to interfere with or detract from the efforts to control the emergency situation. During the emergency phases of the incident, the recovery organization resources will be available to assist and provide support for the Site Emergency Coordinator. A block diagram of the typical recovery organization is presented in Figure 7.2-1.

Table 7.2-1 indicates the personnel designated to assume responsibility of each of the activities shown in the block diagram.

7.2.1 Recovery Manager

The Recovery Manager is the senior position responsible for all on-site activities during the recovery phase following a radiological emergency. He is also responsible for providing the primary interface with State, local and Federal agencies including the coordination of Progress Energy resources during off-site recovery efforts. The specific responsibilities of this position are contained in 0PEP-02.7, Recovery.

7.2.2 Plant General Manager

The Plant General Manager is responsible to the Recovery Manager for implementation of in-plant activities during the Recovery phase with the objective of maintaining a safe shutdown condition and controlling sources of radioactivity in the plant. The specific responsibilities of this position are contained in 0PEP-02.7, Recovery.

7.2.3 Technical Analysis Manager

The Technical Analysis Manager, is responsible to the Recovery Manager for technical support, specifically in the analysis and development of plans and procedures to support recovery activities and to maintain the affected unit in a safe shutdown condition in a manner which minimizes the effect on the health and safety of the public. The specific responsibilities of this position are contained in 0PEP-02.7, Recovery.

7.2.4 Engineering Manager

The Engineering Manager, is responsible to the Recovery Manager for directing and administratively controlling the Progress Energy recovery organization engineering staff while providing engineering, including civil, and design support to meet requirements of the recovery activities. The specific responsibilities of this position are contained in 0PEP-02.7, Recovery.

7.2.5 Administrative and Logistics Manager

The Administrative and Logistics Manager, is responsible to the Recovery Manager for providing administrative, logistic, communications, and personnel support for recovery activities. The specific responsibilities of this position are contained in 0PEP-02.7, Recovery.

7.2.6 Radiological Control Manager

The Radiological Control Manager, is responsible to the Recovery Manager for providing radiation protection and waste disposal plans to support recovery activities. The specific responsibilities of this position are contained in 0PEP-02.7, Recovery.

7.3 RECOVERY PLANNING

For convenience in planning, the recovery activities can be classified as follows:

1. On-site recovery
2. Off-site recovery

7.4 ON-SITE RECOVERY ACTIVITIES

On-site recovery activities are performed in accordance with existing plant procedures. Radiation and contamination levels for determining the need for decontamination and for returning areas or items to normal use are included in these procedures. Additional procedures will be developed as appropriate on a case-by-case basis.

7.5 OFF-SITE RECOVERY ACTIVITIES

7.5.1 General

The Progress Energy Recovery Manager will coordinate with and assist off-site agencies in the recovery activities.

The State will be the lead organization for off-site recovery activities and put emergency regulations into effect to ensure that no food items in the contaminated area are consumed or put on the market without the required health physics monitoring, and to control access into contaminated areas. Authorization for reentry to off-site areas will be made by the senior elected official of the area concerned after consultation with the North Carolina Division of Radiation Protection.

7.5.2 Emergency Cleanup Operations

The most urgent tasks will be to clear (i.e., partially decontaminate) emergency paths to allow access to critical facilities and inhabited areas. These clearing operations will be necessary particularly to:

a. Allow health physics teams to survey the contaminated areas,

b. Allow farmers to provide emergency care for livestock that had to be left in contaminated areas or to assist them in moving the stock to uncontaminated areas.

c. Allow emergency operations of utilities and services (power, water, telephone, sewage treatment, etc.) during the cleanup operation, and

d. Allow decontamination teams to perform the emergency and priority decontamination tasks (these emergency tasks will consist primarily of fire-hosing pavements, plowing or scraping unpaved areas adjacent to roads, and spraying paint or asphalt to fix loose contamination in place).

e. Stabilize the contaminated areas so that the radioactive materials are not spread to other areas or leached into streams. In particular, if public roads run through the area, cleanup of the road will be required, and cleanup of the area to some distance from the road will be needed to minimize exposure to travelers.

After the main roads and utilities have been put back into service, the urgency of the cleanup tasks will drop. However, the population that was evacuated will be eager to return, and industrial operations that had to be shut down need to start up as soon as possible, and business operations need to be resumed.

Some farmland may have to be removed from use, which would cause hardship primarily to the occupants. Thus, it may be feasible to permanently evacuate such areas and pay the owner the market value. Such a step would probably occur at contamination levels where future crops would not be marketable due to the uptake of long-lived isotopes (primarily strontium).

Some of the buildings and houses may be contaminated to such a high level that it is more economical to demolish them than to decontaminate them. Areas where this occurs can be kept vacated; in such cases, demolition and burial can be a routine task, and the work can be scheduled over a longer period of time. Decontamination of the agricultural land may or may not be feasible. Where it is feasible, the changes in agricultural operations that are required can be made on a routine basis.

7.5.3 Countermeasures*

Countermeasures will have serious impact on the economy of contaminated areas, so they must be applied judiciously. They must be no more restrictive than necessary; however, once determined, they will be applied quickly and equitably, and may consist of:

a. Reducing contamination on the surface of any fruits and vegetables that were in the field at the time of the accident by ensuring that the surfaces are washed, that the outer leaves of leafy vegetables are removed, and that more than normal preference is given to peeling.

* J. A. Auxier and R. O. Chester, eds., Report of the Clinch Valley Study, ORNL-4835 (January 1973).

b. Altering production, processing, or distribution practices that affect the movement of radioactive contamination through food chain and into the human body. This will include storage of some food (primarily milk products) and animal feed supplies to allow radioactive decay–particularly of Iodine 131.

c. Diverting affected products to uses other than human consumption.

d. Condemning food.

e. Decontaminating farmland where practical.

f. Converting farmland to other uses for extended periods of time when decontamination is not practical.

g. Decontaminating industrial buildings, stores and shops, and residences and removing milk-producing cattle from the contaminated pastures should be priority items. The longer these activities are delayed, the greater will be the costs and consequently the claims.

7.5.4 Monitoring and Dose Assessment

The North Carolina Division of Radiation Protection (DRP), Department of Environment Health and Natural Resources, will be the lead agency in the collection and analysis of radiation monitoring reports and of environmental air, foliage, food, and water samples. The DRP will be assisted by qualified personnel from the BNP, and the General Electric Company Wilmington Manufacturing Division.

Total population exposure will be periodically determined through a variety of procedures including:

a. Examination of prepositioned TLDs.
b. Bioassy.
c. Estimates based on release rates and meteorology.
d. Estimates based on environmental monitoring of food, water, and ambient dose rates.

TABLE 7.2-1
DESIGNATION OF KEY RECOVERY ORGANIZATION PERSONNEL

Recovery Manager:

1. Vice President - Brunswick Nuclear Plant
2. Director - Site Operations

Plant General Manager:

1. Brunswick Plant General Manager

Technical Analysis Manager:

1. Manager - Regulatory Affairs

Engineering Manager:

1. Manager - Brunswick Engineering Support

Manager - Administrative and Logistics:

1. Manager - Site Support Services

Radiological Control Manager:

1. Manager - E&RC

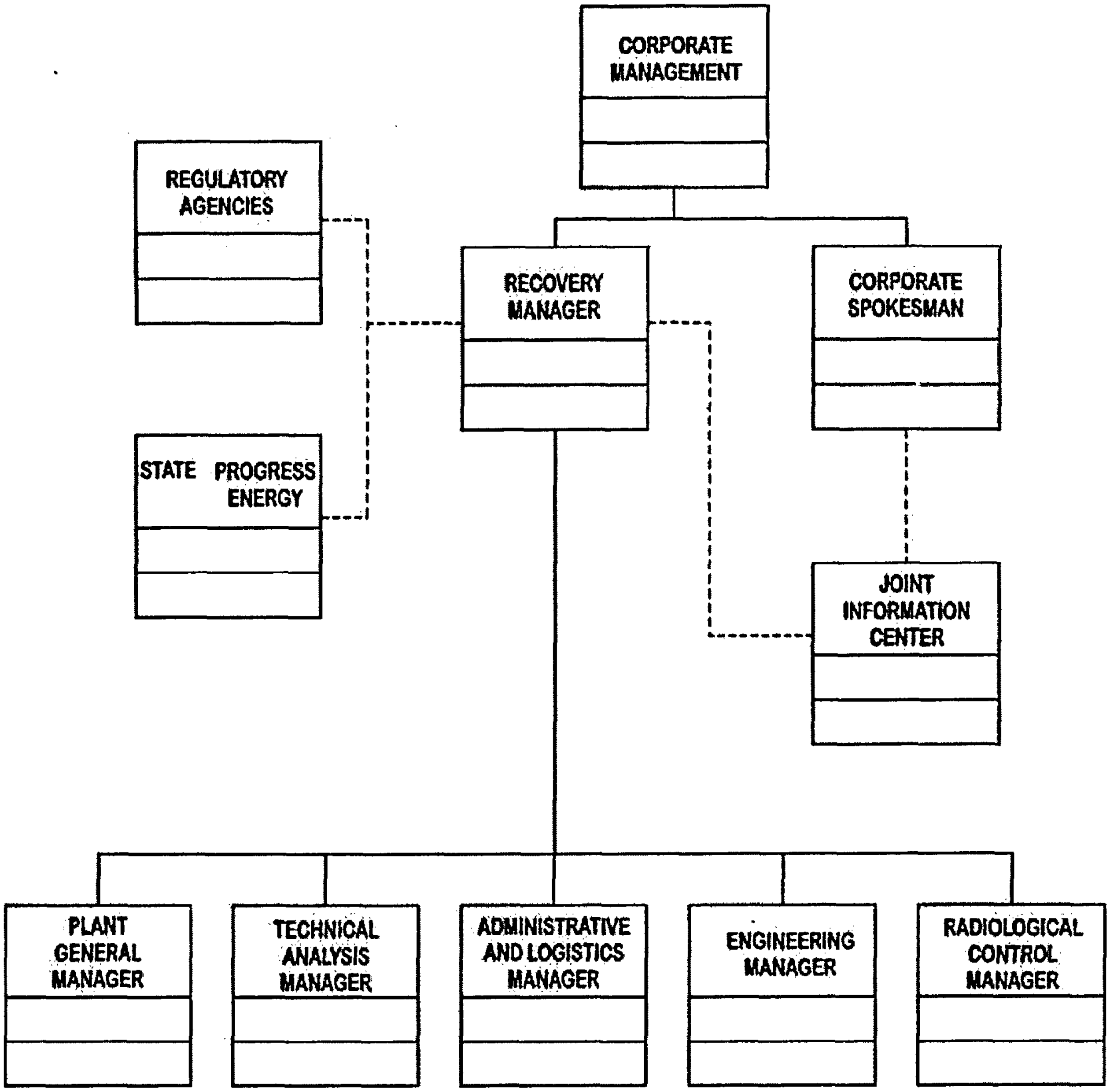

FIGURE 7.2.1 Progress Energy Recovery Organization

8.0 REFERENCES

1. Brunswick Steam Electric Plant Operating Manual, Carolina Power & Light Company, (date varies by volume and by entry).

2. NGGM-PM-0002, Progress Energy Radiation Control and Protection Manual.

3. Updated Final Safety Analysis Report (FSAR), Progress Energy, Brunswick Steam Electric Plant Units 1 and 2.

4. Environmental and Fallout Gamma Radiation Protection Factors Provided By Vehicles, Health Physics, 26, Pg. 41-44, 1974.

5. EPA-400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, U. S. Environmental Protection Agency, May 1992.

6. Brunswick Nuclear Power Plant Evacuation Time Estimates Update For The Plume Exposure Pathway Emergency Planning Zone, November 2002. PBS&J.

7. North Carolina Emergency Response Plan in support of the Brunswick Steam Electric Plant.

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

9. 1990 Census data as reported by the State of North Carolina, Office of State Planning, Center for Geographic Information and Analysis.

10. NUREG-0737, Supplement 1, Clarification of TMI Action Plan Requirements.

11. NUREG/CR-1433, Examination of the Use of Potassium Iodide (KI) as an Emergency Protective Measure for Nuclear Reactor Accidents, March 1990.

12. Title 10, Code of Federal Regulations.

    a. Part 20, Standards for Protection Against Radiation
    b. Part 50, Licensing of Production and Utilization Facilities
    c. Part 50, Appendix E, Emergency Plans for Production and Utilization Facilities
    d. Part 100, Reactor Site Criteria

13. NEI 91-04, Rev. 1, Severe Accident Issue Closure Guidelines

14. Memo, Warren Dorman to PNSC, dated August 11, 1999 Subject Operations Shift Staffing

15. Brunswick Steam Electric Plant, Units 1 and 2 - Issuance of Amendments No. 226 and 253, Elimination of Requirements for Post Accident Sampling System (Docket Nos. 50-325 and 50-324), February 11, 2003.

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16. SOER 02-1, Severe Weather Rec. 3 (12/03/02)

APPENDIX A

BRUNSWICK COMMUNICATIONS SYSTEM

A.0 INTRODUCTION

Communications systems are designed to facilitate emergency communications within the Brunswick Plant and between Brunswick and emergency facilities. Redundant means of communication are provided to locations which provide a vital emergency response role.

A.1 PLANT COMMUNICATION SYSTEMS

A.1.1 Public Address System

The Brunswick Plant public address system provides paging and party line communications between stations located throughout the plant. Inside and outside type wall and desk-mounted stations are used to communicate between roaming personnel and fixed work locations. Plant-wide instructions are issued using the paging feature. This system is powered from the plant uninterruptible power supply which employs battery reserve as well as diesel generator emergency supply.

A.1.2 PBX Telephone System

The Brunswick Site PBX telephone system provides communication capability between telephone stations located within the plant by dialing the four-digit telephone station code. The PBX telephone system also provides for outside communications as discussed in Sections A.2.1 and A.2.2.

A.1.3 Sound Powered Telephone System

The sound powered telephone system is a communications system which uses the mechanical energy in the human voice to generate electrical pulses to power the system. It requires no outside source of power and is therefore very reliable. The system consists of phone jacks, wiring, and the sound-powered handsets. There is no separation in the circuits. A handset plugged into a jack is connected to all other handsets plugged into that circuit. Additional temporary circuits may be easily set up by attaching phone jacks to any unused cable between any points requiring sound-powered communications. Sound powered phone jacks are provided on selected instrument racks. Switch panels are provided in the control room to cross-tie any circuit with any other circuit providing sound-powered phone communications between several plant areas.

A.1.4 Radio Transceivers for Brunswick and Vicinity

VHF transceivers are used for point-to-point communications in the plant vicinity using state frequencies. Control stations are located in the TSC and EOF to talk with mobile and portable units. A primary and secondary source of power is provided for fixed base radio, with portable and mobile units powered by battery.

A.1.5 Brunswick Emergency Telephone and Radio System

The Brunswick Site emergency telephone system consists of dedicated telephone lines between emergency facilities at the Brunswick Plant through a switch which is provided with a primary and secondary source of power (ROLM 4000 series). Radio communications with mobile and portable units reserved for an emergency is possible through a repeater on a Progress Energy-assigned frequency as well as a local (UHF) short-distance frequency. A primary and secondary source of power is provided for fixed radio equipment, with mobiles and portables powered by battery.

A.1.6 Plant Security Communications

A portable radio communication system for plant use is available. Specific channel assignments are designated for security force use.

A.1.7 Emergency Response Facility Information System (ERFIS)

During an emergency, this system provides information on a Video Display Terminal simultaneously in the control room, the Technical Support Center, and the Emergency Operations Facility. The data may also be printed out in hard- copy form. Primary and secondary power sources are supplied to this system.

A.1.8 Satellite Telephone Communications

This system consists of a briefcase enclosed portable, AC, DC, or battery powered satellite link telephone. This telephone has the capability to be connected with a fixed remote antenna or use the briefcase portable antenna with access to either of two geosynchronous communication satellites.

A.2 OFF-SITE COMMUNICATIONS SYSTEMS

A.2.1 Corporate Telephone Communications System (Voicenet)

Interconnected through the site PBX and the emergency telephone system, the corporate telephone system provides a means to communicate with other corporate locations with which the plant has a need to communicate. Corporate transmission facilities provide fiber optic, copper-wire, and microwave radio to ensure a high degree of system reliability. In addition to the redundancy provided by the three system options, backup power is provided for the systems.

A.2.2 Commercial Phone Lines

Commercial telephone lines, which supply public telephone communications, are employed by Progress Energy in three ways: (1) tie-ins through the PBX to any other plant location, (2) lines to plant emergency facilities, and (3) lines to the Joint Information Center for public information purposes. Bell South provides primary and secondary power for their lines at the Central Office.

A.2.3 Dedicated Telephone System to Load Dispatcher

This system provides direct links between the Control Room and the load dispatcher. Transmission facilities are microwave radio. These lines appear on several phones in the Control Room and are selected by pushing the appropriate button on a multibutton phone. The lines are automatically rung at the load dispatcher identifying Brunswick as the caller. Primary and secondary power is supplied at both ends.

A.2.4 Emergency Communications Network

The Emergency Communications Network is a system, separate from other communications systems, which provides back-up dedicated telephone and radio facilities between emergency response centers. The purpose of these facilities is to ensure priority communications at any time from Brunswick Plant to emergency response personnel at the federal, state, local governments, and other Progress Energy facilities, and General Electric Company.

A.2.5 Plant Security

A plant security radio control station provides for radio communications to local law enforcement agencies (LLEA). Primary and secondary power is supplied.

A.2.6 Corporate Informational Data Communications

Large central computers are located at the Corporate headquarters. Smaller special purpose computers are located at other Corporate facilities, including the Brunswick Plant. The communications link between the Brunswick Plant and Corporate headquarters allows the interchange, storage, and processing of information.

A.2.7 NRC Emergency Telecommunications System

The NRC uses a Progress Energy dedicated telephone line which allows direct telephone communications from the plant to NRC regional and national offices. The Progress Energy communications line provides a link independent of the local public telephone network. Telephones connected to this network are located in the Brunswick Control Room, Technical Support Center, and Emergency Operations Facility. There are also telephones connected to this system for use by Health Physics personnel. Primary and secondary sources of power are supplied.

Appendix B
AGREEMENTS

NOTE: Existing agreements are included for this submittal. These agreements will be revised as required to be consistent with this revision of the Plan.

City of Southport
201 East Moore Street
Southport, North Carolina 28461

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the City of Southport and Southport Fire Department's (hereafter identified as Fire Department) understanding and agreement to provide assistance in the event of an accident or emergency at the Brunswick Nuclear Plant. Specifically, we agree to be familiar with the Brunswick Emergency Plan and understand that:

1. This agreement shall take effect on July 1, 1987. Either party may terminate this agreement at any time upon six months written notice to the other party.

2. The Fire Department shall be available to fight fires at the Brunswick Plant upon request by Progress Energy, including fires where radioactivity may be present. However, in any situation where radioactivity may be present, the BNP Shift Incident Commander shall first consult with the Chief Officer of the Southport Fire Department concerning the situation before sending any of the Fire Department into an area where radioactivity may be present. After consultation the Chief Officer of the Fire Department will comply with the Brunswick Shift Incident Commander's request and shall issue the command to his personnel with respect to his department's safety.

3. In the event that the Fire Department is unavailable to respond to Progress Energy's request due to other calls or fire fighting activities, it will incur no liability to Progress Energy for failure to respond to said call.

4. The Fire Department will be under the direction of the BNP Shift Incident Commander who shall issue commands to the personnel of the Fire Department through its Chief Officer. Should it be necessary for more than one fire company to assist in the fighting of a fire at BNP, the Fire Department will assume responsibility as the lead fire company.

5. In the event of possible radioactive contamination of the Fire Department personnel and/or equipment, qualified Progress Energy personnel will provide Fire Department personnel with appropriate monitoring or protective devices prior to engaging said personnel in a radioactive situation to ensure that the radiation level is not unreasonably dangerous.

6. In the event of a chemical fire at BNP, proper clothing will be provided by Progress Energy to Fire Department personnel prior to engagement in fire fighting.

7. Progress Energy shall provide the Fire Department personnel with all necessary instructions and training to enable the Fire Department personnel to engage in fire fighting at BNP. Fire Department personnel agree to participate in said training and in all training exercises and drills. In addition, Progress Energy shall not request Fire Department personnel to engage in fighting of a chemical fire or in a fire where radioactivity may be present prior to any additional instruction or training of Fire Department personnel necessary to qualify them to engage in such activities. Both Progress Energy and the Fire Department personnel shall cooperate with each other in arranging for the instruction and training of the Fire Department personnel necessary to qualify them to engage in such activities. Both Progress Energy and the Fire Department personnel shall cooperate with each other in arranging for instruction and training exercises.

8. Any contaminated articles belonging to the Fire Department or its personnel, including fire trucks, will be adequately decontaminated or replaced by Progress Energy at its own expense as expeditiously as possible.

9. Progress Energy shall be liable to the Fire Department personnel for any radiation injury sustained by said personnel at BNP and shall provide nuclear insurance to cover the Fire Department personnel while engaged in fire fighting at BNP.

10. Progress Energy shall retain the right to periodically inspect, calibrate, and ensure operability of any equipment that may be furnished the Fire Department in order to enhance the performance of the support functions.

11. The Fire Department shall furnish and make available to the Fire Department personnel a procedure manual for assisting the BNP Fire Brigade.

12. As compensation for services provided herein by the Fire Department, Progress Energy shall pay to the City of Southport the sum of $12,000 per year payable on or before December 31, 1987, and each year thereafter.

Sincerely,

(Signature on File)
Norman Holden
City of Southport
Mayor

(Signature on File)
Gregg Cumbee
City of Southport
Fire Chief

TG / TG

SPFD LOA

James R. Forstner, M.D.
4654 Long Beach Road
Southport, North Carolina 28461

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges that I, James R. Forstner, M.D., understand and agree to provide medical supervision and care for employees of the Brunswick Nuclear Plant as requested by responsible plant management personnel.

I am familiar with. the Brunswick Emergency Plan and appropriate implementing procedures and understand that injuries might involve ionizing radiation.

I will provide said medical supervision and treatment within the limitations of my training.

Sincerely,

(Signature on File)
James R. Forstner, M.D.

TG / TG

JR Forstner MD LOA

Peter D Almirall, M.D.
307 Yaupon Drive
Yaupon Beach, North Carolina 28465

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges that I, Peter D. Almirall, M.D., understand and agree to provide medical supervision and care for employees of the Brunswick Nuclear Plant as requested by responsible plant management personnel.

I am familiar with the Brunswick Emergency Plan and appropriate implementing procedures and understand that injuries might involve ionizing radiation.

I will provide said medical supervision and treatment within the limitations of my training.

Sincerely,

(Signature on File)
Peter D. Almirall, M.D.

TG / TG

PD Almirall MD LOA

J.Arthur Dosher Memorial Hospital
924 Howe Street
Southport, North Carolina 28461

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Project
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the J. Arthur Dosher Memorial Hospital's understanding of, and agreement with, actions to be taken in the event of an accident or emergency at the Brunswick Nuclear Project (BNP). Specifically, we are familiar with the BNP Emergency Plan and understand that:

1. A specially designed radiological emergency area will be maintained in state of readiness for use in the event that an accident or injury complicated by possible radiation exposure occurs to your employees. The Dosher Memorial Hospital will admit a patient from the specially designated area for further care if recommended by the supervising physician.

2. In the event of a serious radiation accident, the Hospital will assist in the transfer of patients to the New Hanover Regional Medical Center in Wilmington for further treatment.

3. A Progress Energy representative will be responsible for decontamination of the equipment that is used in treating/decontaminating the person(s) and will replace all hospital equipment that cannot be decontaminated.

4. Adequate instruction of the Medical staff to maintain familiarity with the procedure will be provided by Progress Energy.

5. Disposable articles, such as hats, mask, gowns, and floor coverings, will be provided by and disposed ofby Progress Energy.

Copies *of* the Hospital's Plan and Procedures for the care and treatment of radiologically injured or contaminated patients are kept readily available for use by Hospital employees who will direct the necessary actions.

Sincerely,

(Signature on File)
Edgar Haywood
Administrator
J. Arthur Dosher Memorial Hospital

TG / TG

JADMH LOA

City of Southport Rescue Squad
Southport, North Carolina 28461

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the Southport Rescue Squad understands and agrees to provide medical assistance in the event of an emergency at the Brunswick Nuclear Plant. Specifically, we are familiar with the Brunswick Emergency Plan and understand that:

1. We may be required to transport a patient who is radioactively contaminated.
2. In the event of possible radioactive contamination, qualified Progress Energy personnel will provide Southport Rescue Squad personnel with appropriate monitoring or protective devices.
3. Adequate instructions will be provided by Progress Energy to the Southport Rescue Squad staff to maintain familiarity with the necessary procedures.
4. Any contaminated articles belonging to the Southport Rescue Squad, including the ambulance, will be adequately decontaminated or replaced by Progress Energy as expeditiously as possible.

Copies of the Southport Rescue Squad's procedures for assisting Progress Energy personnel are kept readily available for use by the Southport Rescue Squad personnel.

Sincerely,

(Signature on File)
Douglas A. Ledgett
Chief
Southport Rescue Squad

(Signature on File)
Rob Gandy
City Manager
City of Southport

TG / TG

SRS LOA

Yaupon Beach Volunteer Fire Department
518 Yaupon Drive
Oak Island, North Carolina 28461-0429

February 6, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 2846-0429

Dear Mr. Atkinson,

This letter acknowledges the Yaupon Beach Volunteer Fire Department's understanding and agreement to provide assistance in the event of an emergency at the Brunswick Nuclear Plant. Specifically, we agree to be familiar with the Brunswick Emergency Plan and understand that:

1. Yaupon Beach Volunteer Fire department will be available to fight fires where radioactivity may be present.

2. Should it be necessary for more than one fire department to assist in the fighting of a fire at Brunswick, the Southport Fire department will assume responsibility as lead fire company under the direction of the Brunswick Site Incident Commander.

3. In the event of possible radioactive contamination, qualified Progress Energy personnel will provide Yaupon Beach Volunteer Fire department personnel with appropriate monitoring or protective devices

4. Adequate instruction of the Yaupon Beach Volunteer Fire Department staff to maintain familiarity with the necessary procedures will be provided by Progress Energy.

5. Any contaminated articles belonging to the Yaupon Beach Volunteer Fire Department. including the fire truck, will be adequately decontaminated or replaced by Progress Energy as expeditiously as possible.

Sincerely,

(Signature on File)
James C. Criscoe
Fire Chief
Yaupon Beach Volunteer Fire Department

TG / TG

YBVFD LOA

Boiling Springs Lakes Fire Department
Boiling Springs Lakes
Southport, North Carolina 28461-0429

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the Boiling Springs Lakes Fire Department's understanding and agreement to provide assistance in the event of an emergency at the Brunswick Nuclear Plant. Specifically, we agree to be familiar with the Brunswick Emergency Plan and understand that:

1. Members of the Boiling Springs Lakes Volunteer Fire Department may be requested to fight fires where radioactivity may be present.

2. Should it be necessary for more than one fire department to assist in the fighting of a fire at Brunswick, the Southport Fire department will assume responsibility as lead fire company under the direction of the Brunswick Site Incident Commander.

3. In the event of possible radioactive contamination, qualified Progress Energy personnel will provide Boiling Springs Lakes Fire Department personnel with appropriate monitoring or protective devices.

4. Adequate instruction of the Boiling Springs Lakes Fire Department staff to maintain familiarity with the necessary procedures will be provided by Progress Energy.

5. Any contaminated articles belonging to the Boiling Springs Lakes Fire Department, including fire apparatus, will be adequately decontaminated or replaced by Progress Energy as expeditiously as possible.

Sincerely,

(Signature on File)
Gary Bullard
Fire Chief
Boiling Springs Lakes Fire Department

TG / TG

BSLFD LOA

January 14, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461

Dear Mr. Atkinson:

This letter is to renew the agreement between Brunswick Nuclear Plant (BNP) and the New Hanover Regional Medical Center and New Hanover Regional Emergency Medical Services. We agree that:

1. J. Arthur Dosher Memorial Hospital is the primary hospital to assist BNP in the event of an accident or medical emergency causing injury/illness to your employees. This letter acknowledges that New Hanover Regional Medical Center (NHRMC) and Cape Fear Hospital (CFH) are available to treat your employees who may become injured and/or contaminated with radioactive and/or other hazardous materials and are transported to the hospital(s). It is requested the New Hanover Regional Medical Center, main campus on 17th Street, be utilized as the primary hospital treatment site. A specifically designated radiological decontamination area will be maintained in a state of readiness. NHRMC will hospitalize persons for further care if recommended by the physician in attendance.

2. A Progress Energy trained representative will be responsible for the decontamination of equipment that is used in treating/decontaminating the person(s) and will expeditiously replace all hospital equipment that cannot be decontaminated.

Copies of your emergency response plan are maintained in the Safety Office at New Hanover Regional Medical Center. As previously agreed, please send all updates to these plans to the Safety Office.

If you have questions or need further assistance, please contact Barbara Bissett, the Director of Emergency Response, Safety Management, and Special Police Services at 343-7084.

Sincerely,

(Signature on File)
Kathleen Gormley
Executive Vice President/CFO

cc: Ed Woodard, Vice President/Chief Emergency Medical Services
Barbara Bissett, Director of Emergency Response, Safety Mgmt & Special Police Services
Ann Marie Tyrell, Director of Emergency Services
Fiscal Services - Contract File

New Hanover Regional Medical Center
P.O. Box 9000 / 2131 S. 17th Street / Wilmington, NC 28402-9000
910-343-7000 / Fax 910-343-7220

Oak Island Fire/EMS
4601 East Oak Island Drive
Oak Island, North Carolina 28465

February 6, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the Oak Island Fire/EMS's understanding and agreement to provide assistance in the event of an emergency at the Brunswick Nuclear Plant. Specifically, we agree to be familiar with the Brunswick Emergency Plan and understand that:

1. Oak Island Fire/EMS will be available to fight fires where radioactivity may be present.

2. Should it be necessary for more than one fire department to assist in the fighting of a fire at Brunswick, the Southport Fire Department will assume responsibility as lead fire company under the direction of the Brunswick Site Incident Commander.

3. In the event of possible radioactive contamination, qualified Progress Energy personnel will provide Oak Island Fire/EMS personnel with appropriate monitoring or protective devices.

4. Adequate instruction of the Oak Island Fire/EMS staff to maintain familiarity with the necessary procedures will be provided by Progress Energy.

5. Any contaminated articles belonging to Oak Island Fire/EMS, including the fire truck, will be adequately decontaminated or replaced by Progress Energy as expeditiously as possible.

Sincerely,

(Signature on File)
Al Essey
Chief
Oak Island Fire/EMS

TG / TG

OIFEMS LOA

Brunswick County EMS
P. O. Box 249
Boliva, North Carolina 28422

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the Brunswick County Emergency Medical Service understands and agrees to provide medical assistance in the event of an emergency at the Brunswick Nuclear Plant. Specifically, we are familiar with the Brunswick Emergency Plan and understand that:

1. We may be required to transport a patient who is radioactively contaminated.

2. In the event of possible radioactive contamination, qualified Progress Energy personnel will provide Brunswick County EMS personnel with appropriate monitoring or protective devices.

3. Adequate instructions will be provided by Progress Energy to the Brunswick County EMS staff to maintain familiarity with the necessary procedures.

4. Any contaminated articles belonging to the Brunswick County EMS, including the ambulance, will be adequately decontaminated or replaced by Progress Energy as expeditiously as possible.

Copies of the Brunswick County EMS procedures for assisting Progress Energy personnel are kept readily available for use by the Brunswick County EMS personnel.

Sincerely,

(Signature on File)
B.A.Watts EMS Division Head
Director
Brunswick County Emergency Services

TG / TG

BCEMS LOA

Sunny Point Fire Department
Military Ocean Terminal - Sunny Point
Southport, North Carolina 28461

February 4, 2003

Mr. Gene Atkinson
Supervisor, Emergency Preparedness
Brunswick Nuclear Plant
PO Box 10429
Southport, North Carolina 28461-0429

Dear Mr. Atkinson,

This letter acknowledges the Sunny Point Fire Department/EMS's understanding and agreement to provide assistance in the event of an emergency at the Brunswick Nuclear Plant. Specifically, we agree to be familiar with the Brunswick Emergency Plan and understand that:

1. Sunny Point Fire Department will be available to fight fires where radioactivity may be present as requested by the Southport Fire Department for assistance.

2. Should it be necessary for more than one fire department to assist in the fighting of a fire at Brunswick, the Southport Fire Department will assume responsibility as lead fire company under the direction of the Brunswick Site Incident Commander.

3. We may be required to transport a patient who is radioactively contaminated.

4. In the event of possible radioactive contamination, qualified Progress Energy personnel will provide Sunny Point Fire Department/EMS personnel with appropriate monitoring or protective devices.

5. Adequate instruction of the Sunny Point Fire Department/EMS staff to maintain familiarity with the necessary procedures will be provided by Progress Energy.

6. Any contaminated articles belonging to the Sunny Point Fire Department/EMS, including the fire truck and ambulance, will be adequately decontaminated or replaced by Progress Energy as expeditiously as possible.

Sincerely,

(Signature on File)
Scott Brown
Chief
Sunny Point Fire Department

TG / TG

SPEMS LOA

APPENDIX C
BRUNSWICK NUCLEAR PLANT (BNP)
OFF-SITE AGENCY SUPPORT SUMMARY

Function (NUREG-0654, II.A)	Primary Responsibility	Support Responsibility
1. Command and Control		
a. Onsite	BNP	NRC
b. Offsite	State, County	FEMA Progress Energy Corp
2. Accident Classification		
a. Onsite	BNP	NRC
b. Offsite	N/A	N/A
3. Warning		
a. Onsite	BNP	Local
b. Offsite	County	State, USCG
4. Notification		
a. Onsite	BNP	Local
b. Offsite	BNP	State, Local, Media
5. Communications		
a. Onsite	BNP	NRC Progress Energy Corp.
b. Offsite	State, County	Commercial Phone Co., Progress Energy
6. Transportation		
a. Onsite	BNP/Employees	Local
b. Offsite	Local/Residents	FEMA, State, County
7. Traffic Control Security		
a. Onsite	BNP Security	County
b. Offsite	County	State
8. Accident Assessment		
a. Onsite	BNP	HEEC, HNP, RNP, NRC, GE, County, Progress Energy Corp., FEMA, EPA, DOE, CAP
b. Offsite	State	

APPENDIX C

BRUNSWICK NUCLEAR PLANT (BNP)
OFF-SITE AGENCY SUPPORT SUMMARY

Function (NUREG-0654, II.A)	Primary Responsibility	Support Responsibility
9. Public Information Education		
a. Onsite	BNP, Corp, Comm.	NRC, County,
b. Offsite	State	Progress Energy Corp., Media, FEMA
10. Protective Response		
a. Onsite	BNP	County Progress Energy Corp.
b. Offsite	County, State	Progress Energy Corp., FEMA, EPA, USDA
11. Radiological Exposure Control		
a. Onsite	BNP	Progress Energy Corp.
b. Offsite	State	County, FEMA, EPA, Progress Energy Corp.
12. Fire and Rescue		
a. Onsite	BNP	County/Local Organ.
b. Offsite	County	State
13. Medical		
a. Onsite	BNP	County/Local Organ.
b. Offsite	Local	State, U.S. DHHS
14. Public Health & Sanitation		
a. Onsite	BNP	State, Local, Progress Energy Corp.
b. Offsite	County	State, FEMA, U.S. DHHS
15. Social Services		
a. Onsite	N/A	N/A
b. Offsite	State	County, Red Cross, Salvation Army
16. Training		
a. Onsite	BNP	NRC,
b. Offsite	County	State, Progress Energy Corp., BNP

17.	Exercises		
	a. Onsite	BNP	Progress Energy Corp., NRC
	b. Offsite	State	State, County, Progress Energy Corp., BNP
18.	Recovery/Reentry		
	a. Onsite	BNP	BNP, RNP, HNP, Progress Energy Corp., NRC, GE, FEMA,
	b. Offsite	State	Local, Progress Energy, DOE, EPA, U.S. DHHS, USDA

Note:

BSEP	Brunswick Steam Electric Plant
CAP	Civil Air Patrol
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMA	U.S. Federal Emergency Management Agency
GE	General Electric
RNP	Robinson Nuclear Plant
HEEC	Harris Energy & Environmental Center
NRC	U.S. Nuclear Regulatory Commission
USCG	United States Coast Guard
USDA	U.S. Department of Agriculture
US DHHS	U.S. Department of Health & Human Services
HNP	Harris Nuclear Plant

<u>APPENDIX D</u>

This Appendix has been superseded by the BNP Emergency Procedures.

APPENDIX E
MEDICAL TREATMENT AND ASSISTANCE

E.1. INTRODUCTION

The Medical Treatment and Assistance Plan provides for several levels of treatment based on the severity of injury and degree of radioactive contamination involved, if any.

The first level of assistance will be given on site in the plant First Aid Office, if possible. In this facility, initial evaluation of the severity of the injury will be made by first-aid and medical personnel, and emergency treatment started. In many cases, it may be possible to provide complete treatment at this location.

Concurrently the degree of radiation exposure and/or contamination will be assessed by radiation safety personnel and decontamination begun. All injuries occurring in a contaminated area will be considered as contaminated until monitored and cleared.

If the severity of the injury requires more extensive or prolonged treatment, the patient can be transported to the second level of assistance located at the Dosher Memorial Hospital where special facilities for treatment of contaminated patients have been provided (see Section E.2.2).

Transfer from any level of assistance to the next higher level will be effected only after medical evaluation (unless the urgency of the patient's condition requires immediate action) and will be under the control of the attending physician or his alternate senior physician.

E.2. MEDICAL EMERGENCIES

E.2.1 ON-SITE FIRST AID FACILITIES

It is anticipated that contaminated personnel will not leave the facility for medical treatment except for cases thought to require immediate hospitalization. Emergency medical treatment of contaminated personnel will be handled at the Plant First Aid Office located in the O&M Building (if possible) by site medical personnel. This includes all injuries thought not to require immediate hospitalization.

E.2.2 HOSPITALIZATION

If emergency medical treatment can best be given at Dosher Memorial Hospital in Southport (or another facility as may be advised by a competent medical authority), the injured person may be transported to Dosher Memorial Hospital. Dosher Memorial Hospital is the primary hospital for treating medical emergencies occurring at the Brunswick Plant, with New Hanover Regional Medical Center being the backup. 0PEP-03.9.3, Transport of Contaminated Injured Personnel, will be followed to prevent the spread of radioactive contamination to off-site areas and facilities. If possible, contaminated clothing and equipment should be removed from the patient, or he should be wrapped in clean sheets or clothing to prevent contamination of the transporting personnel and vehicle.

Medical assistance is immediately available at the Southport area from two general practitioners, both of whom are on the staff of Dosher Memorial Hospital, and who have agreed to provide medical assistance for contaminated patients. Also, the U. S. Department of Energy Radiological Assistance Team will provide medical assistance, if required.

E.2.3 TREATMENT FACILITY

A specially designated emergency area is maintained in readiness at Dosher Memorial Hospital for Progress Energy's use for the treatment of contaminated patients. Although this area will be utilized by the hospital when not required by Progress Energy, it will be made immediately available to Progress Energy when required. Equipment is available in the hospital for the emergency treatment of patients. With the facilities and equipment available, extensive decontamination and treatment of an injured patient could be performed, including surgical treatment that may be required.

E.2.4 ON-SITE MEDICAL SERVICES

Agreement has been reached with doctors in Southport who will provide medical services at the plant site when required. Personnel who are contaminated and who require medical treatment may be treated by a doctor in the Plant's First Aid Office.

E.2.5 EMERGENCY EQUIPMENT

An emergency kit is maintained at Dosher Memorial Hospital containing supplies and equipment for personnel monitoring and the control of radioactive contamination. This kit contains the following:

a. Radiation monitoring instruments, one low-level instrument for determining contamination levels, and one intermediate-range instrument for determining dose rates.

b. Personnel monitoring equipment such as TLDs and self-reading dosimeters.

c. Decontamination equipment and supplies for both personnel and facility.

d. Contamination control equipment and supplies such as protective clothing, signs, ropes, tags, plastic bags, etc.

E.2.6 AMBULANCE SERVICE

The City of Southport Rescue Squad has agreed to respond to all emergency calls from the plant, just as they respond to other calls from the Southport area.

APPENDIX F
TECHNICAL BASIS FOR SOURCE TERM MIXES

Background

Since 1962, source term mixes for nuclear power plants have been derived from TID-14844 (Reference 1), as referenced in Regulatory Guides 1.3 and 1.4 (Reference 2). This report established what was believed to be a bounding case for release of radionuclides in a severe core damage accident. The release consisted of 100% of the core inventory of noble gases, 50% of the core inventory of iodines, and 1% of the core inventory of particulates. Since that time the use of probabilistic risk assessments in examining accident consequences has been developed and documented in the NRC Report NUREG-1465, Accident Source Terms for Light Water Nuclear Power Plants (Reference 3). In this document, new source terms were proposed that utilized the risk assessments of five typical PWRs and five BWRs to develop a mean in-containment isotopic release fraction for various core damage events.

In any risk assessment study, a large number of accident sequences and their probabilities of occurrence are analyzed. A separate isotopic release fraction is developed for each accident sequence. The major isotopic release fractions are those fractions of core inventory that are released either through failure of the fuel cladding, melting of the core within the reactor vessel, or release of melted core materials through a breach of the reactor vessel. These fractions are values that when multiplied by the core inventory in curies of the particular isotopes, give curie amounts of isotopes immediately available for release from the containment. The effects of cleanup and engineered safety features are taken into account to the extent consistent with the failures that led to the particular accident sequence. To make the results manageable, the accident sequence and the accident isotopic release are grouped. NUREG-1465 then uses the accident sequence probabilities as a means to weigh the release fractions for that sequence category. The weighted release fractions are added up to determine a "mean" in-containment release fraction.

Source Term Categories

The traditional source term categories used in the industry were based on TID-14844 and utilized the major accidents analyzed in the FSAR, i.e., LOCA, Steam Generator Tube Rupture, etc. The source term based on TID-14844 was in fact a default mix of isotopes that was acted upon by the available engineering safety features and natural phenomena associated with each analyzed accident.

The new source terms are based upon the core melt sequences developed by the methodologies used by NUREG-1465. These sequences look at four categories of core damage: 1) fuel clad failure, 2) in-vessel melting, 3) ex-vessel release through a breach of the vessel by melted fuel, and 4) a late in-vessel melting category. These categories have an associated release duration based upon the length of time that the core is uncovered. As a result, it is possible to construct a source term mix matrix that is dependent on two parameters, whether or not the fuel is uncovered, and the length of time that the fuel is uncovered.

In order to have a dose assessment capability that can be utilized under many circumstances, the vast majority of which are less consequential than a total melt of the core with no removal mechanisms, the effect of engineered safety features and removal phenomena must be included in the source term mix. A review of all the removal effects as listed in RTM-92 (Reference 4) was performed and the results are summarized in Table 1 below. The column, "Fraction Used" is the removal fraction used in developing the source term categories that account for removal process. The fraction used was selected to be the highest value of all of the accident categories regardless of how many mitigating processes are in effect. This was done to develop a single removal fraction to cover all cases where removal processes are in effect.

The "default" condition for selecting a source term mix is to use a mix that takes into account removal mechanisms for particulates and iodines. Only if no removal process, e.g., sprays, filtration, partitioning, is available will the unmitigated source terms be used.

In order to select the proper mix, the release pathway and estimated time duration of core uncovery will have to be determined. The release pathway questions should be very specific, with the user allowed to view all possible choices and then select the one that best fits the plant conditions. The response to the release pathway questions and core uncovery time should result in the selection of one of eight possible accident source term mixes as shown in Table 2. The late in-vessel melt release fractions in NUREG-1465 are approximately one order of magnitude below the early in-vessel values, so no separate category of source terms were developed for that cause.

There remain two special cases of accident mixes which can be handled separately in the dose assessment process. Aged spent fuel involved in shipments and storage from the Brunswick plant have a single isotopic inventory for the gap which consists of long lived isotopes. This inventory will be used as a single case (without consideration for decay when determining detector sensitivities) for determination of a source term for dose assessment purposes. Similarly, the maximum expected inventory of waste gas decay tank will be used as a single mix category (with no decay) for the PWRs.

Radioisotope Inventories

The radionuclides included in the mixes were taken from RTM-92. Additional radioisotopes were taken from the plant's core damage assessment procedure if not already included. Isotopes that had no in-containment release fractions given in the reference documents were removed from the list.

The core inventories for Brunswick were developed using the ORIGEN code assuming an average end of life burnup and enrichment.

The spent fuel assembly source term was developed by taking the values for Kr^{85} and I^{129} from the ORIGEN code runs, decaying the values for 5 years, and then taking release fractions as stated in Regulatory Guide 1.25 (30%).

References

1. Technical Information Document (TID)-14844, Calculation of Distance Factors for Power and Test Reactor Sites, J. J. DiNunno et al, U.S. Nuclear Regulatory Commission, Washington, D.C., 1962

2. Regulatory Guide 1.3, Revision 2, Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors, U.S. Nuclear Regulatory Commission, Washington, D.C., June 1974

3. NUREG-1465, Accident Source Terms for Light Water Nuclear Power Plants, Draft Report for Comment, U.S. Nuclear Regulatory Commission, Washington, D.C., June 1992

4. RTM-92, Response Technical Manual, Vol. 1, Rev. 2, U.S. Nuclear Regulatory Commission, Washington, D.C., October 1992

5. CP&L Design Calculation 0B21-0556, ORIGEN2 Execution for Use in Specifying CPLDOSE Inputs for B1C12 and B2C14

6. ESR 98-00345, Revision 0

Table 1 Brunswick Source Term Removal Groupings

Accident Category	Sprays	No Sprays	Filtered	Not Filtered	Total Fraction	Fraction Used
Drywell Release	.03		.01		.0003	.01
		.75		1	.75	.75
Torus Release[1]			.01		.01	.01
				.75	.75	.75
Cont. Bypass			.01		.01	.01
				.75	.75	.75

[1]The effects of torus scrubbing are not fully included, which would multiply the result by another 0.01 to 0.05. to make the categories consistent, the unfiltered release fraction was very conservatively taken to be 0.75.

Table 2 Brunswick Source Term Categories

Source Term Category	Description
Normal RCS	Accidents that do not result in core uncovery. Filtration and/or containment sprays are considered to be effective.
Gap Release w/f-s	Any accident sequence that results in core uncovery <60 minutes, or mechanical fuel damage has occurred. Filtration and/or containment sprays are considered to be effective.
Gap Release No f-s	Any accident sequence that results in core uncovery <60 minutes or mechanical fuel damage has occurred. Filtration and/or containment sprays are considered to be NOT effective.
Early IV w/f-s	Any accident sequence that results in core uncovery from 1 to 2.5 hours. Filtration and/or containment sprays are considered to be effective.
Early IV No f-s	Any accident sequence that results in core uncovery from 1 to 2.5 hours. Filtration and/or containment sprays are considered to be NOT effective.
Ex-Vessel w/f-s	Any accident sequence that results in core uncovery >2.5 hours. Filtration and/or containment sprays are considered to be effective.
Ex-Vessel No f-s	Any accident sequence that results in core uncovery >2.5 hours. Filtration and/or containment sprays are considered to be NOT effective.
Spent Fuel	An accident involving the damage of a freshly unloaded spent fuel assembly. Filtration is considered to be effective. For spent fuel assembly accidents with no filtration, use "Gap Release No f-s."

APPENDIX G

MINIMUM PROCEDURES REQUIRED TO IMPLEMENT THE SECTIONS OF THE PLAN

PLAN	PROCEDURES	
Section 1: Introduction	N/A	
Section 2: Emergency Classifications	0PEP-02.1	Initial Emergency Actions
	0PEP-02.1.1	Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency
Section 3: Emergency Response Organization	0PEP-02.6.6	Environmental Monitoring Team Leader
	0PEP-02.6.12	Activation and Operation of the Operational Support Center
	0PEP-04.7	Brunswick Emergency Notification (Automated Telephone) System
	0PEP-02.6.26	Activation and Operation of the Technical Support Center (TSC)
	0PEP-02.6.27	Activation and Operation of Emergency Operations Facility (EOF)
	0PEP-02.6.28	Off-Site Protective Action Recommendations
	0PEP-02.6.20	Dose Projection Coordinator
	0PEP-02.6.21	Emergency Communicator
	0PEP-02.1.1	Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency
	0PEP-02.6.29	Activation and Operation of the Joint Information Center (JIC)

APPENDIX G (cont'd)

PLAN	PROCEDURES	
Section 4: Emergency Measures	0PEP-02.1	Initial Emergency Actions
	0PEP-02.1.1	Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, General Emergency
	0PEP-03.1.3	Use of Communication Equipment
	0PEP-03.4.7	Automation of Off-Site Dose Projection Procedure
	0PEP-03.8.2	Personnel Accountability and Evacuation
	0PEP-03.9.2	First Aid and Medical Care
	0PEP-03.9.3	Transport of Contaminated Injured Personnel
	0PEP-03.9.6	Search and Rescue
	0PEP-04.5	Public Education and Information
	0PEP-03.7.6	Emergency Exposure Controls
	0PEP-03.7.7	Onsite Radiological Controls

APPENDIX G (cont'd)

PLAN		PROCEDURES	
Section 5:	Emergency Facilities and Equipment	0PEP-03.4.7	Automation of Off-site Dose Projection Procedure
		0PEP-03.5.5	Environmental Monitoring and Plume Tracking
		0PEP-04.7	Brunswick Emergency Notification (Automated Telephone) System
		0PEP-04.2	Emergency Facilities and Equipment
Section 6:	Maintaining Emergency Preparedness	0PEP-04.1	Record Keeping and Documentation
		0PEP-04.2	Emergency Facilities and Equipment
		0PEP-04.3	Performance of Training, Exercises, and Drills
		0PEP-04.5	Public Education and Information
		0PEP-04.6	Radiological Emergency Kit Inventories
Section 7:	Recovery	0PEP-02.7	Recovery

APPENDIX H

CROSS-REFERENCE BETWEEN NUREG-0654 EVALUATION CRITERIA AND BRUNSWICK RADIOLOGICAL EMERGENCY RESPONSE PLAN

NUREG-0654 Criterion	Brunswick Section(s)
A.1.a	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8 Appendix C
A.1.b	3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
A.1.c	Figures 3.1-1, 3.2-1, 3.4-1
A.1.d	3.0, 3.2.1
A.1.e	3.2, 3.9
A.2.a	N/A
A.2.b	N/A
A.3	Appendix B
A.4	3.0, 3.2, 3.3, 3.4, 3.5
B.1	3.0, 3.1, 3.2
B.2	3.0, 3.2.1
B.3	3.0, 3.2.1
B.4	3.0, 3.2.1
B.5	3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
B.6	Section 3 Appendices A, B, C, E Figure 3.2-1

NUREG-0654 Criterion	Brunswick Section(s)
B.7	Section 3
B.7.a	3.3.5, 3.5.2
B.7.b	3.3.1, 3.3.3, Section 7.0
B.7.c	3.2.1, 3.5
B.7.d	3.6
B.8	3.7.1, Table 3.5-1
B.9	3.7.2, Appendix B, Appendix C, Appendix E
C.1.a	3.8.4.1
C.1.b	3.8.4
C.1.c	3.8
C.2.a	N/A
C.2.b	3.3.1.1, 3.5.8, Figure 3.2-1
C.3	5.7.6, 3.7.1, 3.8
C.4	3.7, 3.8, Appendix B, Appendix C, Table 3.5-1
D.1	Section 2.0
D.2	Section 2.0
D.3	N/A
D.4	N/A

NUREG-0654 Criterion	Brunswick Section(s)
E.1	3.9, 4.1, 4.4.1
E.2	3.2, 3.5, 3.9
E.3	3.9
E.4.a-n	0PEP-02.6.21
E.5	N/A
E.6	3.9, 4.4.6, 0PEP-02.6.21
E.7	3.9, 4.4.7
F.1.a	3.9, 0PEP-02.6.21
F.1.b	3.9, EPL-001, 0PEP-02.6.21
F.1.c	3.9, EPL-001, 0PEP-02.6.21
F.1.d	3.9, EPL-001, 0PEP-02.6.21, 0PEP-03.1.3
F.1.e	3.2, 3.9, EPL-001 0PEP-02.6.21, 0PEP-04.7
F.1.f	3.9, EPL-001, 0PEP-02.6.21
F.2	EPL-001, Table 3.5-1
F.3	6.1.2.1

NUREG-0654 Criterion	Brunswick Section(s)
G.1	4.4.7.1, 6.1.4
G.2	4.4.7.1, 6.1.4
G.3.a	3.6, 5.5
G.3.b	5.4, 5.5
G.4.a	3.6
G.4.b	3.6
G.4.c	3.6, 4.4.7.1
G.5	6.1.4
H.1	5.2, 5.3
H.2	5.4
H.3	N/A
H.4	3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.9 Table 3.5-1
H.5	5.7
H.5.a	5.7
H.5.b	5.7.4
H.5.c	5.7.5
H.5.d	5.8

NUREG-0654 Criterion	Brunswick Section(s)
H.6.a	5.7
H.6.b	5.7
H.6.c	5.7.6
H.7	5.7.4, 5.12
H.8	5.7.2
H.9	5.3, Table 5.0-2
H.10	Procedure 0PEP-04.6
H.11	Procedure 0PEP-04.6 EPL-001
H.12	5.0, 5.7.6
I.1	Section 2, 0PEP-02.1, Section 5.0
I.2	4.2, Section 5.0
I.3.a	4.2.2, PEP-03.6.1, PEP 03.6.3, Appendix F
I.3.b	4.2.2, 4.2.3, 0PEP-03.4.7, PEP-03.5.5
I.4	4.2.2, 0PEP-03.4.7, 0PEP-03.6.1
I.5	5.7.2
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NUREG-0654 Criterion	Brunswick Section(s)
I.7	4.2.4
I.8	4.2.1, 4.2.2, 4.2.3, 4.2.4
I.9	4.2
I.10	4.2
J.1.a	4.4.2, 6.1.1, EPL-001
J.1.b	4.4.2, 6.1.1, EPL-001
J.1.c	4.4.2, 6.1.1
J.1.d	4.4.2, 4.4.6
J.2	4.4.2
J.3	4.4.2.2, 4.4.4.1, 4.4.4.2
J.4	4.4.2.2
J.5	4.4.2.2
J.6.a	4.4.3, 5.9
J.6.b	4.4.3, 5.9
J.6.c	4.4.3
J.7	4.1.5, 4.4.7
J.8	4.4.7.3
J.9	N/A

NUREG-0654 Criterion	Brunswick Section(s)
J.10.a	4.4.7.3, Figures 1.1-1, 4.4-1, Figure 1.1-2
J.10.b	Figures 1.1-1, 1.1-2, 1.1-6
J.10.c	3.9, 4.4.6
J.10.d	N/A
J.10.e	N/A
J.10.f	N/A
J.10.g	N/A
J.10.h	N/A
J.10.i	N/A
J.10.j	N/A
J.10.k	N/A
J.10.l	N/A
J.10.m	See item J.7
J.11	N/A
J.12	N/A
K.1.a-g	4.4.3
K.2	4.4.3
K.3.a	4.4
K.3.b	4.4
K.4	N/A

NUREG-0654 Criterion	Brunswick Section(s)
K.5.a	4.4.4
K.5.b	4.4.4.1, 4.4.4.2, 4.4.5
K.6.a	4.4.4
K.6.b	4.4.4
K.6.c	4.4.4
K.7	4.4.4, 4.4.5
L.1	Appendix B, Appendix E, 5.10
L.2	4.4.5, 5.10, Appendix B, Appendix E
L.3	N/A
L.4	3.7.2.1, 3.7.2.2, 4.4.5, Appendix B, Appendix E
M.1	0PEP-02.7, Section 7.0
M.2	7.2, Figure 7.2.1, Table 7.2-1, 0PEP-02.7
M.3	7.2, 0PEP-02.7
M.4	Figure 1.1-6
N.1.a	6.1.2.2
N.1.b	6.1.2.2
N.2.a	6.1.2.1
N.2.b	6.1.2.1

NUREG-0654 Criterion	Brunswick Section(s)
N.2.c	6.1.2.1
N.2.d	6.1.2.1
N.2.e	6.1.2.1
N.3.a-f	6.1.2
N.4	6.1.2.2
N.5	6.1.2.2
O.1	6.1.1
O.1.a	6.1.1
O.1.b	N/A
O.2	6.1.1
O.3	6.1.1
O.4.a-j	6.1.1
O.5	6.0, 6.1, 6.1.1
P.1	6.1.3
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P.3	6.1.3
P.4	6.2.1
P.5	6.2.1
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NUREG-0654 Criterion	Brunswick Section(s)
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P.106	6.2.1

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0PEP-02.6.28

OFF-SITE PROTECTIVE ACTION RECOMMENDATIONS

REVISION 8

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this procedure is to describe the process for making Protective Action Recommendations (PARs) to off-site agencies.

2.0 REFERENCES

2.1 0PEP-02.1.1, Emergency Control - Notification of Unusual Event, Alert, Site Area Emergency, and General Emergency

2.2 0PEP-02.6.26, Activation and Operation of the Technical Support Center (TSC)

2.3 0PEP-02.6.27, Activation and Operation of the Emergency Operations Facility (EOF)

2.4 0PEP-02.6.21, Emergency Communicator

2.5 0PEP-03.4.7, Automation of Off-Site Dose Projection

2.6 NUREG-0654 Rev. 1 Supp. 3, Criteria for Protective Action Recommendations for Severe Accidents

3.0 GENERAL

3.1 Protective Action Recommendations (PARs) shall be made by the Emergency Response Manager in the EOF.

3.2 The Site Emergency Coordinator shall make Protective Action Recommendations, if necessary, prior to EOF activation.

3.3 This procedure provides the process for making Protective Action Recommendations within 15 minutes of a General Emergency declaration. PARs shall be transmitted to the decision makers on an approved Emergency Notification Form.

3.4 The Protective Action Recommendation is subject to acceptance or modification by state or county decision makers.

3.5 The State/Counties shall assume the responsibility for implementing protective actions taken to protect the health and safety of the general public.

4.0 DEFINITIONS/ABBREVIATIONS

None

5.0 RESPONSIBILITIES

5.1 The Emergency Response Manager shall:

5.1.1 Use the guidance in this procedure to ensure Protective Action Recommendations are made within 15 minutes of the declaration of a General Emergency.

5.1.2 Verbally communicate this information to off-site decision makers.

5.1.3 Approve the Emergency Notification Form.

5.1.4 Maintain an awareness of the state/county acceptance or modification of the Protective Action Recommendations.

5.2 The Site Emergency Coordinator shall:

5.2.1 Prior to EOF activation:

1. Use the guidance in this procedure to ensure Protective Action Recommendations are made within 15 minutes of the declaration of a General Emergency.
2. Verbally communicate this information to off-site decision makers.
3. Approve the Emergency Notification Form.
4. Maintain an awareness of the state/county acceptance or modification of the Protective Action Recommendations.

5.3 The Radiological Control Manager shall:

5.3.1 Recommend PARs to the Emergency Response Manager.

5.3.2 Continually assess Dose Assessment results on radiological conditions and advise the Emergency Response Manager if the initial PAR should be modified.

5.3.3 Immediately provide radiological and meteorological information to the Communications Manager for inclusion on the Emergency Notification Form.

5.4 The Communications Managers, Communications Director, and Emergency Communicator (as applicable) shall:

1. Ensure an Emergency Notification which includes the PAR is made to off-site agencies within 15 minutes of the declaration of a General Emergency.

6.0 PROCEDURE

6.1 Perform the following actions for making predetermined **initial** and **modified** Protective Action Recommendations (PARs) when a General Emergency has been declared.

6.1.1 Initial PAR implementation will be recommended by the Radiation Control Manager (RCM) and approved by the Emergency Response Manager (ERM).

6.1.2 The RCM should obtain the **current** wind direction from the Dose Projection Coordinator or use the EOF Meteorology Status Board.

6.1.3 Using Attachment 2 of this procedure the RCM should select the appropriate wind sector from the column labeled **Wind From**. The wind sector is defined by a range of wind directions.

6.1.4 After identifying the appropriate wind sector, using Attachment 2, the RCM should select the corresponding Local Planning Zones from the **Evacuation Zones** column and recommend evacuating these Zones.

6.1.5 After identifying the appropriate Local Planning Zones for evacuation, using Attachment 2, the RCM should select the corresponding Local Planning Zones from the **Shelter Zones** column and recommend sheltering these Zones.

6.1.6 The RCM should communicate the Local Planning Zones being recommended for **evacuation** and Local Planning Zones being recommended for **sheltering** to the Emergency Response Manger, Communications Managers, and State Liaison.

6.1.7 The Communication Managers should ensure Protective Action Recommendations are included on the Emergency Notification Form and issued within 15 minutes from the General Emergency declaration or Modified PAR development.

6.1.8 The Communications Managers and Emergency Response Manager will ensure off-site decision makers are contacted verbally. Phone talkers will normally make this contact.

1. Brunswick County

2. New Hanover County

3. State

6.1.9 The RCM should ensure PARs are posted on the status board in the EOF.

6.1.10 The RCM and ERM should continually work with the EOF State Representatives to ensure an understanding of off-site recommendations.

6.1.11 The RCM should continually monitor changes in meteorological and radiological conditions and compare to EPA Protective Action Guides. The Dose Projection Coordinator normally provides updates to the RCM on this action.

6.2 The RCM should review and recommend a **modified** Protective Action Recommendation, as necessary, using Attachment 1 and Attachment 2 for guidance.

1. Protective Action Recommendations should be extended to the point **(beyond the 10 mile EPZ**, as necessary) where protective action guideline doses (i.e., ≥ 1 Rem TEDE or ≥ 5 Rem CDE child thyroid) **WILL NOT** be exceeded.

2. A Protective Action Recommendation should not be reduced from the initial recommendation for any Local Planning Zones until the release is terminated and the decision is coordinated with the State and County decisions makers.

3. The following guides apply prior to reducing the initial Protective Action Recommendations:

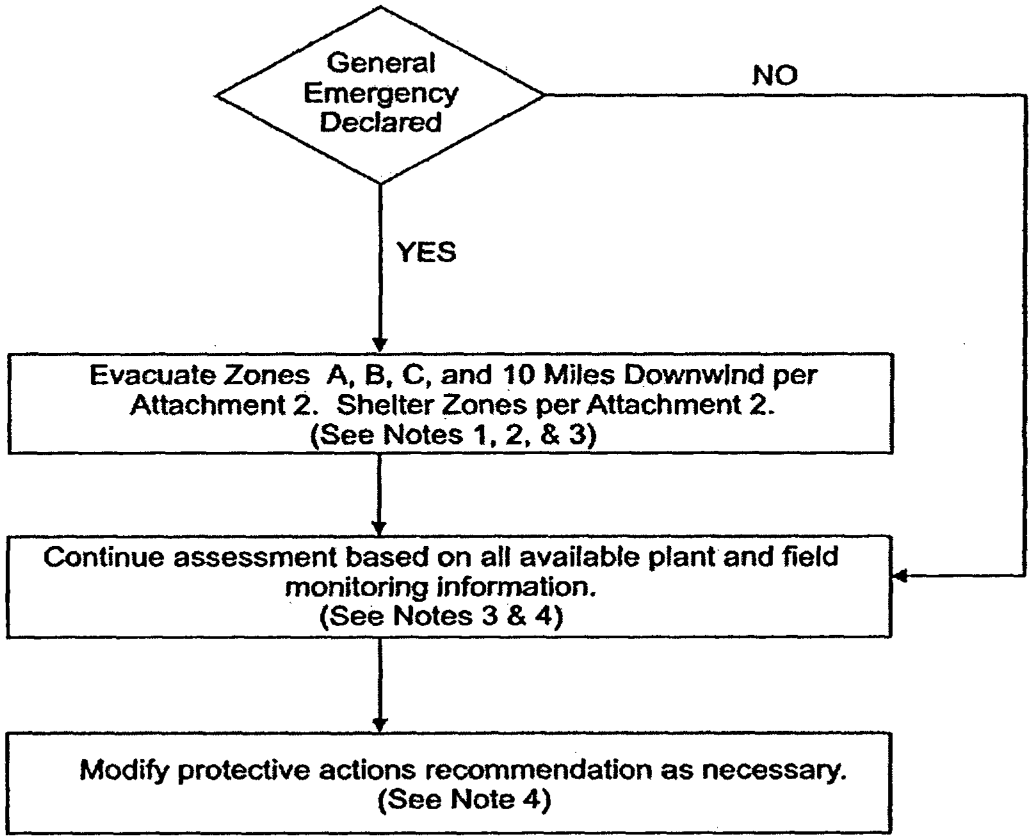
   a. Long term weather forecast conditions are obtained with a high degree of confidence in the forecast.

   b. Radiological environmental conditions are defined.

   c. Plant conditions are stabilized and no additional release as a result of the initiating accident is anticipated.

   d. Population dose savings is quantifiable as a result of the modified PAR and the decision is **ALARA**.

ATTACHMENT 1
Page 1 Of 1
PAR Flowchart



1. Shelter remaining zones to have population indoors to monitor EAS broadcasts.

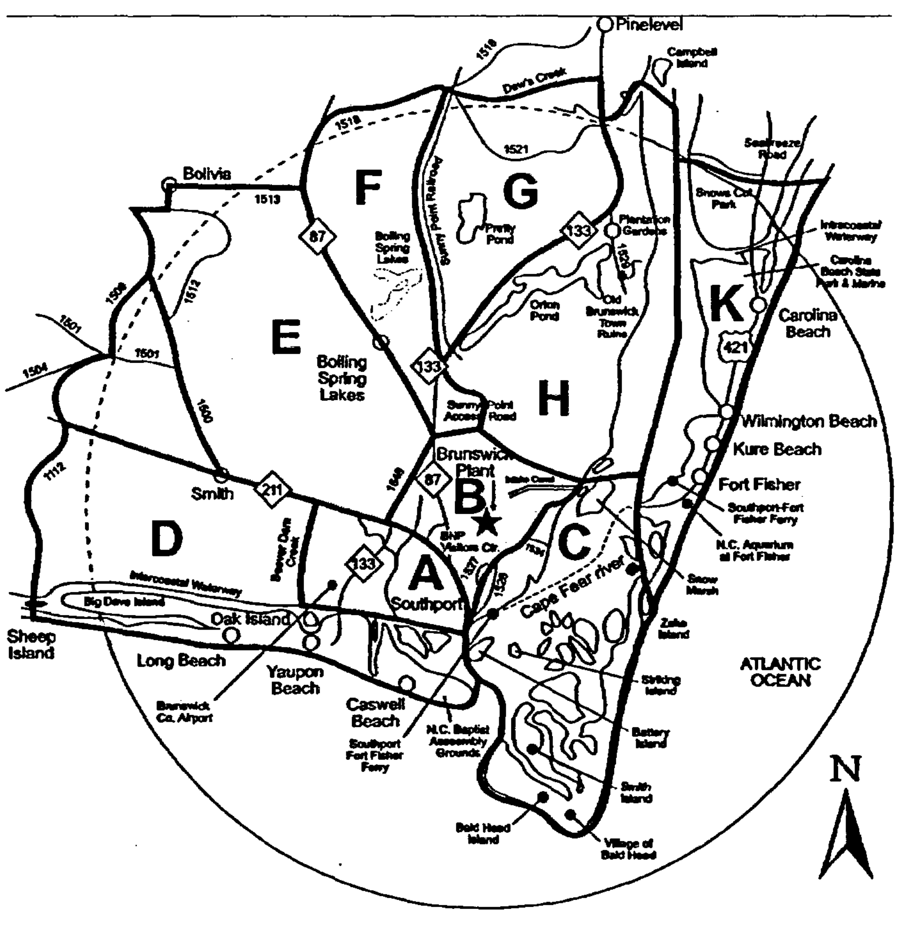
2. Shelter may be the appropriate action for controlled releases of radioactive material from containment If there is assurance that the release is short term (puff release) and the area near the plant cannot be evacuated before the plume arrives.

3. For actual or projected doses > 1 Rem TEDE or > 5 Rem CDE (Thyroid), declare a General Emergency and recommend evacuation of the general public from the affected areas.

4. A protective action recommendation should not be reduced from the initial recommendation for any zone until the release is terminated, and the decision is coordinated with the state and counties. The following guides should be considered prior to reducing a protective action recommendation:
   a) Long term weather forecast conditions are obtained with a high degree of confidence in the forecast. No sea-breeze in effect.
   b) Radiological environmental conditions are defined.
   c) Plant conditions are stabilized.
   d) Population dose savings are quantifiable as a result of the PAR change, and the decision is ALARA.

Evacuation Zones and Time Estimates/10 Mile EPZ Map

WIND FROM	EVACUATE ZONES	SHELTER ZONES	EVACUATION TIMES (MINS) WINTER/SUMMER
NORTH (338 - 022)	A,B,C,D	E,F,G,H,K	290 TO 662
NORTHEAST (023 - 067)	A,B,C,D	E,F,G,H,K	290 TO 662
EAST (068 - 112)	A,B,C,D,E	F,G,H,K	296 TO 670
SOUTHEAST (113 - 157)	A,B,C,D,E,F,G,H	K	340 TO 695
SOUTH (158 - 202)	A,B,C,E,F,G,H,K	D	235 TO 749
SOUTHWEST (203 - 247)	A,B,C,G,H,K	D,E,F	235 TO 749
WEST (248 - 292)	A,B,C,H,K	D,E,F,G	235 TO 749
NORTHWEST (293 - 337)	A,B,C,K	D,E,F,G,H	340 TO 749
ALL ZONES IN 10 MILE	A,B,C,D,E,F,G,H,K		340 TO 749



REVISION SUMMARY

Revision 8 of 0PEP-02.6.28 consists of:

- Changed "CP&L" to "Progress Energy" and deleted "Carolina Power & Light Company" on cover page to reflect company name change.
- Changed reference from "Communications Manager" to "Communications Managers" throughout procedure to reflect NUREG-0654, Table B-1 required minimum staffing levels for EOF.
- Added information in Section 5.4.1 to clarify the time limit for notifying offsite agencies with a Protective Action Recommendation at a General Emergency classification.
- Updated Attachment 2, Evacuation Zones and Time Estimates / 10 Mile EPZ Map, to reflect revised evacuation time estimates for 10-Mile EPZ.
- Added guidance for establishing initial Protective Action Recommendations in Section 6.1.
- Added guidance to modify a Protective Action Recommendation in Section 6.2.
- Added guidance in Attachment 1, PAR Flowchart, for protective action recommendation decision-making as an enhancement.

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0PEP-03.5.5

ENVIRONMENTAL MONITORING AND PLUME TRACKING

REVISION 5

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1.0 PURPOSE

The purpose of this procedure is to define the duties and responsibilities of the Environmental Monitoring Teams and provide guidelines for activities associated with the confirmation of offsite dose projections, plume tracking, and expanded environmental monitoring.

2.0 REFERENCE

2.1 0PEP-02.6.6, Environmental Monitoring Team Leader

2.2 0PEP-03.1.3, Use of Communication Equipment

2.3 0PEP-03.7.6, Emergency Exposure Controls

2.4 0PEP-03.7.7, Onsite Radiological Controls

2.5 0PEP-04.6, Radiological Emergency Kit Inventories

2.6 0E&RC-3101, Radiological Effluent Monitoring Program

2.7 EPA-400-R-92-001, Manual of Protective Action Guidelines and Protective Actions for Nuclear Incidents, USEPA, May 1992

2.8 AR-00022147, Assignment: 08-01, EMT Procedural Improvements

R 9 2.9 Brunswick Steam Electric Plant, Units 1 and 2 - Issuance of Amendments No. 226 and 253, Elimination of Requirements for Post-Accident Sampling System (Docket Nos. 50-325 and 50-324), February 11, 2003.

3.0 DEFINITIONS/ABBREVIATIONS

EMT(L) - Environmental Monitoring Team (Leader)
CCPM - Calculated counts per minute (Sample Activity)

4.0 RESPONSIBILITIES

4.1 The Radiological Controls Manager is responsible for providing up-to-date assessments of the areas affected by radioactivity release into the environment.

4.2 The Environmental Monitoring Team Leader shall provide administrative and technical direction to Environmental Monitoring Teams during environmental monitoring activities.

4.3 Environmental Monitoring Teams shall perform environmental monitoring activities in accordance with direction provided by the Environmental Monitoring Team Leader.

5.0 INSTRUCTIONS

5.1 Activation

5.1.1 When properly notified the Environmental Monitoring Team shall:

1. Report to the EOF for accountability unless otherwise directed by the Environmental Monitoring Team Leader (EMTL).

2. Obtain a vehicle and assemble at the environmental kit location.

3. Obtain one Environmental Monitoring Emergency Kit and perform the following:

   - Kit inventory check (Verifying Seal intact, if not complete inventory necessary for dispatch)
   - Instrument operability and source response checks
   - Report deficiencies to the EMTL.

4. Document dosimeter and TLD information on Attachment 1, Personal Dose Tracking Form, and inform the EMTL.

5. Establish communications with the EMTL, report readiness status, and obtain briefings to include:

   - Priorities (plume tracking, dose projection confirmation, expanded monitoring, etc.)
   - Sample types
   - Locations
   - Frequency
   - Location to deliver samples for analysis
   - Radiological and meteorological conditions

5.2 General Activity Guidelines

5.2.1 A personal TLD and dosimeter **SHALL** be worn at all times. The dosimeter is to be read at a frequency determined by the EMTL and dependent on radiation intensities.

5.3 Plume Tracking

> **NOTE:** Plume tracking is a dynamic activity with conditions constantly changing. Meteorological and radiological conditions must be constantly evaluated to anticipate and track a plume's path.

1. Radiation readings should always be taken while in transit to desired sample locations and during plume tracking activities by placing a radiation survey instrument near the vehicle windshield or window. Readings of ≥ 0.2 mr/hr should be documented, with location and time, and reported to the EMTL.

2. Attempt to identify the edges and centerline of a plume by traversing the plume at right angles to the direction of plume travel. Specific direction will be provided by the EMTL.

   - Survey instrument readings of ≥ 1 mr/hr should establish the criteria necessary to define the edges of the plume.
   - Maximum survey readings should be the criteria used to identify the centerline of the plume.
   - Document times and specific locations of acquired data in the logbook.

> **CAUTION**
>
> Minimize time, to the extent possible, in the defined plume to reduce exposure (i.e., move to lower dose areas to read cartridges and filters)

   - Notify the EMTL of plume tracking results.

3. At the discretion of the EMTL, return to the locations of maximum readings for air samples to determine centerline airborne activity.

5.4 Monitoring and Sample Collection

> **CAUTION**
>
> Assume all emergency environmental samples collected are contaminated and exercise necessary precautions to prevent cross-contamination and personal contamination.
>
> **CAUTION**
>
> Exercise care when operating electric samplers and portable generators in or around substations, water or damp areas.

5.4.1 Sample Labels

1. Each field sample taken shall be documented with sample labels completed and attached to the sample.

2. Complete a sample label for each sample with the following information (See Attachment 8).

   - Sample Control #
   - Sample Type
   - Origin/Location of the sample
   - Radiation reading and time of collection
   - Person taking sample

5.4.1 Sample Labels

3. Air sample iodine cartridges and particulate filter sample labels should also include:

   - Sample duration (start, stop, total)
   - Sample volume
   - I-131 activity estimation

> **NOTE:** The primary radiological monitoring process used for dose projection confirmation and plume tracking is a combination of area radiation surveys and air samples.

5.4.2 Area Radiation Surveys

1. Area radiation surveys shall be taken initially at waist level (1 meter) to determine the presence of radioactive materials.

2. If the presence of radioactive material is indicated; open and closed window readings shall be taken at two distances from the surface:

   - Waist level (≈ 1 meter); and,

   - 3" - 6" from the surface

> **NOTE:** Open window measurements must be taken with the probe facing downward.

3. A minimum of two area radiation measurements shall be taken during the time air samples are being collected with the area sufficiently surveyed to ensure the measurement is representative for the location.

4. Document the survey results on Attachment 2, Dose Rate Survey Data.

R 9 **5.4.3 Airborne Monitoring**

CAUTION
Precautions should be taken to ensure a representative air sample is attained. Improper air sampler placement may interfere with accurate sample analysis. The sampler should be placed so as to prevent loose surface contamination from becoming airborne due to sampler exhaust or liquids coming into contact with the filter.

1. Air samples shall be collected to determine the presence and concentration of radioactive particulate and radioiodines.

2. Air samples should be taken using a 47 mm glass fiber particulate filter and a charcoal or silver zeolite cartridge.

NOTE: Silver zeolite cartridges should be used in place of charcoal cartridges when sampling in the presence of high noble gas concentrations.

NOTE: In the absence of silver zeolite cartridges, a charcoal cartridge may be used with the following caution; noble gases will be retained on the cartridge and slowly off-gas providing some indication based primarily on Rb-88.

NOTE: A ten minute sample provides sufficient volume to meet the 10^{-7} μCi/cc minimum detectable limit for I-131.

3. Collect a 30 ft^3 air sample ± 10 %. (Any deviation in sample duration or volume must be directed by the EMTL.)

4. Record air sampler and collection information on a separate Airborne Monitoring Data (Attachment 3) sheet for each air sample collected.

5. Remove the particulate filter and iodine cartridge from the air sampler and place in separate, clean plastic bags.

   - Use forceps and/or gloves to prevent personnel or cross-contamination.

5.4.3 Airborne Monitoring

6. Conduct a field estimate of airborne I-131 and particulate activity by performing the following:

NOTE: Record all data on Attachment 3, Airborne Monitoring Data

- Locate, measure, and record background radiation levels for an area of relatively low background (using RM-14).
- Measure the initial activity (on contact readings) of the iodine cartridge (in the plastic bag) with an RM-14 by placing the probe against one flat surface of the cartridge and note the highest reading.
- Calculate the net (sample) activity by subtracting the measured background radiation from the highest measurement taken on the iodine cartridge and record data.

NOTE: If the activity at the second reading is within 25% of the initial measurement, it should be presumed that iodine is present, pending isotopic analysis. If the reading is not within 25% contact the EMTL.

- Obtain a second set of readings after 5 minutes of initial measurement and calculate the net (sample) activity for the filter and cartridge.
- Repeat the activity measurement process with the particulate filter.
- Plot the highest calculated sample activity (ccpm) against the calculated sample volume on Attachment 5, Iodine Activity with a Frisker, to determine the airborne concentration of radioiodines (μCi/cc) and record results.
- Plot the highest calculated sample activity (ccpm) against the calculated sample volume on Attachment 4, Particulate Activity with a Frisker, to determine the airborne concentration (μCi/cc) and record results.

5.4.3 **Airborne Monitoring**

7. Report all results to the Environmental Monitoring Team Leader.

8. Complete and attach a sample label to each of the particulate filter and iodine cartridge samples. (See Attachment 8, Sample Labels)

5.4.4 **Collection of Soil Samples**

> **NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Soil samples should be obtained from an open noncultivated level area.

2. Outline a one square foot (1 ft^2) area and clear away vegetation, rocks, litter, and other non-soil material.

3. Remove soil from the outlined area to a depth of two (2) inches.

4. Place the soil in a new clean container and leave open for at least five minutes to allow the sample to off-gas.

5. Obtain a radiation measurement using a survey instrument and record the data on the sample label.

6. Complete a sample label and attach to the sample.

7. Document the sample on Attachment 7, Environmental Sample Data, and report results to the EMTL.

5.4.5 **Collection of Potable Water Samples**

> **NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Potable water samples should consist of at least a one-gallon sample of drinking water.

5.4.5 Collection of Potable Water Samples

2. Flush all sample lines and rinse the sample container thoroughly.

3. Fill the sample container to overflowing and cap securely.

4. Obtain a radiation measurement of the sample using a survey instrument.

5. Complete a sample label and attach to the sample container.

6. Document sample data on Attachment 7, Environmental Sample Data, and report results to the EMTL.

5.4.6 Collection of Surface Water Samples

> **NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Surface water samples may be collected from the plant cooling water intake and discharge canal stationary automatic composite samplers. Locations are provided in E&RC-3101.

2. If the automatic composite samplers are operating, remove the collection container and fill a one-gallon sample container to overflowing and cap securely.

3. If the automatic composite samplers are not operating or a different body of water requires sampling, grab samples may be obtained by dipping a clean container into the water. A 1000 ml Tri-pour beaker with string is recommended.

> **NOTE:** For snow and ice samples, to obtain an equivalent liquid sample of at least 500 mls, a 4-liter sample of snow, ice, etc. is needed.

4. Fill a one-gallon sample container with the dip samples to overflowing and cap securely.

5. Obtain a radiation measurement of the sample using a survey instrument.

5.4.6 Collection of Surface Water Samples

6. Complete a sample label and attach to the sample container.

7. Document the sample data on Attachment 7, Environmental Sample Data, and report results to the EMTL.

5.4.7 Collection of Vegetation and Crop Samples

> **NOTE:** Refer to Attachment 6, Collection of Environmental Samples, for precautions, methods, and guidelines to use during sample collection.

1. Gather a 12" x 12" bag packed full of leafy vegetables or other vegetation (no stems) as directed by the EMTL. The samples should be obtained from the top most portion of the vegetation and from an open area.

2. Place the sample in a sample container and obtain a radiation measurement with a survey instrument.

3. Do not seal the sample container for at least five minutes to allow the sample to off-gas.

4. Complete a sample label and attach to the sample container.

5. Document the sample data on Attachment 7, Environmental Sample Data, and report results to the EMTL.

5.4.8 Expanded Environmental Monitoring

1. Additional evaluation of offsite conditions is available via the collection of previously installed TLDs and stationary air sampler filters and cartridges.

2. Collect, replace, and supplement environmental TLDs as directed by the EMTL and in accordance with 0E&RC-3101, which also contains the locations of the TLDs.

3. Collect filters/cartridges from the stationary air samplers as directed by the EMTL in accordance with E&RC-3101.

5.5 Deactivation

5.5.1 When properly notified the Environmental Monitoring Team shall:

1. Return instruments to proper storage.
2. Inventory and reseal the Environmental Monitoring Emergency Kit(s) used during this activity per 0PEP-04.6.
3. Return vehicle to designated area.

6.0 DIAGRAMS/ATTACHMENTS

6.1 Diagrams

None

6.2 Attachments

6.2.1 Attachment 1, Personnel Dose Tracking Form

6.2.2 Attachment 2, Dose Rate Survey Data

6.2.3 Attachment 3, Airborne Monitoring Data

6.2.4 Attachment 4, Particulate Activity with a Frisker

6.2.5 Attachment 5, Iodine Activity With a Frisker

6.2.6 Attachment 6, Collection of Environmental Samples

6.2.7 Attachment 7, Environmental Sample Data

6.2.8 Attachment 8, Sample Labels

ATTACHMENT 1
Page 1 of 1
Personnel Dose Tracking Form

NAME EMT#	TLD #	DOSIMETER #	INITIAL DOSIMETER READING	FINAL DOSIMETER READING	NET DOSE

ATACHMENT 2
Page 1 of 1
Dose Rate Survey Data

DATE ________   Page __ of __

LOCATION/TIME					
1 METER READING OPEN WINDOW (mr/hr)					
1 METER READING CLOSED WINDOW (mr/hr)					
6" READING OPEN WINDOW (mr/hr)					
6" READING CLOSED WINDOW (mr/hr)					
INSTRUMENT TYPE/ SERIAL #					
TECHNICIAN					

Airborne Monitoring Data

Air Sample Collection Date: ____________________

Air Sample Location: ____

Air Sampler Serial Number: ____________________ Cal Due Date: __________________

Air Sample Flow Rate (ft^3/min.): ______________________

Air Sample Start/Stop Time: _______/__________

Air Sample Volume (ft^3): _____________________________ (flow rate x time)

Air Particulate Filter

Sample Control #:______________________

Background (cpm)	
Initial Reading (cpm)	
5-min Reading (cpm)/ Time:____________	
Net Activity (µCi/cc) (Attach. 4)	
Survey Meter No.:_____________________ Serial No.:___________________________ Cal Due Date:_______________________	

Air Cartridge

Sample Control #:____________________

Background (cpm)	
Initial Reading (cpm)	
5-min Reading (cpm)/ Time:____________	
Net Activity/I-131 Est. (µCi/cc) (Attach. 5)	
Survey Meter No.:_____________________ Serial No.:___________________________ Cal Due Date:_______________________	

Technician: ____

Technician: ____

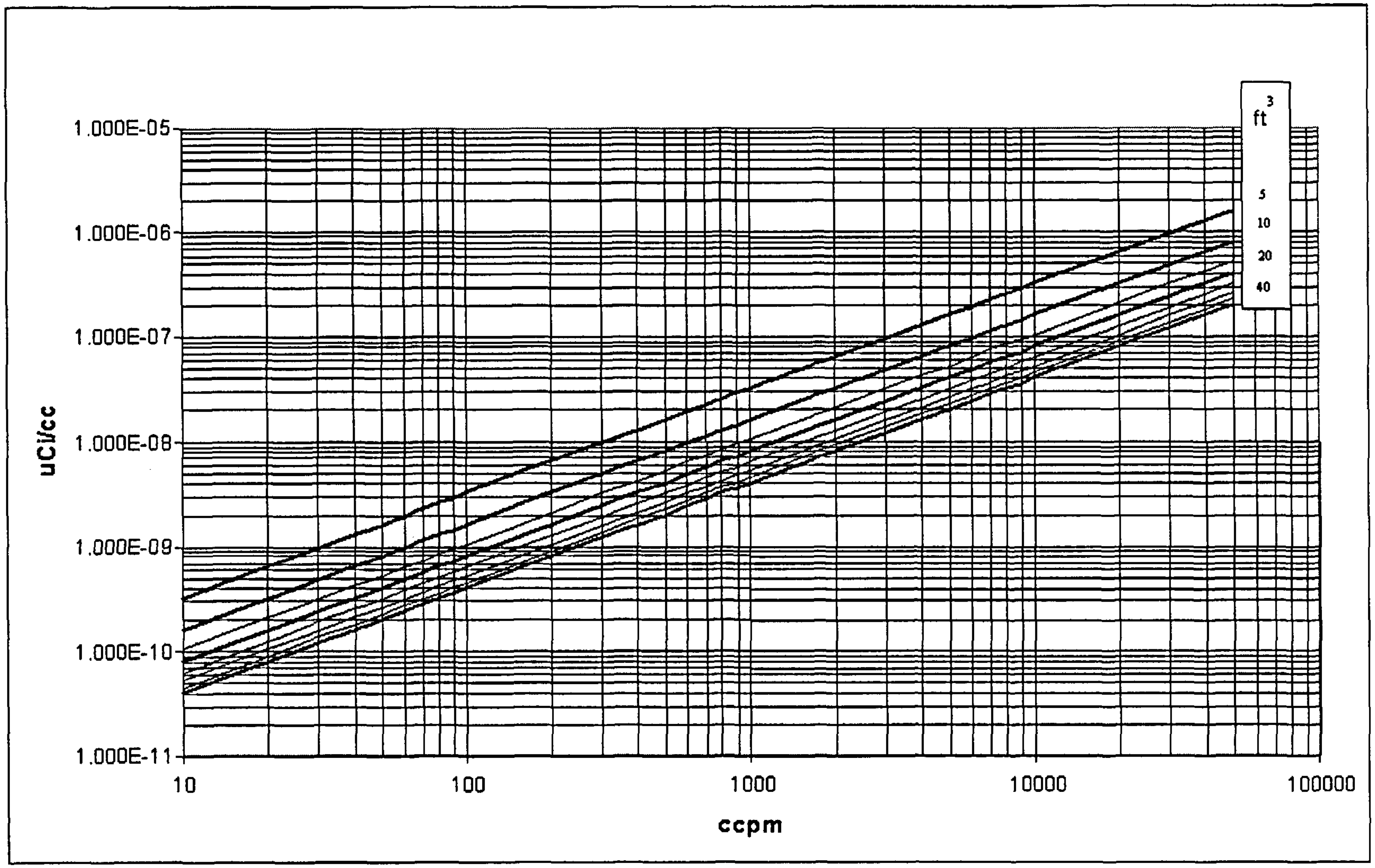
Sample Control #: AA-BB-CC-DD

AA - Environmental Monitoring Team # (01, 02, 03, etc.)
BB - Sample Type
CC - Sequential sample number
DD - Lab number

Sample Types

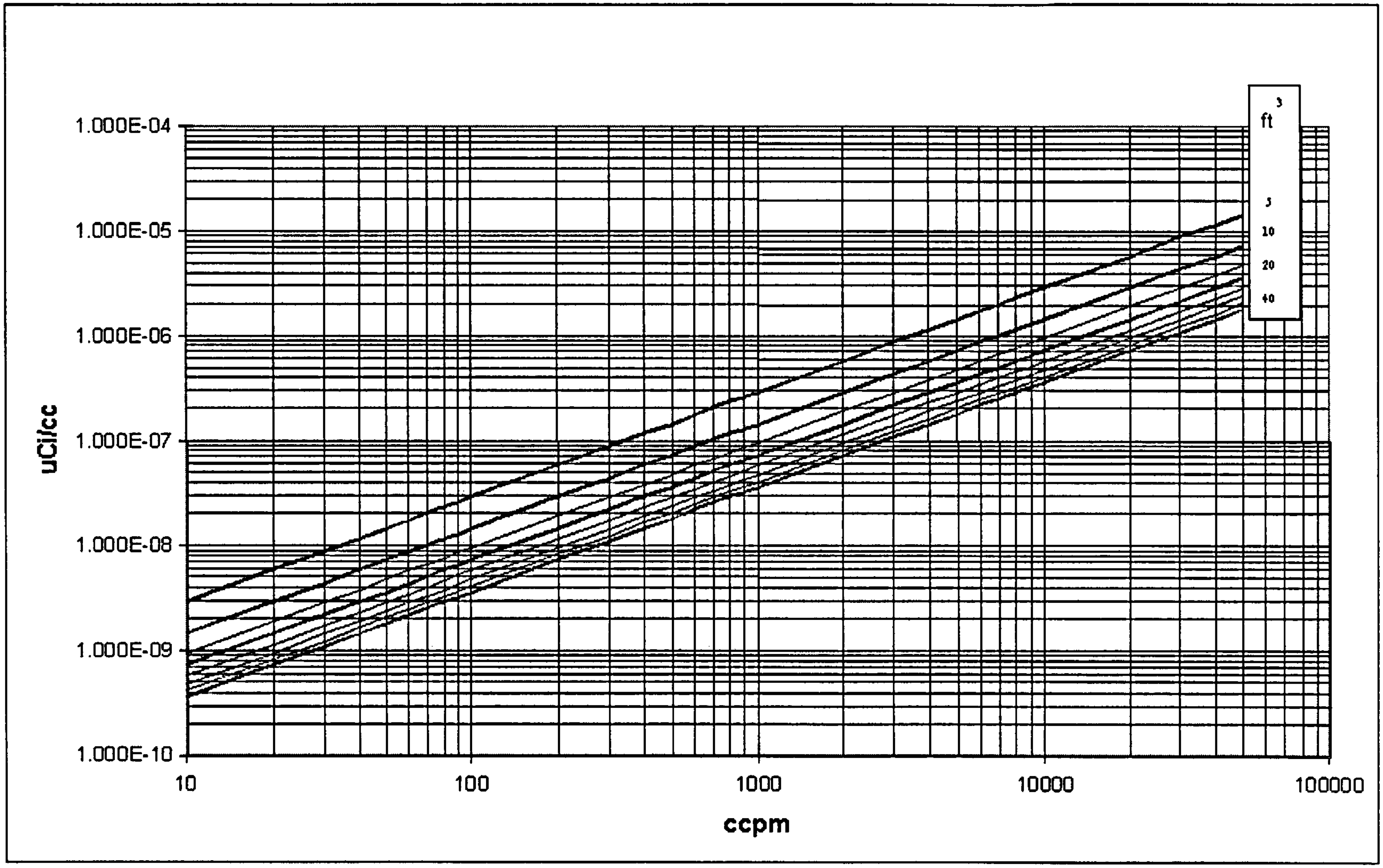
AP Air Particulate
AC Air Cartridge

Particulate Activity With a Frisker



R 9

ATTACHMENT 5
Page 1 of 1
Iodine Activity With a Frisker



ATTACHMENT 6
Page 1 of 2
Collection of Environmental Samples

SAMPLE TYPE	PRECAUTIONS	METHODS AND GUIDELINES
A. SOIL	1. Assume ALL samples are contaminated and handle using techniques to prevent cross-contamination. 2. Do Not Seal container of soil for at least five minutes. This will permit radon gases to off-gas.	1. When possible, select an open, level area for sampling. 2. Clear ≈ 1 ft.^{2} area of vegetation, rocks, litter, and other nonsoil items. 3. Mark out =1 ft.^{2} and remove soil within area to a depth of 2" (≈ 5 cm). 4. Place soil in container.
B. POTABLE WATER	1. Assume ALL samples are contaminated and handle using techniques to prevent cross-contamination.	1. Collect at least 1-gallon sample of drinking water. 2. Flush sample lines and rinse sample container before filling. 3. Fill container to overflowing and cap securely .
C. SURFACE WATER	1. Assume ALL samples are contaminated and handle using techniques to prevent cross-contamination.	1. Surface water samples from the plant cooling water and discharge structures may be collected from the automatic samplers. 2. If samples are out-of-service, obtain a grab sample from boat, bridge, or shore. NOTE: More specific sampling instructions will be provided by the EMT Leader. 3. Collect 1-gallon sample to overflowing and secure tightly.
D. SNOW & ICE	1. Assume ALL samples are contaminated and handle using techniques to prevent cross-contamination.	1. OBJECTIVE - Obtain the equivalent of at least 500 mls. of liquid for analysis. This will require a 4-liter sample of snow, ice, etc.

Collection of Environmental Samples

SAMPLE TYPE	PRECAUTIONS	METHODS AND GUIDELINES
E. VEGETATION & CROPS	1. Assume ALL samples are contaminated and handle using techniques to prevent cross-contamination. 2. Do Not Close or Seal Container for at least five minutes to allow the sample to off-gas.	1. Obtain a 12" x 12" bag packed full of leafy vegetables and/or other vegetation (no stems) as directed by the EMT Leader. 2. If milk is to be collected, collect samples of pasture grass as close to the roots as possible without including dirt in the sample. 3. If possible, tree leaves should be sampled from topmost part of tree. 4. Large, leafy vegetation is better than small. 5. Ground covers should be selected from open areas.
R 9 F. MILK	1. Assume ALL samples are contaminated and handle using techniques to prevent cross-contamination.	1. Sampling should begin the day after an atmospheric release of radioactive material and every 2 days thereafter until levels of I-131 return to normal. NOTE: Peak Iodine (I-131) activity is expected on Day 3 following the release. 2. If available, collect at least 1-gallon sample from a thoroughly mixed tank or from a single milk cow when available. 3. Collect approximately 1000 grams of pasture grass and/or feed whenever milk samples are collected.

ATTACHMENT 7
Page 1 of 1
Environmental Sample Data

DATE __________ Page __ of __

SAMPLE ID	INSTRUMENT TYPE	INSTRUMENT SERIAL #	TIME	TYPE	VOLUME/WT	SURVEY (mr/hr)	LOCATION

Sample Labels

ENVIRONMENTAL SAMPLE LABEL

SAMPLE CONTROL #
SAMPLE TYPE ______________________________
ORIGIN/LOCATION ______________________________
____
TAKEN BY ____________ DATE/TIME ______________
RADIATION LEVEL UPON
COLLECTION ______________________________
TIME RECEIVED IN LAB/INITIAL ______________________
COMMENTS ______________________________
____
____

AIR SAMPLE LABEL

SAMPLE CONTROL NUMBER
AIR SAMPLER ____________ TAKEN BY ______________
ORIGIN/LOCATION ______________________________
____
SAMPLE ON (DATE/TIME/INITIAL) ____/____/____
SAMPLE OFF (DATE/TIME/INITIAL) ________/________/________
TOTAL SAMPLE TIME (MIN) ______________________
FLOW (ft^3min) ______________ FINAL VOLUME ____________ft^3
INITIAL RADIATION LEVEL __________ mR/HR TOTAL VOLUME ________ft^3
I-131 ACTIVITY ESTIMATE __________µCI/cc
TIME RECEIVED IN LAB/INITIAL ____/____
COMMENTS ______________________________

Sample Control # AA-BB-CC-DD

AA - Environmental Monitoring Team # (01, 02, 03, etc.)
BB - Sample Type
CC - Sequential sample number
DD - Lab number

Sample Types

AC	Air Cartridge	AP	Air Particulate	AV	Aquatic Vegetation
BO	Benthic Organisms	FC	Food Crops	FH	Fish
FO	Fodder or Feed	GW	Groundwater	MK	Milk
OY	Oysters	SD	Bottom Sediment	SH	Shrimp
SS	Soil	SW	Surface Water	TL	TLD
TV	Terrestrial Vegetation			ZO	Zooplankton

- Sample types must be very specific

REVISION SUMMARY

Revision 5 of 0PEP-03.5.5 consists of the following changes:

- Changed "CP&L" to "Progress Energy" and deleted reference to Carolina Power & Light Company on Cover Page to reflect company name change.
- Added Brunswick Steam Electric Plant, Units 1 and 2 - Issuance of Amendments No. 226 and 253, Elimination of Requirements for Post-Accident Sampling System as new reference 2.9, and added reference commitments in procedure, as appropriate. This change follows approval of Amendments 226 and 253 which deleted PASS from the Brunswick Technical Specifications.

PLANT OPERATING MANUAL

VOLUME XIII

PLANT EMERGENCY PROCEDURE

UNIT
0

0PEP-03.6.3

ESTIMATE OF THE EXTENT OF CORE DAMAGE UNDER ACCIDENT CONDITIONS

REVISION 13

TABLE OF CONTENTS

1.0 PURPOSE

To estimate the general extent of core damage resulting from loss of adequate cooling under severe accident conditions by using containment radiation monitor readings, containment hydrogen values, or measured fission concentrations in either the reactor water or containment gas samples. Refinement of core damage estimates can be achieved by a Ba, Sr, La, and Ru analysis.

2.0 REFERENCES

2.1 NEDC-33045P, Revision 0, July 2001, Methods of Estimating Core Damage in BWRs

2.2 0EOP-WS-10, RPV Limits

2.3 Lin, C. C., Procedure for the Determination of the Extent of Core Damage Under Accident Conditions, NEDO-22215, 1982.

2.4 Letter and Attachment from Mr. D. K. Smith, Service Supervisor - Nuclear, General Electric to Mr. A. C. Tollison, Jr., General Manager, Brunswick Steam Electric Plant, dated November 9, 1979, Subject: Radiation Source Term Information.

2.5 Letter and Attachments from Mr. T. J. Dente, Chairman - BWR Owner's Group to Mr. D. G. Eisenhut, Licensing Director - USNRC, dated June 17, 1983, Subject: Transmittal of Generic Procedures for Estimation of Core Damage Using Postaccident Sampling System.

R6 2.6 Amendments No. 226 and 253, Elimination of Requirements for Post-Accident Sampling System (Dockets 50-325 and 50-324), 11 February 2003.

3.0 RESPONSIBILITIES

The Radiological Control Director (RCD) is responsible to the Site Emergency Coordinator (SEC) for determining the magnitude of potential radioactive releases to the environment. The Technical Assessment Director (TAD) and the Accident Assessment Team Leader (AATL) are responsible to ensure that results of this procedure are provided to the RCD and SEC.

The Technical Assessment Director and the Accident Assessment Team Leader should be familiar with this procedure and be available for consultation.

4.0 DEFINITIONS/ABBREVIATIONS

4.1 **Core Damage -** Degradation of the fuel pellet or cladding fission product barriers due to inadequate core cooling.

4.2 **Cladding Damage -** Degradation of the fuel rod cladding permitting the release of gaseous and volatile fission products from the space between the fuel pellets and the fuel cladding.

4.3 **Overheating Damage -** Release of gaseous and volatile fission products from the fuel pellets at high fuel temperatures. Temperatures are not sufficient to melt the core.

5.0 PRECAUTIONS AND AND LIMITATIONS

5.1 Radiation level measurements may *underestimate* core damage if:

5.1.1 The primary containment or RPV has been vented

5.1.2 Primary system isolations have been defeated to permit continued use of the main condenser under failure-to-scram conditions.

5.1.3 Primary containment integrity has been lost.

5.2 Radiation level measurements may *underestimate* core damage if:

5.2.1 The suppression pool has been bypassed.

5.2.2 Suppression pool water level is low.

5.3 Hydrogen concentration measurements may *underestimate* core damage if:

5.3.1 The primary containment has been vented.

5.3.2 Primary containment integrity has been lost.

5.3.3 Significant amounts of hydrogen remain trapped in the RPV.

5.4 Hydrogen concentration measurements may *overestimate* core damage if:

5.4.1 Significant amounts of hydrogen have been generated by radiolysis.

5.5 Steam is present in the drywell but the drywell atmosphere is not at saturation conditions.

R6

6.0 SPECIAL TOOLS AND EQUIPMENT

None

7.0 PROCEDURE

7.1 Check for indications of possible core damage using Table 1.

7.2 If core damage is suspected, evaluate the type and amount of damage using Table 2.

7.2.1 Evaluate drywell radiation levels.

7.2.2 If cladding damage is possible or likely, estimate the amount of cladding damage using Section 7.5.

7.2.3 If overheating damage is possible or likely, estimate the amount of overheating damage using Section 7.6.

7.3 Interpret the results using Section 7.7.

7.4 IF PASS sample is available, perform Appendix.

Table 1

Indications of Possible Core Damage

Condition	Indications
Loss of adequate core cooling	See Figure 1 Maximum Steam Cooling RPV Level (MSCRWL) = -33 in
High primary containment radiation	Drywell radiation level above 1 R/hr
Hydrogen generation	Drywell or suppression chamber hydrogen concentration above 0.5%

Table 2

Preliminary Core Damage Assessment

Containment Radiation Drywell	Possible Core Damage States	Action
Below 1% cladding damage radiation level: 10^3 R/hr 1 hour after shutdown 10^2 R/hr 24 hours after shutdown	Core damage unlikely	None
Between 1% cladding damage radiation level and 1% overheating damage radiation level: 10^3 R/hr to 10^4 1 hour after shutdown 10^2 R/hr to 10^3 R/hr 24 hours after shutdown	Limited cladding damage Overheating damage unlikely	Estimate the amount of cladding damage using Section 7.5.
Between 1% overheating damage radiation level and 100% cladding damage radiation level: 10^4 R/hr to 10^5 1 hour after shutdown 10^3 R/hr to 10^4 R/hr 24 hours after shutdown	Widespread cladding damage Possible overheating damage	Estimate the amount of cladding damage using Section 7.5. Estimate the amount of overheating damage usi Section 7.6.
Above 100% cladding damage radiation level: 10^5 R/hr 1 hour after shutdown 10^4 R/hr 24 hours after shutdown	Widespread cladding damage Widespread overheating damage	Verify the amount of cladding damage using Section 7.5. Estimate the amount of overheating damage usi Section 7.6.

Note: Subtract 0.5 x 10^1 from damage values in table if spray is on

7.5 Estimating Cladding Damage

7.5.1 Indications

1. Drywell radiation level above 1% cladding damage radiation level.

2. Drywell or suppression chamber hydrogen concentration above 0.5%.

3. RPV water level below Maximum Steam Cooling RPV Water Level (MSCRWL), -33 in, and Core Spray flow less than design.

7.5.2 Cladding Damage Steps

1. Determine the drywell radiation levels corresponding to 100% cladding damage from Figure 2.

2. Estimate the amount of cladding damage using the equation below.

% Cladding Damage = (Indicated Radiation Level/100% Cladding Damage Radiation Level) X 100

3. IF hydrogen concentration is available complete Worksheet 1 to calculate the volume weighed average hydrogen concentration. This average hydrogen concentration will be used to estimate the amount of zirconium that has oxidized.

4. Estimate the amount of zirconium oxidation using Figure 3 or Worksheet 2. Use Worksheet 2 if a more accurate estimate is needed.

5. Refer to Section 7.6 for guidance on interpreting the damage assessment results.

   - 0-10% damage = Limited Damage
   - >10% damage = Widespread Damage

7.6 Estimating Overheating Damage

7.6.1 Indications

1. Drywell radiation level above 1% overheating damage radiation level.

2. Drywell or suppression chamber hydrogen concentration above overheating damage hydrogen threshold.

3. RPV water level below Maximum Steam Cooling RPV Water Level (MSCRWL), -33 in, and Core Spray flow less than design for more than 30 min.

7.6.2 Overheating Damage Steps

1. Determine the drywell radiation levels corresponding to 100% overheating damage from Figures 2.

2. Estimate the amount of cladding damage using the equation below.

% Overheating Damage = (Indicated Radiation Level/100% Overheating Damage Radiation Level) X 100

3. IF hydrogen concentration is available complete Worksheet 1 to calculate the volume weighed average hydrogen concentration. This average hydrogen concentration will be used to estimate the amount of zirconium that has oxidized.

4. Estimate the amount of zirconium oxidation using Figure 3 or Worksheet 2. Use Worksheet 2 if a more accurate estimate is needed.

5. Refer to Section 7.6 for guidance on interpreting the damage assessment results.

   - 0-10% damage = Limited Damage
   - >10% damage = Widespread Damage

7.7 Discussion

7.7.1 General

1. This procedure provides a general evaluation of the status of the core. The accuracy of the results is governed by source term uncertainties, instrumentation characteristics, and event-specific variations.

2. Use appropriate engineering judgment to reconcile any differences between assessment results and obtain a best estimate of core damage.

3. Due to the flux distribution in the core, core damage is expected to occur at different rates in different parts of the core. Overheating damage may exist in the hottest regions of the core while fuel in lower power regions remains undamaged.

7.7.2 Radiation Levels

1. A radiation level above the 1% cladding damage value is positive indication of cladding damage.

2. The cladding damage and overheating damage radiation ranges overlap. Within the overlap range, the relative amounts of each type of damage cannot be distinguished. Calculating separate values for each type of damage tends to overestimate both amounts.

3. A radiation level above the 1% overheating damage value is not a positive indication of overheating damage since the same radiation level could be reached with only cladding damage. However, it is unlikely that widespread cladding damage would exist without at least some overheating damage. Above the 50% cladding damage radiation level, it may be assumed that overheating damage also exists.

4. The values of drywell radiation levels are event-dependent. If a primary system break exists and steam is discharged into the drywell, drywell radiation levels will probably increase first. If no primary system break exists and steam is discharged through the SRVs, suppression chamber radiation level will probably increase first.

5. Rapid hydrogen production begins at temperatures above the threshold for cladding damage but below the onset of significant overheating damage.

6. Detectable hydrogen is an indication of possible cladding damage.

7. If no hydrogen is detected, it is unlikely that overheating damage exists.

Worksheet 1

Volume-Weighted Average Hydrogen Concentration

Use this worksheet to calculate the volume-weighted average primary containment hydrogen concentration for use with Figure 3.

Drywell hydrogen concentration (%):	H_{dw}	= ______________	%
Suppression chamber hydrogen concentration (%):	H_{sc}	= ______________	%
Drywell airspace free volume (ft3):	V_{dw}	= ______________	(ft3)
Suppression chamber airspace free volume (ft3):	V_{sc}	= ______________	(ft3)

Volume-weighted average hydrogen concentration:

$H_{avg} = (H_{dw} V_{dw} + H_{sc} V_{sc}) / (V_{dw} + V_{sc})$ = ______________ %

Drywell free volume airspace = 164,100 ft^3 (Vdw)

Suppression Pool free volume airspace = 122,270 ft^3 (Vsc)

Worksheet 2

Zirconium Oxidation Fraction

Use this worksheet to verify estimates obtained from Figure 3.

1. Calculate the mass of oxidized zirconium based on the drywell hydrogen concentration:

Drywell hydrogen concentration (%):	Hdw	= ______________	%
Drywell airspace free volume (ft3):	Vdw	= ______________	ft3
Drywell pressure (psig):	Pdw	= ______________	psig
Drywell temperature (°F):	Tdw	= ______________	°F
Saturation pressure for Tdw (psia)	Pdw sat=	______________	psia

Mass of oxidized zirconium in the drywell:

$$m_{dw\,Zr} = 0.04242 \times H_{dw}\, V_{dw} \left(P_{dw} + 14.7 - P_{dw\,sat} \right) / \left(460 + T_{dw} \right)$$

= ______________ lbm

2. Calculate the mass of oxidized zirconium based on the suppression chamber hydrogen concentration:

Suppression chamber hydrogen concentration (%): Hsc		= ______________	%
Suppression chamber airspace free volume (ft3):	Vsc	= ______________	ft3
Suppression chamber pressure (psig):	Psc	= ______________	psig
Suppression chamber temperature (°F):	Tsc	= ______________	°F
Saturation pressure for Tdw (psia)	Psc sat =	______________	psia

Mass of oxidized zirconium in the suppression chamber:

$$m_{sc\,Zr} = 0.04242 \times H_{sc}\, V_{sc} \left(P_{sc} + 14.7 - P_{sc\,sat} \right) / \left(460 + T_{sc} \right)$$

= ______________ lbm

3.Calculate the total zirconium oxidation fraction:

$$F_{zr} = \left(\left(m_{dw\,Zr} + m_{sc\,Zr} \right) / 72439 \right) \times 100$$

= ______________ %

Figure 1

Core Cooling Assessment

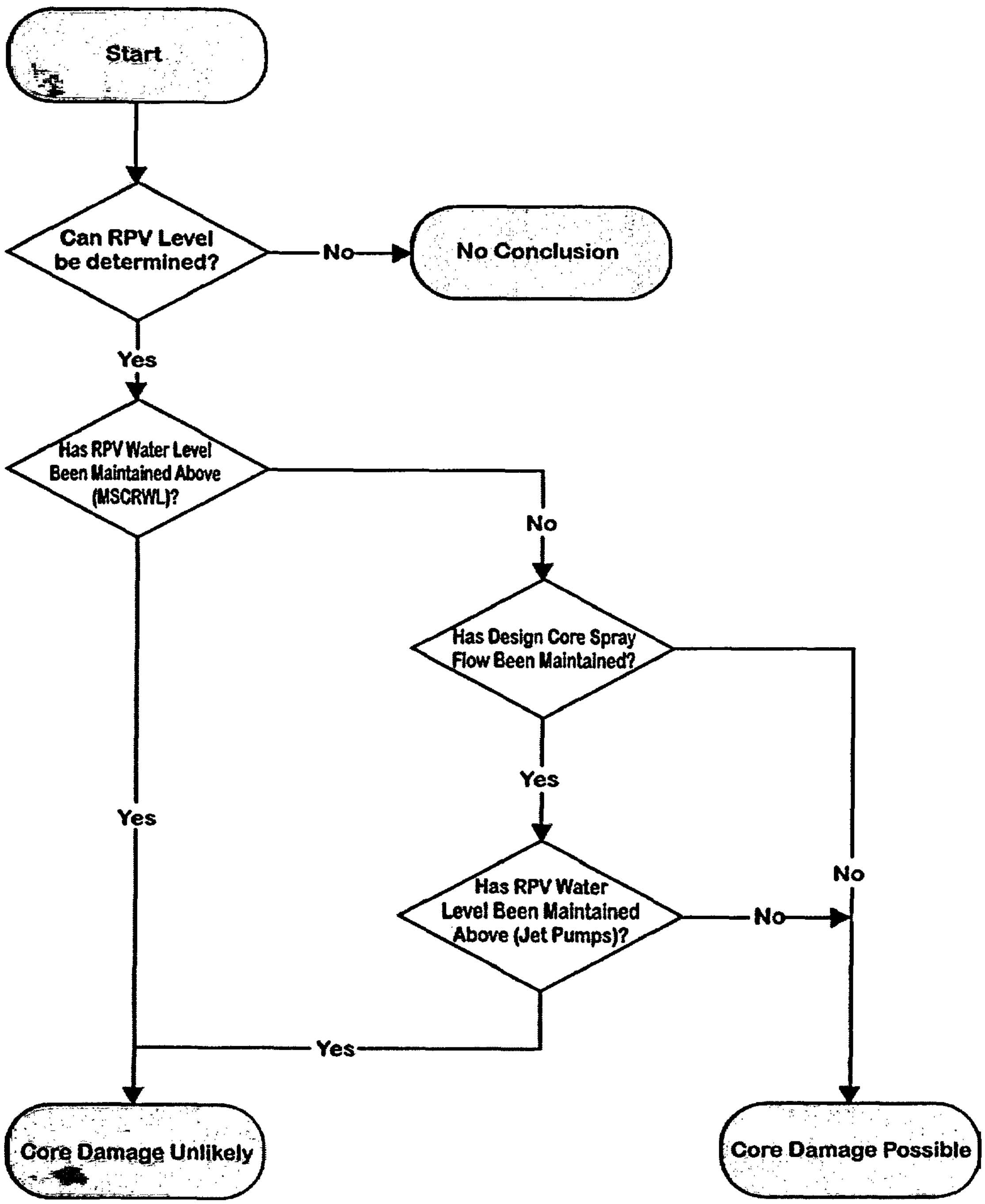


Figure 2

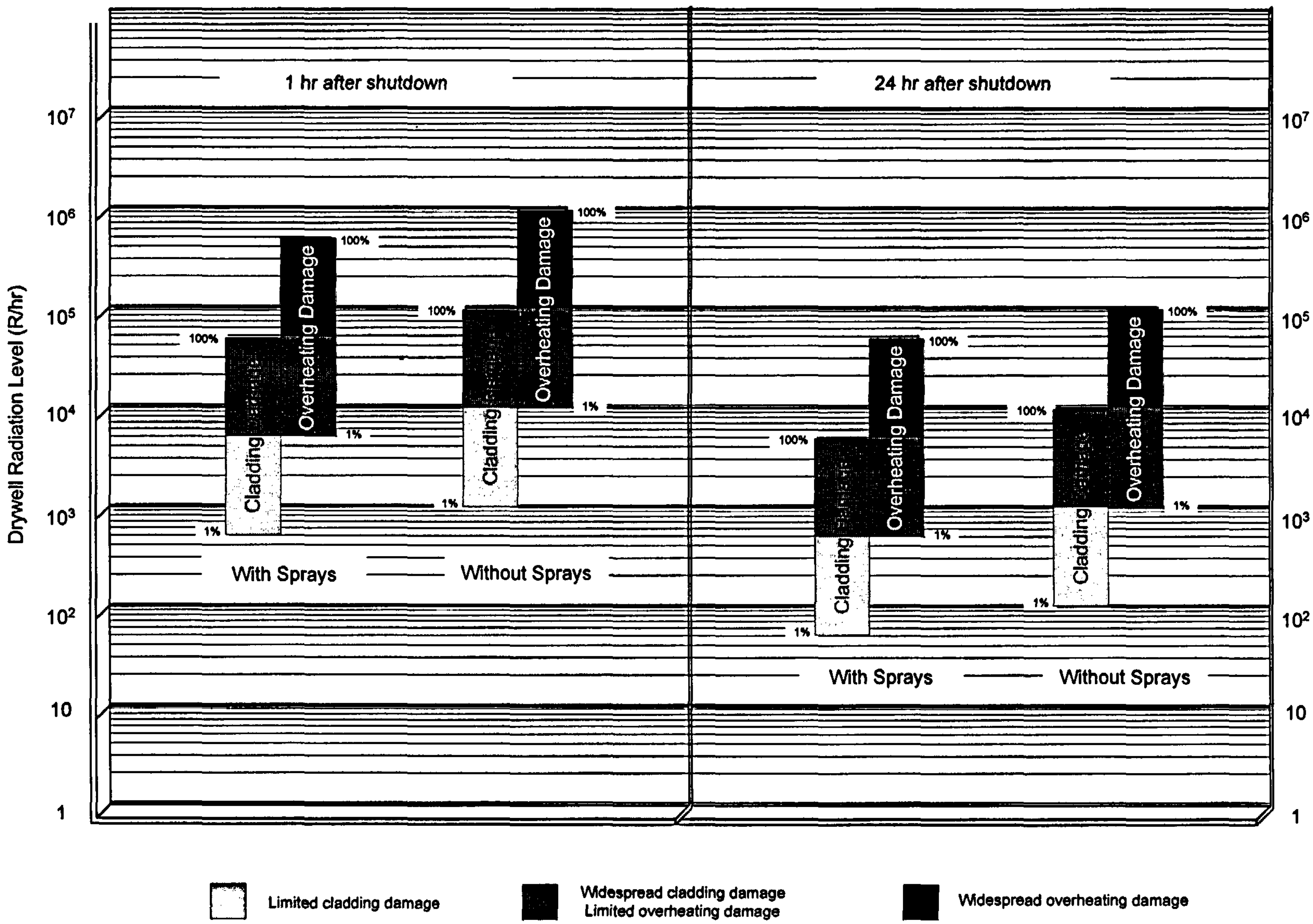
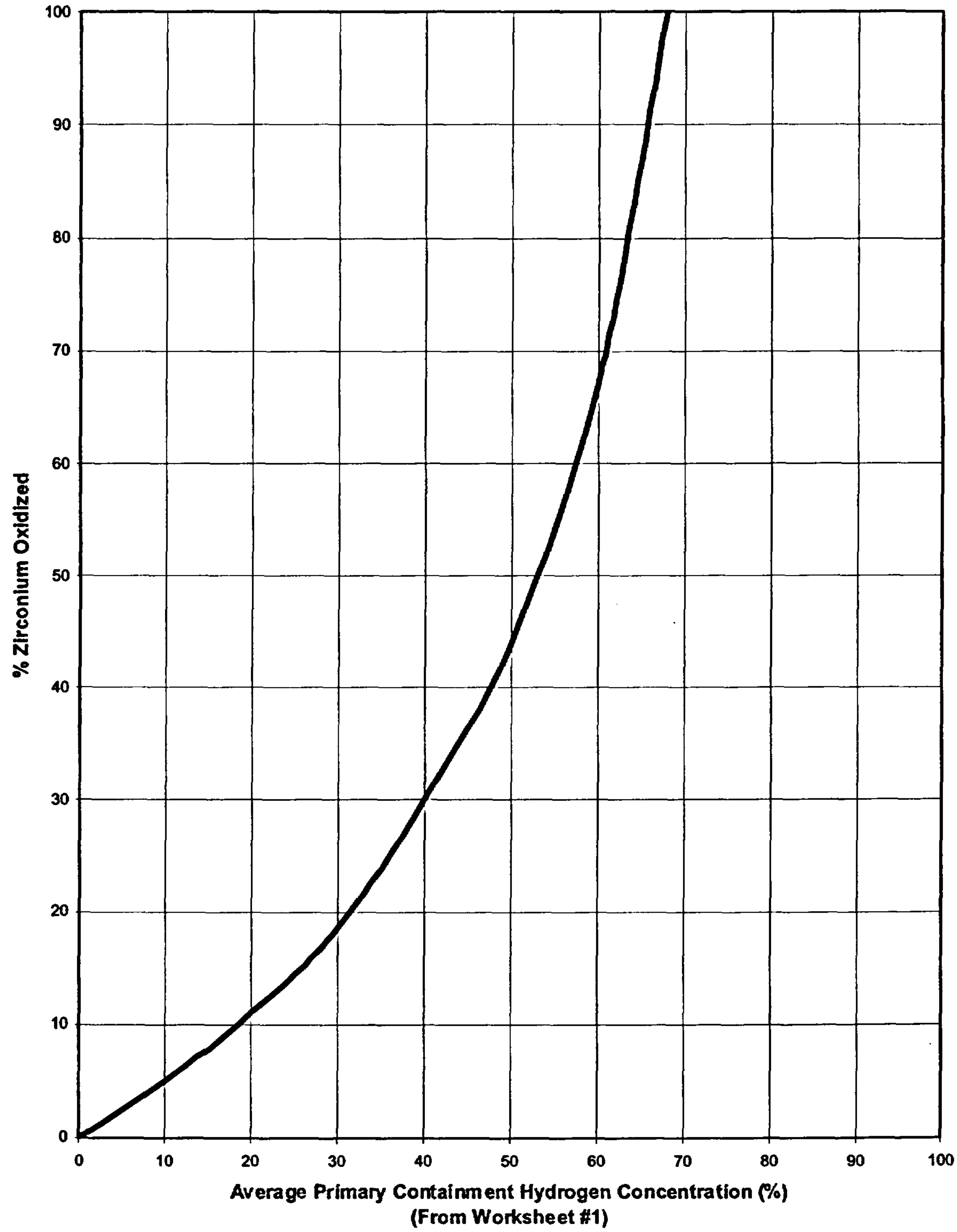

Drywell Radiation Level (R/hr)
1 hr after shutdown
24 hr after shutdown
10⁷
10⁶
10⁵
10⁴
10³
10²
10
1
Cladding
Overheating Damage
100%
1%
With Sprays
Without Sprays
Limited cladding damage
Widespread cladding damage
Limited overheating damage
Widespread overheating damage

Figure 3

Zirconium Oxidation Fraction



Appendix

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Core Damage Evaluation Using PASS sample

1.1 Summary of Method

Liquid and gaseous samples can be obtained from the Post Accident Sampling System (PASS) --Liquid from the reactor coolant and/or suppression pool and gaseous samples from the primary and/or secondary containment. The samples will be quantitatively analyzed on the appropriate equipment. The results of the above analysis, in addition to containment radiation level, and the core water level history, will be used in the estimation.

1.2 General Discussion

1.2.1 Analysis of PASS samples for concentrations of Ba, Sr, La, and Ru and consideration of the relative amounts of fission products would indicate if any fuel melt has occurred.

1.2.2 The selection of a sample location should account for the type of event which will determine where the fission products will concentrate.

1.2.3 The recommended sampling locations are as follows:

Gaseous

Event Type	Sample Location
Nonbreaks (e.g., MSIV)	Suppression pool atmosphere
Small breaks	Drywell (before depressurization); suppression pool atmosphere (after depressurization)
Large breaks (liquid or steam) in primary containment	Drywell
Large breaks outside primary containment	Suppression pool atmosphere

Core Damage Evaluation Using PASS sample

1.2.4 The recommended sampling location for liquid for all events is the jet pumps as long as there is sufficient reactor pressure (normally > 50 psig) to provide a sample from that location. If there is not sufficient reactor pressure to allow a sample to be taken from the jet pumps, the sample should be taken from the sample points on the RHR System.

1.2.5 If a jet pump liquid sample is requested at low (< 1%) power conditions for a small break or nonbreak event, recommend to Operations that the reactor water level be raised to the level of the moisture separators. This will fully flood the moisture separators and will provide a thermally induced recirculation flow path for mixing.

2.0 PROCEDURE STEPS

2.1 Evaluations of Liquid and Gaseous Samples

> **NOTE:** An estimate of the extent of core damage can be determined by comparing the measured concentrations of major fission products in either the gas or water samples, after appropriate normalization, with the reference plant data.

2.1.1 The Radiological Controls Director should request samples from the PASS.

> **NOTE:** Steps 2.1.2 through 2.1.6 can be accomplished using the PASS Program, a computer program on the Accident Assessment Team (AAT) computer. To use the program, a member of the AAT verifies proper operation of the program by running the test cases in Exhibit 1, Verification of PASS. These tests cases should be used to demonstrate the validity of the PASS Program each time the program is initially used. On successful completion of test cases, Attachment A, Computer Inputs for the PASS Program, is completed and the data is inputted to the PASS Program. The results are provided to the Technical Assessment Director or the Accident Assessment Team Leader.

2.1.2 Obtain the samples from the PASS and determine the concentration of the fission product i (C_{wi} in water or C_{gi} in gas) as determined in Attachment A for computer method or Worksheet A1 for manual method.

Appendix (Cont'd)

Core Damage Evaluation Using PASS sample

NOTE: Ensure that the measured gaseous activity concentration has been corrected for temperature and pressure difference in the sample vial and the containment (torus) gas phase. This is normally included in the quantitative analysis results.

2.1.3 Correct the measured concentration on Worksheet A1 for decay to the time of reactor shutdown.

2.1.4 Calculate the fission product inventory correction factor F_{Ii} per Attachment B and record on Worksheet A2.

2.1.5 Using the results from Worksheet A1 and A2 and the correction factors, listed on Attachments C, Calculate the normalized concentration, C_{wi}^{Ref} or C_{gi}^{Ref}, and record on Worksheet A3.

2.1.6 Use best estimate data from Exhibit 2 to estimate the extent of fuel or cladding damage using C_{wi}^{Ref} for Cs-137 and I-131 and C_{gi}^{Ref} for Xe-133 and Kr-85. Record data on Worksheet A4.

3.0 DIAGRAMS AND ATTACHMENTS

3.1 List of Exhibits

1 Verification of PASS

2 Relationships between Isotopic Concentration in the Primary Coolant and the Extent of Core Damage in Reference Plant

3 BNP to Reference Plant Parameters

4 Core Inventory of Major Fission Products in a Reference Plant

3.2 List of Attachments

Attachment A Computer Inputs for the PASS Program

Attachment B Inventory Correction Factor

Attachment C Plant Parameter Correction Factors

3.3 List of Worksheets

Worksheet A1 Calculation of Isotopic Concentrations

Worksheet A2 Calculation of Inventory Correction Factor

Worksheet A3 Calculation of Normalized Isotopic Concentrations

Worksheet A4 Estimate of Fuel/Cladding Damage

EXHIBIT 1
Verification of PASS
(A Computer program for estimating core damage based on Post accident Sampling System results)

This exhibit is intended to provide a means to ensure that PASS, a core damage estimate program designed for the IBM Personal Computer, is working properly. This is demonstrated by duplicating expected results of known computer inputs. These results can be validated by comparison to manual calculations for the same input.

Two different test cases are presented so that a number of alternate paths within the program can be tested. The test cases with their expected results follow.

TEST CASE 1

Computer Prompt	Expected Input
Enter The Concentration of the Fission Products	
Concentration of I-131 in Reactor Water (µCi/ml)	1.72E + 3
Concentration of I-131 in Suppression Pool (µCi/ml)	1.49E + 2
Concentration of Cs-137 in Reactor Water (µCi/ml)	6.55E + 2
Concentration of Cs-137 in Suppression Pool (µCi/ml)	5.70E + 1
Concentration of Xe-133 in Drywell (µCi/cc)	1.82E + 2
Concentration of Xe-133 in Torus (µCi/cc)	2.41E + 2
Concentration of Kr-85 in Drywell (µCi/cc)	1.43E + 0
Concentration of Kr-85 in Torus (µCi/cc)	1.90E + 0
For the inventory correction factor do you want to use the conservative default values which are bases upon BNP's operations under the same operational constraints (YES or NO)?	YES
Enter time between the reactor shutdown and the Sample Time (Days)	2

The results should resemble the printout on the following page. If they do not, carefully check your inputs and try the test again. If the results still are not similar, try a backup copy of the program. If that fails, then seek programming help.

Estimate the Extent of Core Damage Under Accident Conditions

DATE: 03-28-1984
TIME: 13:21:27

The concentration of the fission products are:

I-131 in Reactor Water	1.72E + 3 μCi/ml
I-131 in Suppression Pool	1.49E + 2 μCi/ml
Cs-137 in Reactor Water	6.55E + 2 μCi/ml
Cs-137 in Suppression Pool	5.70E + 1 μCi/ml
Xe-133 in Drywell Air	1.82E + 2 μCi/cc
Xe-133 in Torus Air	2.41E + 2 μCi/cc
Kr-85 in Drywell Air	1.43E + 0 μCi/cc
Kr-85 in Torus Air	1.90E + 0 μCi/cc

Time between the reactor shutdown and the sample time is: 2 days

The Conservative Default values of the Inventory Correction Factors were used.

Estimate of Fuel/Cladding Damage
Primary Coolant Analysis

Nuclide	CwREF (μCi/ml)	% Cladding Failure	% Fuel Meltdown
I-131	3.00E + 02	69.00	1.35
Cs-137	1.00E + 02	64.54	4.27

Containment Gas Analysis

Nuclide	CwREF (μCi/ml)	% Cladding Failure	% Fuel Meltdown
Xe-133	7.99E + 01	53.26	1.84
Kr-85	5.00E - 01	56.35	1.92

TEST CASE 2 **Computer Prompt**	**Expected Input**
Enter The Concentration of the Fission Products	
Concentration of I-131 in Reactor Water (μCi/ml)	1.35E + 3
Concentration of I-131 in Suppression Pool (μCi/ml)	1.18E + 2
Concentration of Cs-137 in Reactor Water (μCi/ml)	1.17E + 2
Concentration of Cs-137 in Suppression Pool (μCi/ml)	1.02E + 1
Concentration of Xe-133 in Drywell (μCi/cc)	1.84E + 2
Concentration of Xe-133 in Torus (μCi/cc)	2.45E + 2
Concentration of Kr-85 in Drywell (μCi/cc)	2.91E - 1
Concentration of Kr-85 in Torus (μCi/cc)	3.86E - 1
For the inventory correction factor do you want to use the conservative default values which are bases upon BNP's operations under the same operational constraints (YES or NO)?	NO
Enter time between the reactor shutdown and the Sample Time (Days)?	2
Enter number of Operating Periods from the unit operating history?	3
For period number (1) enter:	
Average steady reactor power operated in this period (MWT)?	1000
Duration of this operating period (days)?	60
Time between the end of this operating period and the time of the most recent reactor shutdown (days)?	254
For period number (2) enter:	
Average steady reactor power operated in this period (MWT)?	2000
Duration of this operating period (days)?	200
Time between the end of this operating period and the time of the most recent reactor shutdown (days)?	44
For period number (3) enter:	
Average steady reactor power operated in this period (MWT)?	3000
Duration of this operating period (days)?	14
Time between the end of this operating period and the time of the most recent reactor shutdown (days)?	0

The results should resemble the printout on the following page. If they do not, carefully check your inputs and try the test again. If the results still are not similar, try a backup copy of the program. If that fails, then seek programming help.

Estimate the Extent of Core Damage Under Accident Conditions

DATE: 03-28-1984
TIME: 13:27:17

The concentration of the fission products are:

I-131 in Reactor Water	1.35E + 3 μCi/ml
I-131 in Suppression Pool	1.18E + 2 μCi/ml
Cs-137 in Reactor Water	1.17E + 2 μCi/ml
Cs-137 in Suppression Pool	1.02E + 1 μCi/ml
Xe-133 in Drywell Air	1.84E + 2 μCi/cc
Xe-133 in Torus Air	2.45E + 2 μCi/cc
Kr-85 in Drywell Air	2.91E - 1 μCi/cc
Kr-85 in Torus Air	3.86E - 1 μCi/cc

Time between the reactor shutdown and the sample time is: 2 days

The Inventory Correction Factors were calculated from the following:

Period No.	Operation Time (days)	Time Between Period & Last Shutdown (days)	Average Power (MWt)
1	60	254	1000
2	200	44	2000
3	14	0	3000

Estimate of Fuel/Cladding Damage
Primary Coolant Analysis

Nuclide	CwREF (μCi/ml)	% Cladding Failure	% Fuel Meltdown
I-131	3.00E + 02	69.02	1.35
Cs-137	9.99E + 01	64.49	4.27

Containment Gas Analysis

Nuclide	CwREF (μCi/ml)	% Cladding Failure	% Fuel Meltdown
Xe-133	8.00E + 01	53.30	1.84
Kr-85	5.00E - 01	56.40	1.92

ATTACHMENT A
Page 1 of 1

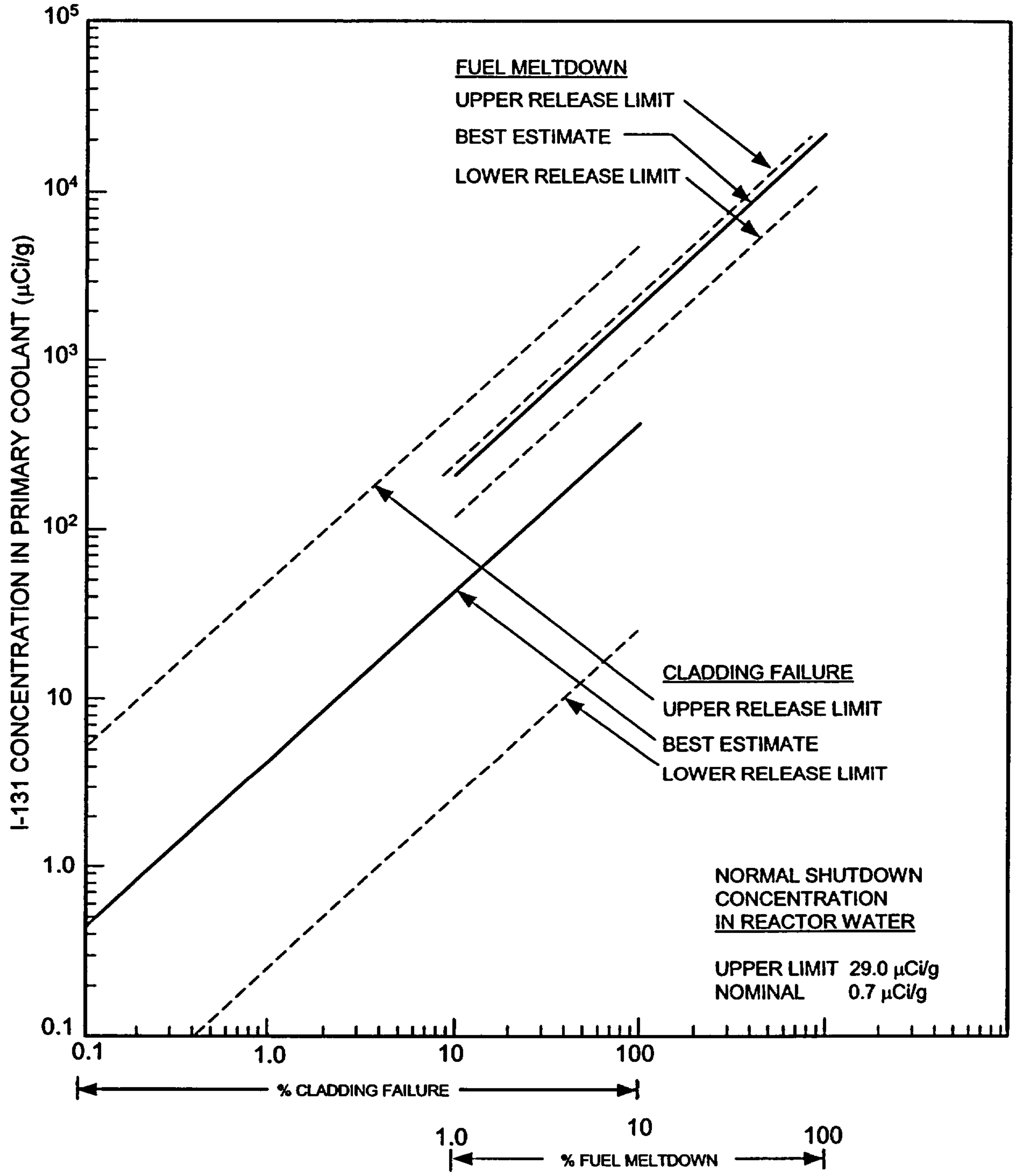
Computer Inputs for the PASS Program

Concentration of I-131 in Reactor Water (μCi/ml)	______
Concentration of I-131 in Suppression Pool (μCi/ml)*	______
Concentration of Cs-137 in Reactor Water (μCi/ml)	______
Concentration of Cs-137 in Suppression Pool (μCi/ml)*	______
Concentration of Xe-133 in Drywell (μCi/cc)	______
Concentration of Xe-133 in Torus (μCi/cc)**	______
Concentration of Kr-85 in Drywell (μCi/cc)	______
Concentration of Kr-85 in Torus (μCi/cc)**	______
Time between Reactor Shutdown and Sample Time (days)	______

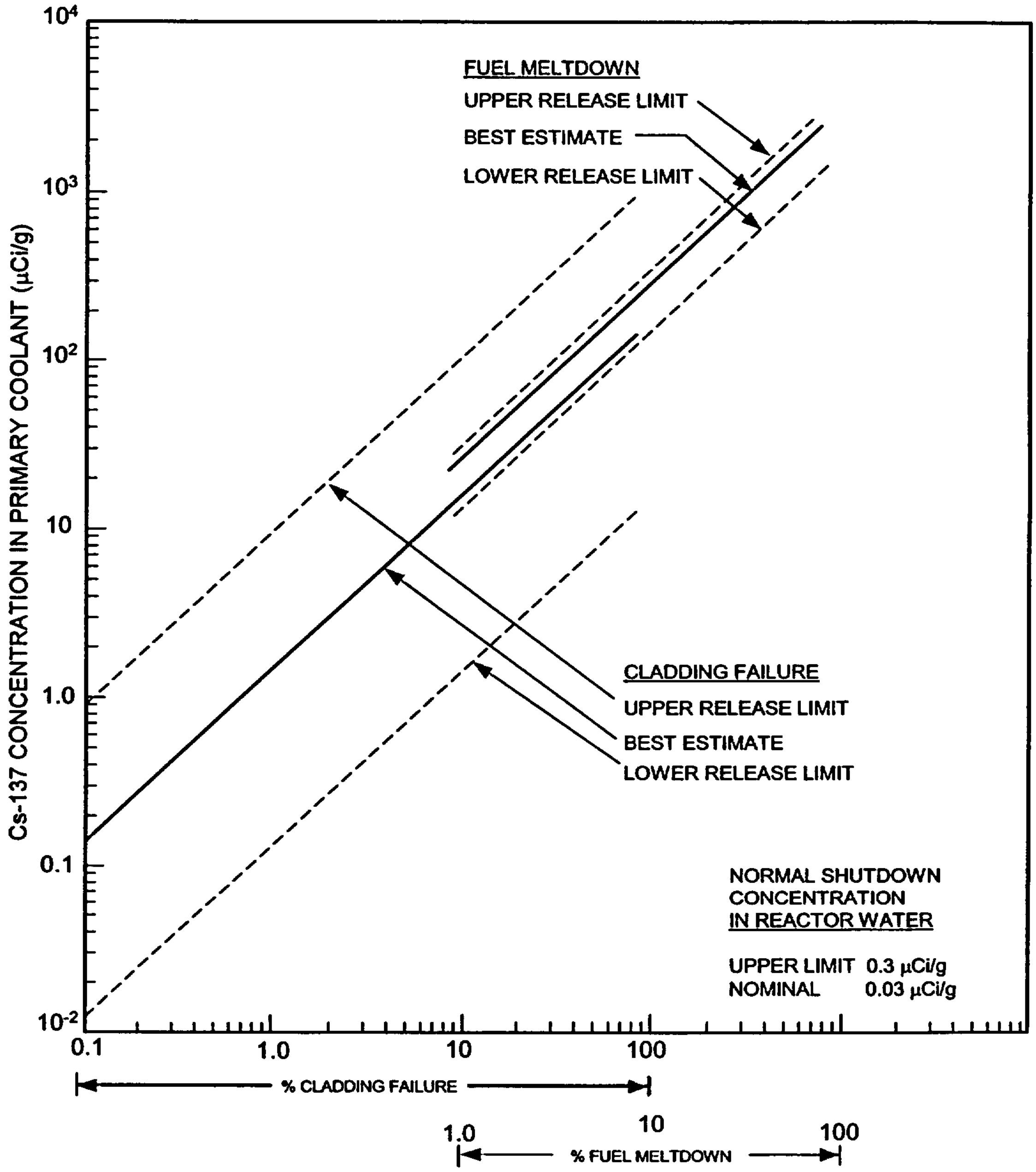
If time and availability permits, attach information necessary for the calculation of Inventory Correction Factors (see Attachment B); otherwise, conservative default correction factors will be used.

Accident Assessment Team Member: Enter data into PASS computer program and provide results to the Technical Assessment Director or the Accident Assessment Team Leader.

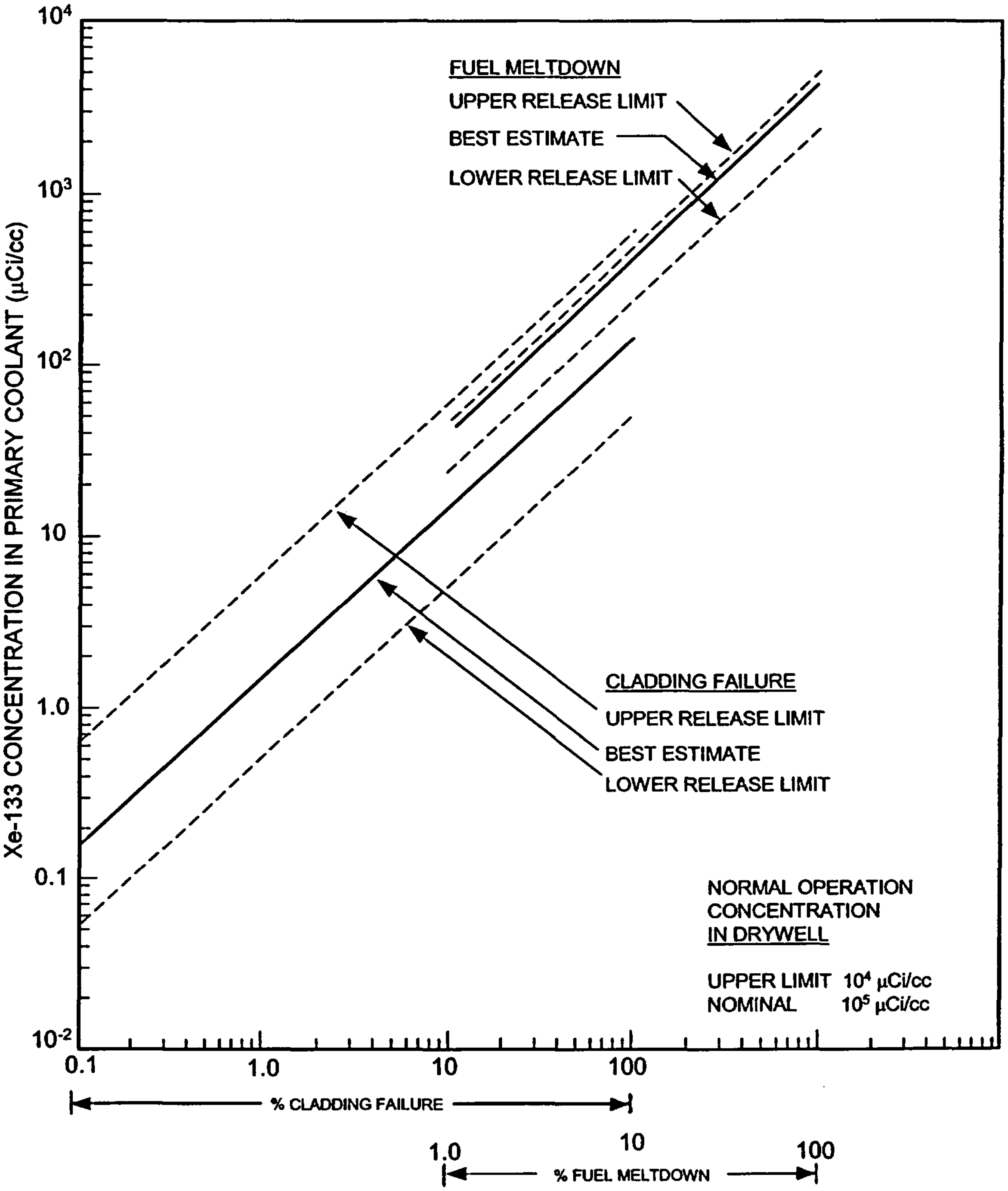
*If unavailable, assume suppression pool activity = 0 μCi/ml.
**If unavailable, assume torus concentration equal to drywell in μCi/cc.



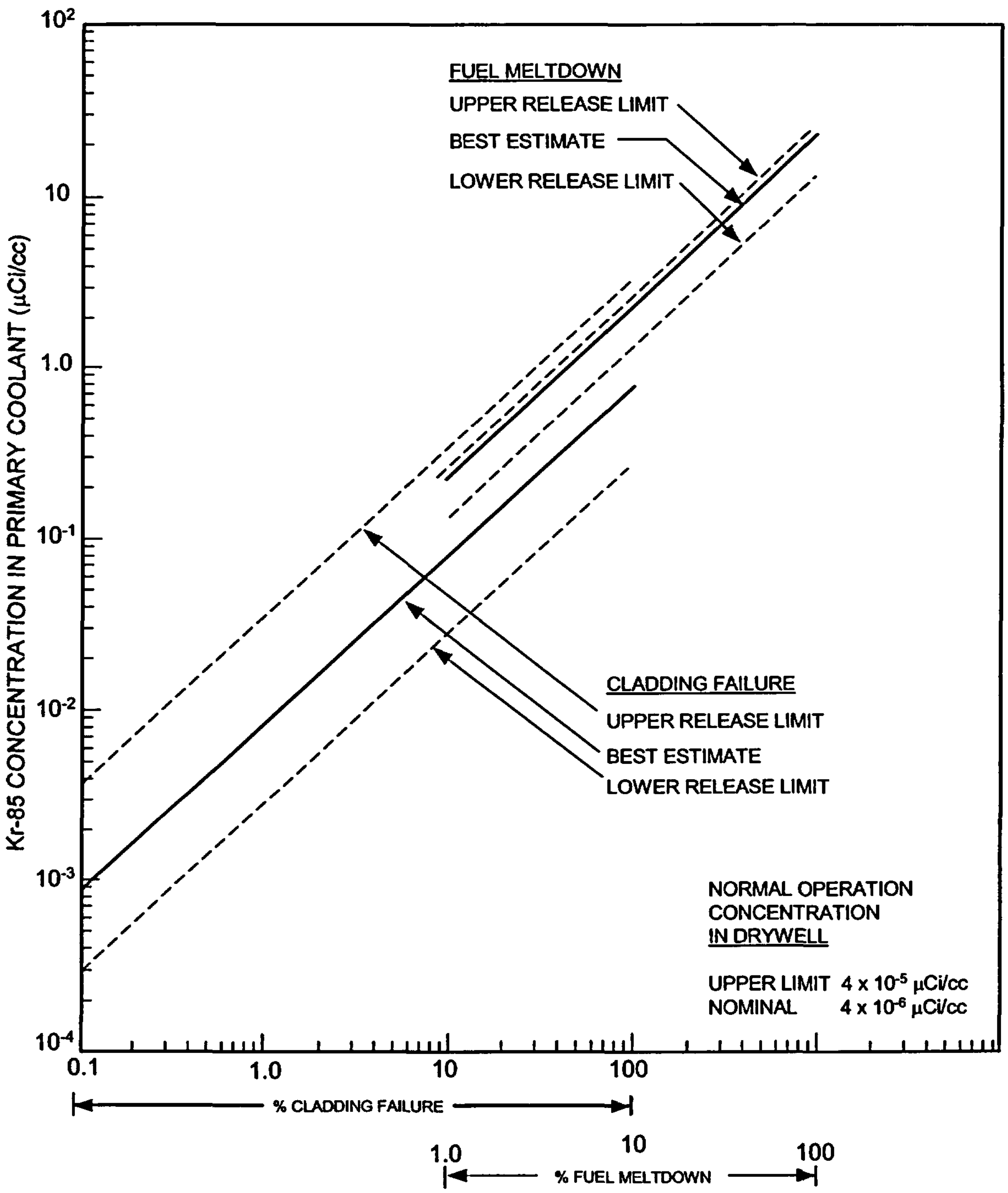
Relationship between I-131 Concentration in the Primary Coolant (Reactor Water + Pool Water) and the extent of Core Damage in Reference Plant.



Relationship between Cs-137 Concentration in the Primary Coolant (Reactor Water + Pool Water) and the extent of Core Damage in Reference Plant.



Relationship between Xe-133 Concentration in the Containment Gas (Drywell + Torus Gas) and the extent of Core Damage in Reference Plant.



Relationship between Kr-85 Concentration in the Containment Gas (Drywell + Torus Gas) and the extent of Core Damage in Reference Plant.

BNP TO REFERENCE PLANT PARAMETERS

Comparison With Reference Plant Data

The extent of core damage can be estimated from the measured fission product concentrations in either the gas or water samples, as described for the reference plant. However, the measured concentration must be corrected for the differences in operation power level, time of operation, primary coolant mass, and containment gas volume.

$$\overset{Ref}{C_{wi}} = C_{wi}\, e^{\lambda_i t} \times F_{Ii} \times F_w \qquad 1$$

OR

$$\overset{Ref}{C_{gi}} = C_{gi}\, e^{\lambda_i t} \times F_{Ii} \times F_g \qquad 2$$

Ref C_{wi} = Concentration of isotope i in the reference plant coolant (μCi/g).

Ref C_{gi} = Concentration of isotope i in the reference plant containment gas (μCi/cc).

C_{wi} = Measured concentration of isotope i in BNP's coolant (μCi/g) See Worksheet A1.

C_{gi} = Measured concentration of isotope i in BNP's containment gas (μCi/cc). See Worksheet A1.

$\lambda_i te$ = Decay correction to the time of reactor shutdown.

λi = Decay constant of isotope i (day^{-1}).

t = Time between the reactor shutdown and the sample time (days).

F_{Ii} = Inventory correction factor for isotope i. See Attachment B.

F_g = Containment gas volume correction factor. See Attachment C.

F_w = Primary coolant mass correction factor. See Attachment C.

BNP to Reference Plant Parameters

	Reference Plant	BNP
Reactor Thermal Power	3651 MWt	2923 MWt
Number of Fuel Bundles	748 bundles	560 bundles
Total Primary Coolant Mass (reactor water plus suppression pool water)	3.92×10^9 g	2.69×10^9 g
Total Drywell and Torus Gas Space Volume	4.0×10^{10} cc	8.11×10^9 cc
Reactor Water	2.46×10^8 g	2.14×10^8 g
Suppression Pool	3.67×10^9 g	2.48×10^9 g
Drywell Gas Volume	7.77×10^9 cc	4.65×10^9 cc
Torus Gas Volume	3.25×10^{10} cc	3.46×10^9 cc

EXHIBIT 4

Core Inventory of Major Fission Products in a Reference Plant Operated at 3651 MWt for Three Years

Chemical Group	Isotope	Half-Life*	Inventory 10^6Ci	Major Gamma Ray Energy -Intensity - keV(γ /d)
Noble Gases	Kr-85m	4.48 h	24.6	151 (0.753)
	Kr-85	10.72 y	1.1	514 (0.0044)
	Kr-87	76.00 m	47.1	403 (0.495)
	Kr-88	2.84 h	66.8	196 (0.26), 1530 (0.109)
	Xe-133	5.25 d	202.0	81 (0.365)
	Xe-135	9.11 h	26.1	250 (0.899)
Halogens	I-131	8.04 d	96.0	364 (0.812)
	I-132	2.30 h	140.0	668 (0.99), 773 (0.762)
	I-133	20.80 h	201.0	530 (0.86)
	I-134	52.60 m	221.0	847 (0.954), 884 (0.653)
	I-135	6.59 h	189.0	1132 (0.225), 1260 (0.286)
Alkali Metals	Cs-134	2.06 y	19.6	605 (0.98), 796 (0.85)
	Cs-137	30.17 y	12.1	662 (0.85)
	Cs-138	32.20 m	178.0	463 (0.307), 1436 (0.76)
Tellurium Group	Te-132	78.00 h	138.0	228 (0.88)
Noble Metals	Mo-99	66.02 h	183.0	740 (0.128)
	Ru-103	39.40 d	155.0	497 (0.89)
Alkaline Earths	Sr-91	9.52 h	115.0	750 (0.23), 1024 (0.325)
	Sr-92	2.71 h	123.0	1384 (0.9)
	Ba-140	12.80 d	173.0	537 (0.254)
Rare Earth	Y-92	3.54 h	124.0	934 (0.139)
	La-140	40.20 h	184.0	487 (0.455), 1597 (0.955)
	Ce-141	32.50 d	161.0	145 (0.48)
	Ce-144	284.40 d	129.0	134 (0.108)
Refractories	Zr-95	64.00 d	161.0	724 (0.437), 757 (05.53)
	Zr-97	16.90 h	166.0	743 (0.928)

* h = hour
d = day
m = month
y = year

Inventory Correction Factor

$$F_{Ii} = \frac{\text{inventory of nuclide } i \text{ in reference plant}}{\text{inventory of nuclide } i \text{ in operation plant}}$$ 3

$$F_{Ii} = \frac{3651\left(1-e^{-1095\lambda_i}\right)}{\Sigma_j\left[P_j\left(1-e^{-\lambda i\, Tj}\right)\left(e^{-\lambda i\, Tjo}\right)\right]}$$ 4

where:

P_j = average steady reactor power operated in period j (MWt).

T_j = duration of operating period j (day).

T_j^o = time between the end of operating period j and the time of the last reactor shutdown (day).

3651 = reference plant MWt.

If the unit operating history is not readily available, use the following F_I values (based upon Brunswick plant operations under the same operational constraints):

Nuclide	Conservative F_I	λ_i (day $^{-1}$)
I-131	1.34	0.0862
Cs-137	1.39	6.29×10^{-5}
Xe-133	1.46	0.1320
Kr-85	1.51	1.77×10^{-4}

Plant Parameter Correction Factors

$$F_w = \frac{\text{BNP total coolant mass } (2.69 \times 10^9 \text{ g})}{\text{reference plant coolant mass } (3.92 \times 10^9 \text{ g})}$$ 5

= 0.68622

$$F_g = \frac{\text{BNP total containment gas volume } (8.11 \times 10^9 \text{ cc})}{\text{reference plant containment gas volume } (4 \times 10^{10} \text{ cc})}$$ 6

= 0.20275

Calculation of Isotopic Concentrations in Primary Water and Suppression Pool Water (Cw_i) and Drywell Gas and Torus Gas (Cg_i)

References

Section 2.1.2, 2.1.3
Attachment A
Exhibit 3

Date ________ and Time ________ of Reactor Shutdown
Date ________ and Time ________ of Sample
Time between reactor shutdown and sample time (days) ________

Cw_i (μCi/ml) = (Cs^{137}) [(Concentration Rx H_20)$_i$ (0.08) + (Concentration Suppression Pool H_20)$_i$ (0.92)] (decay correction factor)

(____________ + ____________) (____________)

= __________ μCi/ml$_{Cs}{}^{137}$

Cw_i(μCi/ml) = (I^{131}) [(Concentration Rx H_20)$_i$ (0.08)] + (Concentration Suppression Pool H_20)$_i$ (0.92)] (decay correction factor)

(____________ + ____________) (____________)

= __________ μCi/ml$_I{}^{131}$

Cg_i (μCi/cc) = (Xe^{133}) [(Concentration Drywell)$_i$ (0.57) + (Concentration Torus)$_i$ (0.43)] (decay correction factor)

(____________ + ____________) (____________)

= __________ μCi/cc$_{Xe}{}^{133}$

Cg_i (μCi/cc) = (Kr^{85}) [(Concentration Drywell)$_i$ (0.57) + (Concentration Torus)$_i$ (0.43)] (decay correction factor)

(____________ + ____________) (____________)

= __________ μCi/cc$_{Kr}{}^{85}$

WORKSHEET A2

Page 1 of 1

Calculation of Inventory Correction Factor (F_{Ii})

References

Section 2.1.4
Attachment B
Exhibit 4

P_j = ____________ $MW_{thermal}$

T_j^o = ____________ Days

T_j = ____________ Days

λ_i = ____________ $Days^{-1}$

$$F_{Ii} = \frac{3651\left(1 - e^{-1095\lambda_i}\right)}{\Sigma_j \left[P_j \left(1 - e^{-\lambda i\, Tj}\right) \left(e^{-\lambda i\, Tjo}\right)\right]} 7$$

= ________________________________ (Cs^{137})

________________________________ (I^{131})

________________________________ (Xe^{133})

________________________________ (Kr^{85})

Calculation of Normalized Isotopic concentrations in Primary Water and Suppression Pool Water (Cw_1^{Ref}) and Drywell Gas and Torus Gas (Cg_i^{Ref})

References

Section 2.1.5
Attachment C
Worksheet A1 (Cw_i and Cg_i)
Worksheet A2 (Fl_i)

NOTE: For BNP,
Fw = 0.68622
Fg = 0.20275

$Cw_i^{Ref} = Cw_i\, e^{\lambda i t} \times Fl_i \times Fw$
(Cs^{137})

= ____________ x ____________ x ____________

= ______________________________ $\mu Ci/ml_{Cs}{}^{137}$

$Cw_i^{Ref} = Cw_i\, e^{\lambda i t} \times Fl_i \times Fw$
(I^{131})

= ____________ x ____________ x ____________

= ______________________________ $\mu Ci/ml_I{}^{131}$

$Cg_i^{Ref} = Cg_i\, e^{\lambda i t} \times Fl_i \times Fg$
(Xe^{133})

= ____________ x ____________ x ____________

= ______________________________ $\mu Ci/cc\ Xe^{133}$

$Cg_i^{Ref} = Cg_i\, e^{\lambda i t} \times Fl_i \times Fg$
(Kr^{85})

= ____________ x ____________ x ____________

= ______________________________ $\mu Ci/cc\ Kr^{85}$

Estimate of Fuel/Cladding Damage

References

Section 2.1.6
Exhibit 2
Worksheet A3

Primary Coolant Analysis

Isotope	Cw_i^{Ref}(μCi/ml)	% Cladding Failure	% Fuel Meltdown
I^{131}			
Cs^{137}			

Containment Gas Analysis

Isotope	Cg_i^{Ref}(μCi/ml)	% Cladding Failure	% Fuel Meltdown
Xe^{133}			
Kr^{85}			

REVISION SUMMARY

Revision 13 – Revision incorporates PASS Technical Specification change. Procedure places primary focus on radiation levels in the containment as initial indicators of core damage. Use of the PASS is maintained in the procedure to permit more precise determination of core damage from gas and liquid samples.

Revision 12 - Changes to reflect power uprate on Unit 2 from 2558 to 2923 MWt, including:

- Deletion of Unit 2 specific information in Exhibit 3, BNP to Reference Plant Parameters; and
- Deletion of separate calculation for Unit 2 on Worksheet B1, Determination of Fuel Inventory Release Based on Containment Radiation Monitoring Reading.