NORTH CAROLINA STATE UNIVERSITY AT RALEIGH

SCHOOL OF ENGINEERING

DEPARTMENT OF NUCLEAR ENGINEERING
NUCLEAR REACTOR PROGRAM
BOX 5636 ZIP 27650

November 3, 1982

NRP-RGC-82-204

Director of Nuclear Reactor Regulations
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket No. 50-297
EMERGENCY PLAN

Dear Sir:

Please find enclosed ten (10) copies of the North Carolina State University PULSTAR Reactor Emergency Plan. The Plan has been prepared in accordance with Title 10 Code of Federal Regulations, Part 50 Appendix E, and with the guidance of ANSI/ANS 15.16 and NUREG-0849 (For interim use and comment). If you should have any questions concerning the Plan, please contact me or Mr. David Caccamo of my staff.

Sincerely,

Robert G. Cockrell

Robert G. Cockrell, Director
Nuclear Reactor Program

RGC/bwl

Enclosures (10)

cc: (w/o enclosure)
Dr. P. J. Turinsky
Mr. D. P. Caccamo
Mr. T. C. Bray
Mr. R. D. Cross

X009
1/10

PULSTAR

EMERGENCY PLAN

North Carolina State University
Box 5067, Raleigh 27650

Office of the Chancellor

LETTER OF PROMULGATION

Need for Emergency Plan

To avoid undue risk to the health and safety of the public and the University employees and students, it is necessary to prepare an Emergency Plan that provides for adequate training and readiness.

It is the policy of North Carolina State University to ensure that emergency planning is at a level that will meet or exceed government regulations and will merit public satisfaction by providing for the safe and efficient operation of the University's research reactor.

Responsibility

The Chancellor of North Carolina State University is responsible for the execution of the PULSTAR Emergency Plan. The authority for development and execution of the Plan is delegated to the Director of the Nuclear Reactor Program through the direction of the Department Head, Nuclear Engineering Department and the Dean of the School of Engineering.

The head of each organization performing Emergency Plan related activities is responsible for: identifying those activities within his organization which are emergency related as defined by the Emergency Plan; establishing and clearly defining the duties and responsibilities of personnel within his organization who execute those activities; and planning, selecting, and training personnel to meet the requirements of the Emergency Plan.

Bruce R. Poulton

Bruce R. Poulton, Chancellor
North Carolina State University

TABLE OF CONTENTS

APPENDICES:

1.0 INTRODUCTION

This Emergency Plan applies to the North Carolina State University (NCSU) PULSTAR's license pursuant to Title 10 of Federal Regulations, Chapter 1, Part 50, as a research reactor, Facility Operating License No. R-120 (Docket No. 50-297).

The North Carolina State University PULSTAR reactor is a pool reactor presently operating with PULSTAR pin-type fuel elements. The PULSTAR fuel is 4% enriched with Uranium-235. The reactor core is attached to the outlet pipe and includes a flapper assembly, a grid plate, and a frame for holding the core instrumentation. Core loading is a 5 x 5 array of twenty-five (25) fuel elements placed on a 6 x 6 aluminum grid plate. Ten (10) graphite reflectors are in peripheral grid positions. The maximum licensed steady-state operating power is 1 MW(t). The North Carolina State University PULSTAR reactor is located in the Burlington Nuclear Facility on the campus of the North Carolina State University, Raleigh, North Carolina (Figure 1-1).

The PULSTAR reactor is used for experimentation and research by undergraduate and graduate students at the University. In addition, services are provided to utilities and industry in reactor operator training, neutron radiography, and neutron activation analysis. The reactor is normally operated five days per week during business hours. Typically the PULSTAR accumulates approximately 800 MW-hrs per year.

The objectives of this Emergency Plan are to establish guidelines and designate areas of responsibility for the Nuclear Reactor Program (NRP) staff and NCSU supporting personnel should an accident or incident occur at the PULSTAR Reactor that may present an undue risk to the health and safety of individuals, or may result in damage to property. Additionally, the Plan identifies the off-site support organizations that may be activated if required.

North Carolina State University has a campus-wide Radiation Protection Office which is intended to integrate radiological safety at all campus facilities using radioactive materials or radiation producing devices. The North Carolina State University PULSTAR Emergency Plan applies to Reactor related emergencies only and will be implemented and directed by the Director, NRP, in lieu of any other University office.

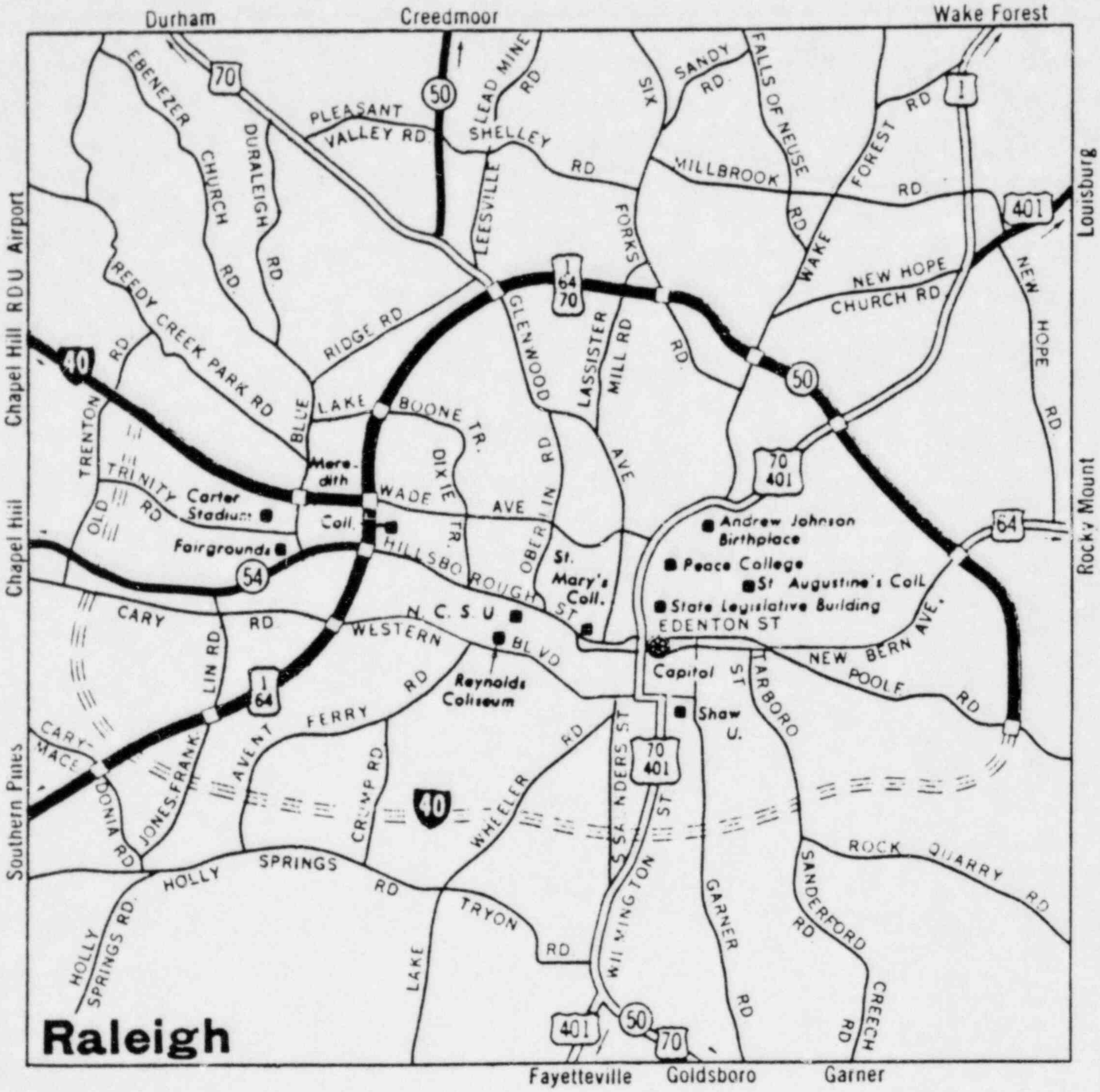

Durham
Creedmoor
Wake Forest
Louisburg
Rocky Mount
Chapel Hill RDU Airport
Chapel Hill
Southern Pines
Fayetteville
Goldsboro
Garner
Raleigh
EBENEZER CHURCH RD.
DURALEIGH RD.
PLEASANT VALLEY RD.
LEAD MINE RD
SHELLEY RD
LEESVILLE
SIX FORKS
SANDY RD.
FALLS OF NEUSE RD
MILLBROOK RD.
WAKE FOREST RD
NEW HOPE CHURCH RD.
NEW HOPE RD.
REEDY CREEK PARK RD
RIDGE RD
LAKE BOONE TR.
BLUE
TRENTON RD.
GLENWOOD
LASSISTER MILL RD
RD.
TRINITY RD
OLD
Carter Stadium
Meredith Coll.
WADE AVE
DIXIE TR.
OBERLIN RD
AVE
Fairgrounds
HILLSBOROUGH ST
St. Mary's Coll.
Andrew Johnson Birthplace
Peace College
St Augustine's Coll.
State Legislative Building
EDENTON ST
CARY RD
N. C. S. U
WESTERN BLVD
Capitol
NEW BERN AVE.
POOLE RD
LIN RD
Reynolds Coliseum
FERRY RD
Shaw U.
TARBORO ST
CARY-MACE
DONIA RD
JONES FRANK
AVENT
CRUMP RD
WHEELER RD
S SAUNDERS ST
WILMINGTON ST
GARNER RD
SANDERFORD RD
ROCK QUARRY RD
HOLLY SPRINGS RD
HOLLY SPRINGS RD.
TRYON RD
LAKE
CREECH RD
70
50
1
401
64
40
54

Figure 1 - 1

2.0 DEFINITIONS

2.1 Burlington Nuclear Facility

The Burlington Nuclear facility is composed of the Administrative and Laboratories building with its basement and three stories which house the Departments' of Nuclear Engineering and Engineering Research, their offices and laboratories, and the Reactor Building and mechanical equipment room.

2.2 Site

The North Carolina State University PULSTAR Reactor Site includes the Burlington Engineering Laboratories (BEL), the area between East Broughton Drive and West Broughton Drive and the area between East Yarborough Drive and the North Face of the Burlington Building as shown in Figure 2-1.

2.3 Reactor Building

The Reactor Building includes the Reactor Bay, Control Room, and Mechanical Equipment Room and serves as a confinement area in case of an emergency (Figure 2-2).

2.4 Operations Boundary

The operations boundary is the border which demarcates the Reactor Building (Figure 2-2).

2.5 Assessment Actions

Those actions taken during or after an accident to obtain and process information which is necessary to make decisions to implement specific emergency procedures.

2.6 Corrective Actions

Those measures taken to correct and terminate an emergency.

2.7 Protective Actions

Those measures taken in anticipation of or after an emergency has occurred to protect the health and safety of individuals and prevent damage to property.

2.8 Recovery Actions

Those actions taken after the emergency to restore the facility to its pre-emergency condition.

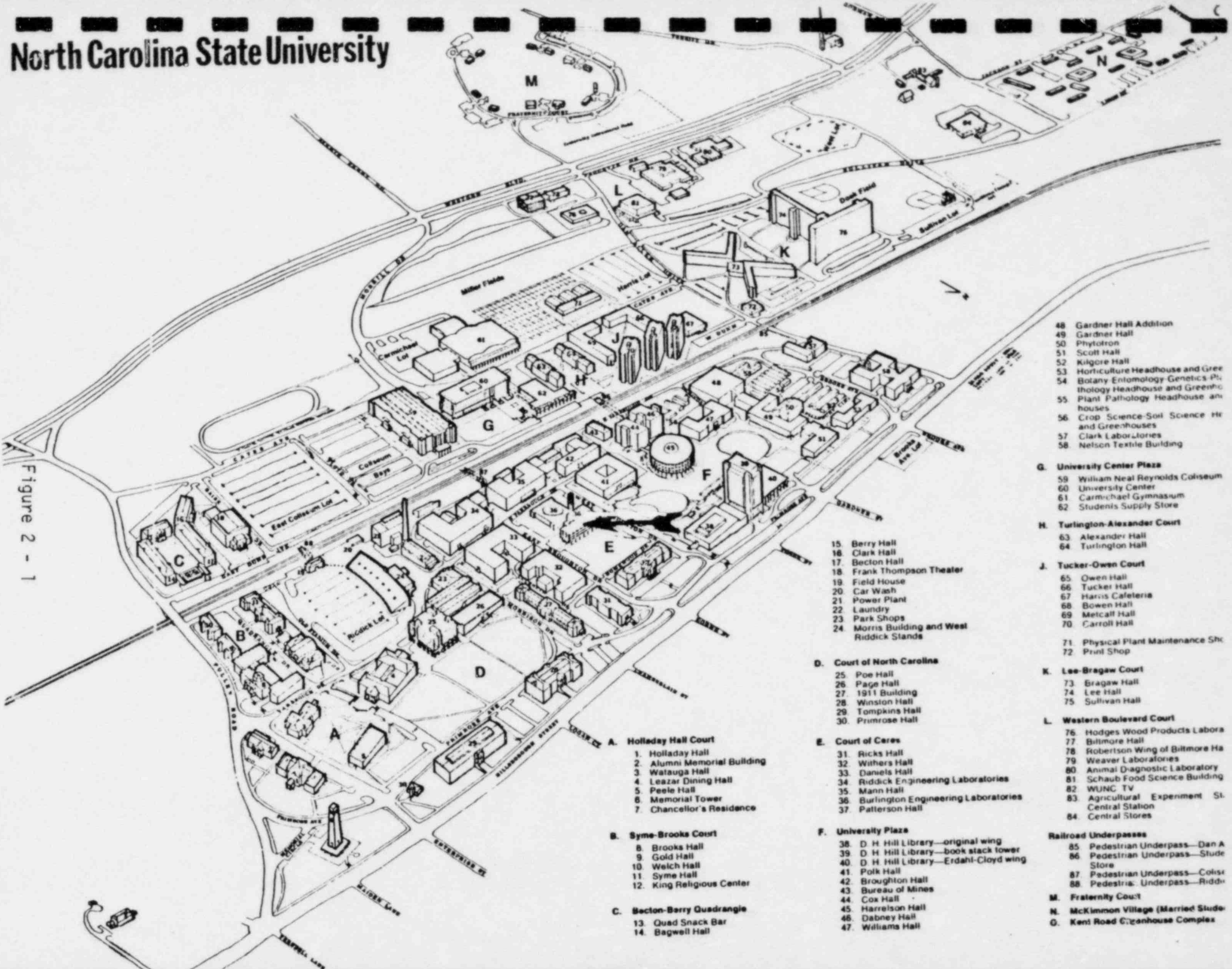
2.9 Warning Point

The warning point is the point of contact for notifying the State of North Carolina Department of Crime Control and Public Safety.

2.10 Shall, Should, and May

The word "shall" is used to denote a requirement; the word "should" to denote a recommendation; and the word "may" to denote permission, neither a requirement nor a recommendation.

North Carolina State University



A. **Holladay Hall Court**
1. Holladay Hall
2. Alumni Memorial Building
3. Watauga Hall
4. Leazar Dining Hall
5. Peele Hall
6. Memorial Tower
7. Chancellor's Residence

B. **Syme-Brooks Court**
8. Brooks Hall
9. Gold Hall
10. Welch Hall
11. Syme Hall
12. King Religious Center

C. **Becton-Berry Quadrangle**
13. Quad Snack Bar
14. Bagwell Hall
15. Berry Hall
16. Clark Hall
17. Becton Hall
18. Frank Thompson Theater
19. Field House
20. Car Wash
21. Power Plant
22. Laundry
23. Park Shops
24. Morris Building and West Riddick Stands

D. **Court of North Carolina**
25. Poe Hall
26. Page Hall
27. 1911 Building
28. Winston Hall
29. Tompkins Hall
30. Primrose Hall

E. **Court of Ceres**
31. Ricks Hall
32. Withers Hall
33. Daniels Hall
34. Riddick Engineering Laboratories
35. Mann Hall
36. Burlington Engineering Laboratories
37. Patterson Hall

F. **University Plaza**
38. D. H. Hill Library—original wing
39. D. H. Hill Library—book stack tower
40. D. H. Hill Library—Erdahl-Cloyd wing
41. Polk Hall
42. Broughton Hall
43. Bureau of Mines
44. Cox Hall
45. Harrelson Hall
46. Dabney Hall
47. Williams Hall
48. Gardner Hall Addition
49. Gardner Hall
50. Phytotron
51. Scott Hall
52. Kilgore Hall
53. Horticulture Headhouse and Gree
54. Botany-Entomology-Genetics-Pl thology Headhouse and Greenho
55. Plant Pathology Headhouse an houses
56. Crop Science-Soil Science He and Greenhouses
57. Clark Laboratories
58. Nelson Textile Building

G. **University Center Plaza**
59. William Neal Reynolds Coliseum
60. University Center
61. Carmichael Gymnasium
62. Students Supply Store

H. **Turlington-Alexander Court**
63. Alexander Hall
64. Turlington Hall

J. **Tucker-Owen Court**
65. Owen Hall
66. Tucker Hall
67. Harris Cafeteria
68. Bowen Hall
69. Metcalf Hall
70. Carroll Hall
71. Physical Plant Maintenance Sh
72. Print Shop

K. **Lee-Bragaw Court**
73. Bragaw Hall
74. Lee Hall
75. Sullivan Hall

L. **Western Boulevard Court**
76. Hodges Wood Products Labora
77. Biltmore Hall
78. Robertson Wing of Biltmore Ha
79. Weaver Laboratories
80. Animal Diagnostic Laboratory
81. Schaub Food Science Building
82. WUNC TV
83. Agricultural Experiment St Central Station
84. Central Stores

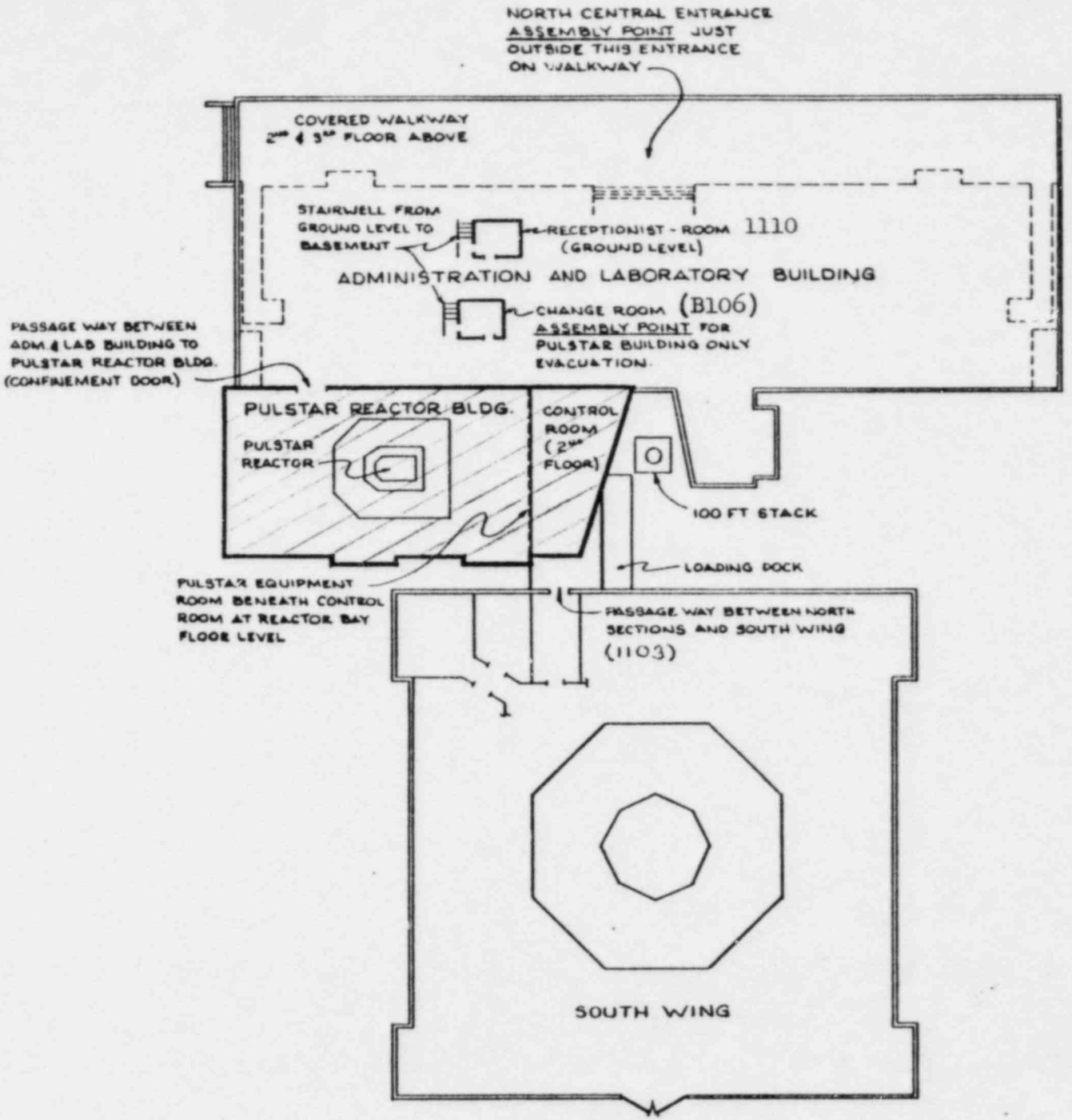
Railroad Underpasses
85. Pedestrian Underpass—Dan A
86. Pedestrian Underpass—Stude Store
87. Pedestrian Underpass—Colise
88. Pedestrian Underpass—Riddi

M. **Fraternity Court**

N. **McKimmon Village (Married Stude**

O. **Kent Road Greenhouse Complex**

Figure 2 - 1



NOTE:
1) DOTTED LINES MARK THE PERIMETER OF THE FIRST FLOOR WALLS
2) CROSS HATCHING MARKS REACTOR BLDG / OPERATIONS BOUNDARY

Figure 2 - 2

3.0 ORGANIZATION AND RESPONSIBILITIES

The North Carolina State University PULSTAR Emergency Plan is designed to provide a means of meeting the additional operational demands that are encountered during an emergency situation. To effect this goal, an Emergency Organization compatible with the normal operating staff is employed in which:

a. A single individual is tasked with the responsibility to direct all emergency response activities.
b. The normal operating staff is assigned specific authorities, responsibilities, and duties.
c. The organization is structured to provide additional resources as is necessary for the proper conduct of the emergency.
d. The Emergency Organization structure allows for the effective transition to it from the normal one.

This Emergency Organization is responsible for all phases of the emergency from its initiation until the commencement of the recovery operation.

3.1 Normal Organization Structure

Figure 3-1 details the normal operating organization for the North Carolina State PULSTAR Nuclear Reactor Program. The personnel available during normal working hours provide the broadest base of specialties to respond to an emergency.

3.2 Emergency Organization Structure

The NCSU Emergency Organization is designed to include as many similarities and functional characteristics as possible from the normal operating structure. This allows a smooth transition into the Emergency Organization and for the effective deployment of expertise (Figure 3-2). Available staff personnel, not specifically designated positions in the Organization, will be assigned to the Emergency Operations Manager for duty on emergency teams.
The Emergency Director shall have the authority to modify the internal Emergency Organization structure responsible to him as he feels is necessary during the actual course of an emergency.

3.2.1 Emergency Director

A Designated NRP Staff Member initiates the Emergency Organization and response using the criteria given in Sections 4 and 5 for the various classes of emergency. The position of Emergency Director is then initially filled by this Staff Member until he is relieved by the Director, Nuclear Reactor Program (NRP), or if he should arrive prior, the Reactor Operations Manager who becomes Acting Emergency Director. The Emergency Director, whether interim, alternate, or principal, is delegated the immediate and unilateral authority to act on behalf of the University in the conduct of all emergency actions involving the facility.

Reports to: Nuclear Engineering Department Head

Supervises: Nuclear Reactor Program staff and all on-campus Emergency Organization assets

Basic function: The Emergency Director is responsibile for taking all actions necessary to manager the reactor emergency.

Primary Responsibilities

1. Coordinating and directing the combined activities of the NCSU Emergency Organization, both on-site and on-campus.
2. Classifying the emergency.
3. Assuring notification of University and local agencies as delineated in the procedures which implement the Emergency Plan.
4. Issuing instructions to the Emergency Organization and insuring that appropriate actions are taken.
5. Initiating protective action to be taken on-campus as required.

6. Determining the feasibility of re-entry operations during or immediately following an emergency situation, including the authorization for re-entry to any part of the facility and the authorization of emergency workers to incur radiation exposures in excess of 10CFR20 limits (in accordance with 10CFR20 requirements and with the advice of the Emergency Coordinator).
7. Assuring continuity of on-campus resources.
8. Insuring Health Physics activities on-campus are carried out.
9. Declaring the termination of the emergency.

Principal Working Relationships:

1. Emergency Operations Manager concerning review and approval of all emergency and recovery plans and procedures.
2. Information Services Director concerning public information needs.
3. Local, State and Federal emergency support agencies concerning services, technical opinions and advice.
4. Health Physicist and Emergency Coordinator concerning radiological considerations.
5. Administrations and Logistics Support Manager concerning administrative needs of the Emergency Organization.
6. Nuclear Engineering Department Head concerning status of the Emergency Organization.

Principal: Director, Nuclear Reactor Program
Alternate: Reactor Operations Manager
Interim: Designated NRP Staff Member

3.2.2 Health Physicist

Reports to: Emergency Director

Supervises: Health Physics staff

Basic Functions: The Health Physicist is responsible for the development of plans and procedures to process and control liquid, gaseous, and solid wastes in a manner consistent with the Emergency Organization objectives, to minimize the radiological effects on the health and safety of the Emergency Organization workers, other University activities, and the public, and to prevent the spread of contamination.

Primary Responsibilities:

1. Develop plans and procedures for sampling and processing liquid, gaseous, and solid wastes.
2. Provide information and recommendations to the Emergency Director concerning future operations that could affect the reactor or the environment.
3. Supervise the Health Physics staff and NRP personnel assigned by the Emergency Director to decontamination, monitoring, and sampling as required by the situation.

Principal Working Relationships:

1. Emergency Operations Manager regarding implementation of plans to obtain samples and process liquid, gaseous, and solid wastes, and to obtain data on reactor waste systems' status.
2. Reactor Support Manager for drawings of systems and equipment.
3. Emergency Director concerning review and approval of proposed modifications to procedures.
4. Emergency Coordinator regarding total on-campus radiological protection.

Principal: Reactor Health Physicist

Alternate: Reactor Safety Specialist

3.2.3 Emergency Operations Manager

Reports to: Emergency Director

Supervises: Reactor Operations Staff

Basic Functions: The Emergency Operations Manager is responsible for the implementation of the emergency activities with the objective of taking the reactor to a safe shutdown condition and maintaining it in that condition in a manner which minimizes the effect on the health and safety of the public.

Primary Responsibilities:

1. Responsible for the implementation of reactor operating and emergency procedures in support of the emergency operation.
2. Responsible for all reactor maintenance activities.
3. Responsible for training of reactor operating personnel on the required emergency operating and maintenance plans and procedures.
4. Provide information and recommendations to the Recovery Manager concerning future operations that could affect the reactor or the environment.

Principal Working Relationships:

1. Emergency Director concerning review and approval of proposed modifications to procedures, systems, and equipment.
2. Health Physicist concerning plans and procedures to process and control liquid, gaseous, and solid wastes.
3. Reactor Support Manager, for drawings of systems and equipment.
4. Emergency Coordinator concerning plans and procedures affecting off-site radiation protection programs.

Principal: Reactor Operations Manager

Alternate: Chief Reactor Operator

Interim: Designated Senior Reactor Operator

3.2.4 Emergency Coordinator

Reports to: Emergency Director

Supervises: Radiation Protection Office

Basic Functions: Coordinate the Emergency Plan, particularly with respect to off-campus radiological consequence assessment and its interaction with the remainder of the Emergency Plan arrangements specific to his facility.

Primary Responsibilities:

1. Establish communications with the on-campus Emergency Support Center and obtain information on the diagnosis and prognosis of the emergency condition, the estimates of radioactive material releases, and the prevailing meteorological conditions. This communication channel is to remain in use for this information as long as is necessary.
2. Maintain communications with off-campus authorities designated in the Emergency Plan and relate the accident diagnosis and prognosis information necessary for the off-campus authorities to implement their emergency plans.
3. Organize and dispatch radiological monitoring teams as required.
4. Interpret all the radiological data obtained and update the on-campus Emergency Support Center and off-campus authorities with the results, in terms of both real-time measurements and, to the extent possible, projected radiological exposures.
5. Arrange for any further on and off-campus radiological evaluations that are requested.

6. Arrange for and dispatch any special assistance or service requested (e.g. radiological measurements or protection equipment, on-campus emergency medical treatment, etc.)
7. Receive any responding representatives from off-campus emergency agencies and assist in their information and communication needs.
8. Consult with Emergency Director concerning Radiation exposures to Emergency Organization personnel.

Principal: Radiation Protection Officer
Alternate: Associate Radiation Protection Officer
Interim: Reactor Engineer

3.2.5 Reactor Support Manager

Reports to: Emergency Director

Supervises: Technical Support Staff functions of I&C Support, System Analysis Support, Licensing Procedures Support, and a data facility.

Basic Functions: This manager is responsible for the analysis and development of plans and procedures in direct support of Reactor Operations personnel with the objective of taking the reactor to a safe shutdown condition in a manner which minimizes the effects on the health and safety of the public. This manager provides a central facility for the collection, retention, retrieval, and transmitting of reactor data.

Primary Responsibilities:

1. Analyze instrument and control problems, determine alternates, develop emergency procedures, design and coordinate the installation of short term instrument and control modifications.
2. Analyze problems, determine alternates, and develop emergency procedures in the area of system operations.

3. Analyze conditions and develop guidance for reactor operations personnel on protection of the core.
4. Develop out-of-normal operating and emergency procedures in direct support of reactor operations personnel.
5. Provide a central point for the collection, retention, retrieval, and transmitting of reactor data.
6. Resolve questions concerning reactor operating licensing requirements with NRC representatives.

Principal Working Relationship:

1. Emergency Operations Manager regarding the implementation of the Emergency Plan and its procedures.
2. Emergency Coordinator regarding any reactor manipulations that might affect off-site doses.
3. Health Physicist regarding any plant manipulations that might affect in-plant radiation or waste inventory levels.

Principal: Reactor Engineer

Alternate: To be named by directive

3.2.6 Administration and Logistics Manager

Reports to: Emergency Director - as a resource only.

Supervises: Administration, Logistics, and Advisory Support.

Basic Functions: Provides administrative, logistic, communications, technical advisory, and personnel support for emergency operations.

Primary Responsibilities:

1. Function as the emergency organization purchasing agent with responsibility for contract negotiation/administration and material control.
2. Administer the petty cash fund and expense accounts. Provide for handling of payroll matters.
3. Meet the manpower request needs of the emergency organization both in the technical and craft disciplines. Insure that clerical support is available and provide labor relations assistance as required.

4. Supervise Advisory Staff providing day-to-day support to Emergency Director. Should be in attendance at all staff meetings of the emergency organizations.

The Administration and Logistics Manager is responsible for a processing center where registration of all arriving emergency personnel is conducted. The center will maintain personnel lists giving names and locations of all emergency personnel.

The Advisory Staff consists of those senior technical personnel who will serve on the Emergency Director's staff. Typically, they will consist of the Nuclear Engineering Department Faculty/Professional Staff and the Nuclear Regulatory Representative.

Principal: Department Head, Department of Nuclear Engineering

Alternate: Graduate Administrator

3.2.7 Emergency News Center Director

Reports to: Emergency Director - as a resource only.

Supervises: Information Services staff.

Primary Responsibilities:

The Emergency News Center Director is the ranking public information representative for the University who (1) relays information to other Information Services, (2) supervises all communications operations at his office, (3) distributes all news releases and statements, and (4) maintains direct contact with the media representatives, to develop guidance on policy and background material. This person coordinates information with his counterparts from local, state, and federal agencies and with other agencies involved with the emergency, and provides a means of meeting the media's needs. He will coordinate all information releases with the State Emergency Response Team Public Information Officer.

Principal Working Relationships

1. Information Services Staff regarding all development and policy decisions they need.
2. Emergency Director for the handling of the press's technical questions.

3. Federal, state, and local government public relations officials.
4. News reporters.

Principal: Information Services Director

Alternate: Nuclear Engineering Extension Specialist

3.2.8 Response Teams

Three Response Teams are under the control of the Emergency Operations Manager, and one of these, the Damage Control Team, is structured so that it may be subdivided into additional specialist Teams.

3.2.8.1 Radiological Emergency Team Leader

The Radiological Emergency Team consists of members of the Radiation Health Physics organization and other Nuclear Engineering Department personnel who have received the necessary training.

Functions:

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

The Senior Health Physics person present becomes the Radiological Emergency Team Leader. When in the judgement of the Emergency Director the emergency situation has stabilized sufficiently, the Health Physics Group members will be released from the direct supervision of Team duties. The existence of this team early in the emergency situation is to enable direct operational control by the Emergency Operations Manager of all personnel during the critical period.

Principal: Reactor Health Physicist

Alternate: Reactor Safety Specialist

Interim: To be named by directive

3.2.8.2 Damage Control Team Leader

At the discretion of the Emergency Operations Manager, any number of damage control teams may be activated to deal with equipment specific emergencies (i.e. electronic, mechanical, etc.). This being the case, no one principal is designated as leader. Rather a pool of alternates from which to choose is composed of the NRP staff and licensed operators.

Functions:

1. Assessment of equipment damage.
2. Emergency repair as required.
3. Installation of emergency systems, structures, or components.
4. Performance of other actions necessary to reduce the effect of an emergency, or to slow down a release when repair is not possible.

Principals:

To be named by directive.

3.2.8.3 Environmental Monitoring Team Leader

The environmental monitoring team is composed of members of the Radiation Protection Office.

Primary Responsibilities:

1. Conduct on-campus (other than in-facility) monitoring and surveys as required to confirm projected releases and to determine levels of environmental contamination.

Principal: Radiation Protection Officer

Alternate: Associate Radiation Protection Officer

3.2.9 Public Safety

Personnel from Public Safety have primary responsibility for all crowd control and security requirements on the NCSU campus. The Public Safety response will be activated by means of the Emergency Telephone Number, 737-3333. They will normally place all additional emergency request calls.

3.3 Off-Campus Service Support

To assist the North Carolina State University Emergency Organization, outside agencies may be required. The following sub-sections describe the assistance to be provided when required.

3.3.1 Medical Assistance

Rex Hospital has the emergency medical facilities available to render immediate treatment to contaminated and non-contaminated injured personnel. The on-call Hospital Administrator, when appraised of the emergency situation, will activate those positions in the Rex Emergency Plan that are required to respond.

3.3.2 Ambulance Service

The Wake County Emergency Medical Service will provide emergency transportation for contaminated and non-contaminated injured personnel to Rex Hospital. Ambulance personnel have installed two-way radio communication with the Rex Hospital Emergency Room staff for the purposes of emergency treatment and triage.

3.3.3 Fire Assistance

The Raleigh Fire Department provides primary fire fighting protection for North Carolina State University. In case of fire, Fire Station #5 will provide a pumper truck and, if required, Fire Station #1 will provide a ladder truck. Normal Fire Department response time is less than 5 minutes as measured during drills.

3.3.4 Wake County Radiation Management Team

The Wake County Radiation Management Team was formed to aid with emergency services at any time an accident involving radio-

active materials happens in Wake County. The team is under the direction of the Chief of the State Radiation Protection Branch. The team is in no way designed to take command of an emergency at the scene, but would render aid to the State Radiation Protection Branch in handling the situation.

3.3.5 Department of Crime Control and Public Safety

The Department of Crime Control and Public Safety functions as the State of North Carolina's Emergency Planning Coordinator. In that capacity, the department has overall management responsibility for planning, developing, and updating North Carolina's Radiological Emergency Response. The Department coordinates emergency response activities for the state of North Carolina and other government response agencies.

3.3.6 North Carolina State Radiation Protection Emergency Team

The North Carolina State Radiation Protection Team is available through the Radiation Protection Section of the Division of Facility Services, Department of Human Resources. Whenever the NCSU Emergency Organization is activated, the Radiation Protection Section and the Department of Crime Control and Public Safety will be notified and advised of the situation and any required assistance. During other than normal working hours, both departments are alerted by calling the State Highway Patrol, which also, within the Department of Crime Control and Safety, provides backup security forces.

3.3.7 Nuclear Regulatory Commission

At the request of North Carolina State University, the Nuclear Regulatory Commission (NRC) will provide additional technical advice, assistance, and personnel during and following a radiological emergency. The NRC will be notified and advised upon the activation of the Emergency Organization.

3.3.8 Department of Energy

Upon the request of the State of North Carolina, the Department of Energy (DOE) will provide equipment, supplies, and personnel to evaluate hazards and minimize radiation exposure. In addition, the

DOE will assist in carrying out emergency response operations and implementing protective actions. DOE coordinates under the Inter-agency Radiological Plan (IRAP) federal resources in the event of a radiological emergency.

3.3.9 Wake County/City of Raleigh

Notification of Wake County and the City of Raleigh is done simultaneously by contacting the Emergency Preparedness Office for Wake County. No direct support is received from either other than the emergency services previously detailed.

PULSTAR NRP ORGANIZATION

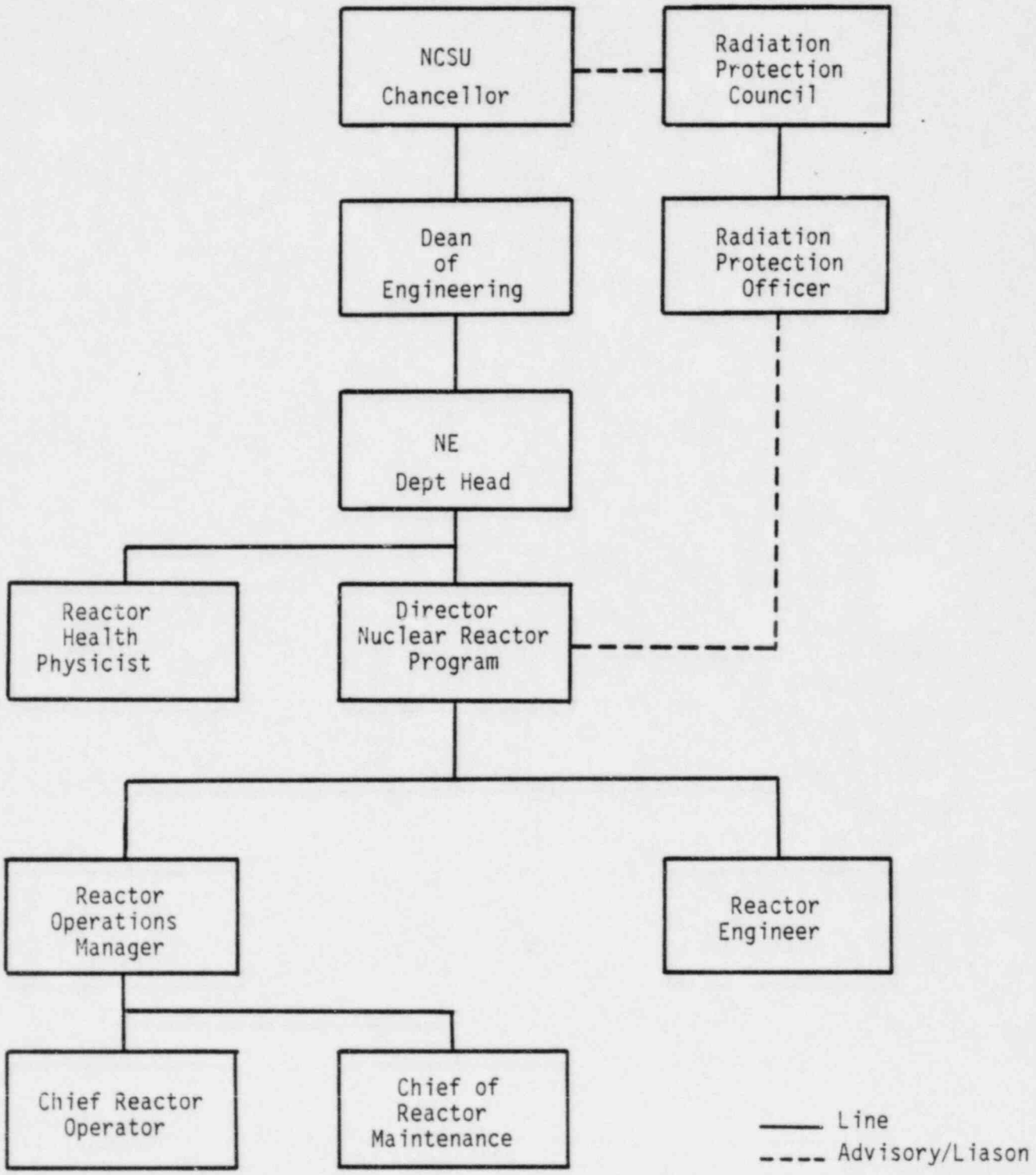


Figure 3 - 1

NCSU
EMERGENCY ORGANIZATION

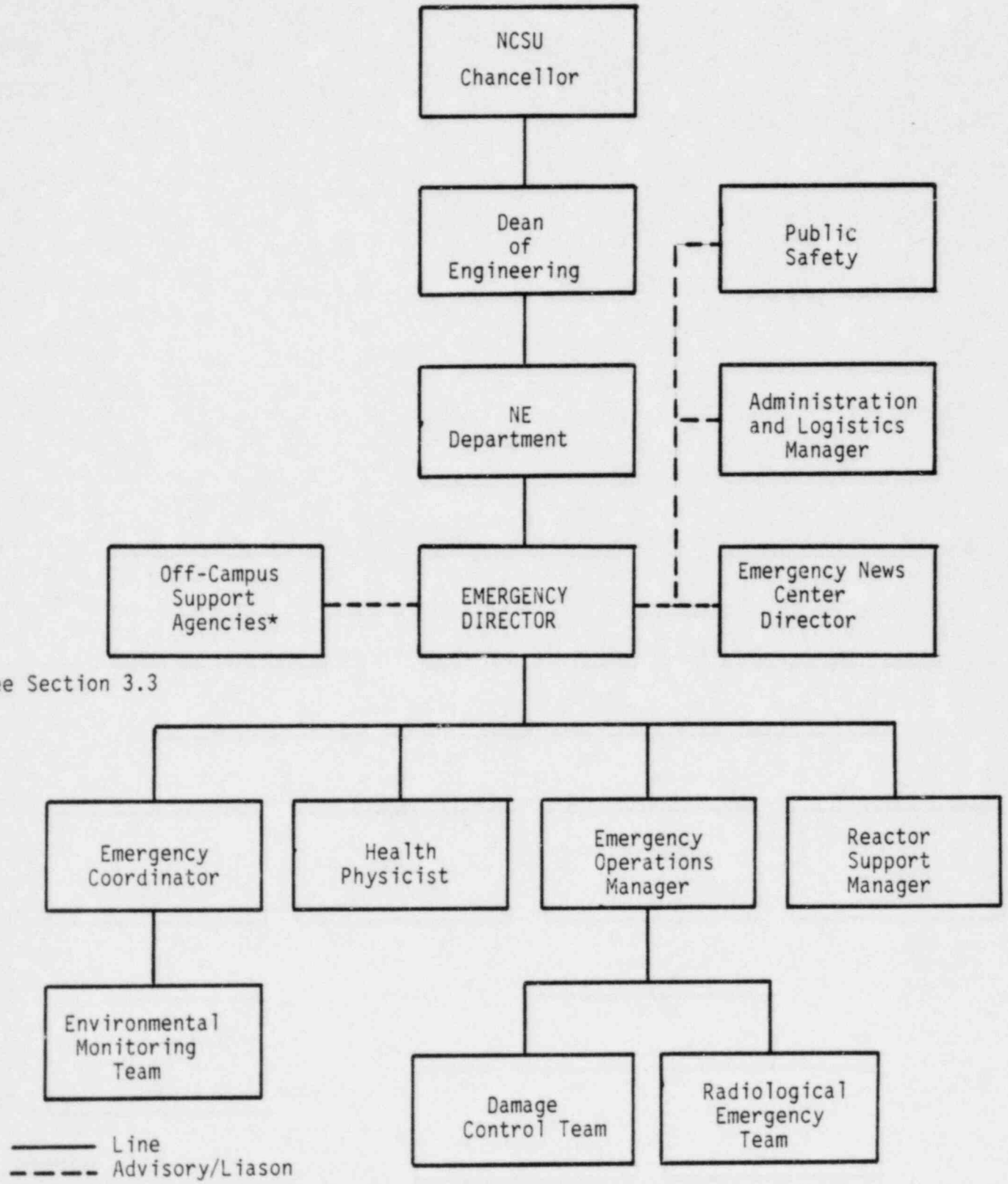


Figure 3 - 2

4.0 EMERGENCY CLASSIFICATION SYSTEM

A key element of the PULSTAR Emergency Plan is a pre-planned system of notifying and activating various emergency organizations. This system uses graded levels of emergency response where the actions specified are organized according to the general severity of the emergency condition. While many potential emergencies exist that have less severe off-site consequences than the least severe class specified below, the planning for on-site emergencies is important.

4.1 Emergency Classes

There are three (3) basic tests or criteria that must be considered in deciding what emergency class exists. These are:

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

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, reactor building, etc. pose a potential danger to the public?

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

4.1.1 The four (4) Emergency Classes in increasing order of severity are:

1. Notification of Unusual Events
2. Alert
3. Site Area Emergency
4. General Emergency

4.2 Emergency Class Categorization

The categorization of events and combinations of events according to one of the four Emergency Classes is implemented through

Emergency Action Levels (EAL's). These are specific sets of reactor conditions, instrument readings, and events which, unless promptly corrected, coincide with the conditions associated with one of the four (4) emergency classes. The EAL's have been selected with the view toward insuring 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 projected releases and resultant exposures are performed. The results, along with other reactor status assessment, are the bases for whether or not protective actions for the public will be implemented.

4.3 Types of Emergency Classes

In the following subsections each of the four Emergency Classes is discussed.

4.3.1 Notification of Unusual Events

Events are in process or have occurred which indicate a potential degradation of the level of safety of the reactor.

4.3.1.1 Emergency Action Levels for Notification of Unusual Events

1. Failure of an experiment with minor releases of radioactivity as determined by observing the following levels on the radiation monitoring system.*
    a. Stackgas - 500 MPC
    b. Stack particulate - 500 MPC
    c. Aux. GM - 500 MPC
    d. Filter GM - 500 MPC
2. Radionuclide effluents at the site boundary exceeding 10 MPC averaged over 24 hours or 15 mrem whole body accumulated in 24 hours.
3. Fire in the facility lasting more than 10 minutes.
4. A leak in the Primary System resulting in a loss of reactor pool level at a rate which may be replaced by normal pool fill.
5. Security threat or attempted entry, or attempted sabotage.

6. Natural phenomena being experienced or projected beyond usual levels:
    a. any earthquake
    b. a tornado or hurricane on the NCSU campus

Note: Due to the location of the Burlington Building, no danger of flooding from natural sources exists.

7. Other imminent or existing hazards such as:
    a. high energy missiles impacting on the facility.
    b. an explosion in the facility or immediately adjacent to it that affects the reactor operation.
    c. uncontrolled releases of toxic or flammable gases in the facility.
    d. Aircraft crash on-site.

4.3.2 Alert

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

4.3.2.1 Emergency Action Levels for an Alert

1. Transient that requires the use of shutdown systems, but the reactor fails to Scram
2. An on-going compromise of security.
3. Severe natural events that are imminent or existing such as:
    a. earthquakes that are damaging reactor safety equipment or the Reactor Building
    b. tornado or hurricane winds that appear to be damaging the Reactor Building structure.
4. Other imminent or existing hazards that occur when the reactor is not shutdown. Examples include:
    a. aircraft crashes into the Reactor Building

b. severe damage to safe shutdown equipment from missiles or explosions, and

c. the entrance of uncontrolled toxic or flammable gases into the Reactor Building where lack of access would constitute a safety problem.

5. Severe fuel damage or failure of an experiment resulting in significant releases of radioactivity as determined by observing the following levels on the radiation monitoring system.*

   a. Stackgas - 2500 MPC
   b. Stack particulate - 2500 MPC
   c. Aux GM - 2500 MPC
   d. Filter GM - 2500 MPC

6. Radionuclide effluents at the site boundary exceeding 50 MPC averaged over 24 hours or 75 mrem whole body accumulated in 24 hours.

7. Radiation levels at site boundary of 20 mrem/hr for 1 hour whole body or 100 mrem/hr thyroid dose.

8. Area radiation monitor readings sufficient to cause evacuation of the reactor building.

   a. Control Room 25 mR/hr
   b. Pool 100 mR/hr
   c. West Wall 100 mR/hr

9. Fire in the Control Room, on the reactor bridge, or in the immediate vicinity of any nuclear instrumentation or control equipment which could affect reactor safety.

4.3.3 Site Area Emergency

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

4.3.3.1 Emergency Action Levels for a Site Area Emergency

No credible accidents attributable to the reactor or its operation are postulated which can cause emergency conditions beyond the site boundary. The Emergency Director however, retains the right to declare this class if he deems conditions require such.

4.3.4 General Emergency

Events are in process or have occurred which involve actual or imminent substantial core degradation or damage with potential for loss of confinement integrity.

4.3.4.1 Emergency Action Levels for a General Emergency

No credible accidents attributable to the reactor or its operation are postulated which can cause emergency conditions beyond the site boundary. The Emergency Director however, retains the right to declare this class if he deems conditions require such.

*For the purposes of off-site release calculations, the upper floor of the Library Building is more limiting than the actual site boundary. The dillution factor from the stack to this point is 50. Once the ventillation system is in confinement, the dillution factor is 800 and adjustments should be made accordingly.

5.0 EMERGENCY ACTION LEVELS

The Action Levels specified in Table 5-1 and described in subsections of Section 4 are considered Emergency Action Levels. (EAL's) for activating the emergency organization and the initiation of Protective Actions appropriate for the emergency event. These Action Levels are specified for effluent monitors and other on-site parameters for which dose rates and radiological effluent releases at the operations boundary can be projected. In situations where the EAL's are not applicable, the Emergency Director retains the right to declare an Emergency in any circumstance where, in his judgement, the status of the reactor warrants it.

	NOTIFICATION OF UNUSUAL EVENTS	ALERT
SCRAM		1. Reactor fails to scram
SECURITY THREAT	1. Security threat 2. Attempted entry 3. Attempted sabotage	1. On-going compromise of security
POOL LEVEL	1. Drop of 1" in a 2 hr period	1. Drop of 5" in 15 min period
FIRE	1. Lasting more than 10 minutes	1. In control room, on reactor bridge or in vicinity of nuclear instrumentation
NATURAL PHENOMENA	1. Any earthquake 2. Tornado or hurricane on campus	1. Earthquake damaging reactor safety system or reactor building 2. Tornado or hurricane damaging reactor building

Table 5-1 (1 of 2)

	NOTIFICATION OF UNUSUAL EVENTS	ALERT
OFFSITE READINGS AND EFFLUENT MONITORS	1. Stackgas - 500 MPC 2. Stack Particulate - 500 MPC 3. Aux GM - 500 MPC 4. Filter - 500 MPC 5. Effluents at most conservative off-site location 10 MPC averaged over 24 hrs 6. 15 mrem whole body accumulated over 24 hrs	1. Stackgas - 2500 MPC 2. Stack Particulate - 2500 MPC 3. Aux GM - 2500 MPC 4. Filter - 2500 MPC 5. Effluents at most conservative off-site location 50 MPC averaged over 24 hrs 6. 75 mrem whole body accumulated over 24 hrs 7. Radiation levels of 20 mrem/hr for 1 hour whole body at most conservative off-site location 8. Radiation level of 100 mrem/hr thyroid dose at most conservative off-site location
AREA RADIATION MONITORS		1. Control Room - 25 mR/Hr 2. Pool -100 mR/Hr 3. West Wall -100 mR/Hr
OTHER	1. High energy missile impact on facility 2. Explosion in facility (or adjacent) that affects reactor operation 3. Uncontrolled release of toxic or flammable gas in facility 4. Aircraft crash into facility	1. Aircraft crashes into reactor 2. Severe damage to safe-shutdown equipment from missiles or explosion 3. Toxic or flammable gases restricting access to reactor building where such constitutes a safety problem

Table 5-1 (2 of 2)

6.0 EMERGENCY PLANNING ZONES

The Operations Boundary is established as the Emergency Planning Zone (EPZ). The size of the area within the Operations Boundary is large enough to provide a response base that would support activity outside this area should this ever be needed. The predetermined Protective Actions for the EPZ are described in Section 7.

Section 13.3 of the NCSU PULSTAR FSAR states "A review of those accidents which could possibly occur...indicates the MCA [Maximum Credible Accident]...consists of an assumed complete loss of pool water due to a ruptured inlet or outlet pipe... The hazard is related only to the vertical radiation beam eminating from the shutdown core from which vertical shielding has been removed. Corrective measures can be taken to plug the leak and refill the pool without danger from the vertical radiation beam." And from Section 13.2.1.4 of the FSAR, "Assuming this complete draining of the tank [pool] did occur, the radiation at the top of the tank...was estimated to be less than 100mR/hour..." Considering the MCA, the total inventory of the core and the fact that the core is air coolable, at no time would the Protective Action Guides of 1 rem wholebody or 5 rem to the thyroid be exceeded. Therefore, no danger to any surrounding populations exists in the event of the MCA.

7.0 EMERGENCY RESPONSE

Subsequent to the establishment that an emergency condition exists, the Emergency Organization will be activated. This organization must assess the nature and magnitude of the situation, take corrective actions to bring the emergency to an end, and take all those protective actions necessary to assure the health and well being of personnel, both on and off-site. Concurrent with the activation of the on-site organization, notification of off-site agencies must proceed to insure their support and the safety of all concerned. Off-site organizations which will provide support have signified such with Letters of Agreement (Appendix A).

7.1 Activation of the Emergency Organization

Listed in the following subsections are the means of initiating the Emergency Organization commensurate to the level of emergency declared.

7.1.1 Activation of Emergency Organization for a Notification of Unusual Events

The Designated NRP Staff member, when informed that an Emergency Action Level has possibly been exceeded, verifies the indication and classifies the emergency in one of the four categories. For an emergency categorized as a Notification of Unusual Events, the Designated NRP Staff member will take all those immediate actions necessary to correct and/or mitigate the situation. He will direct the activation of those portions of the Emergency Organization as shown in Figure 7-1. As soon as practicable after the initiation of a Notification of Unusual Events, the necessary organizations and agencies will be notified. He will ensure that the Warning Point is notified within 30 minutes of the initiation of the Notification of Unusual Events.

7.1.2 Activation of Emergency Organization for an Alert

The designated NRP Staff member, when informed that an Emergency Action Level has possibly been exceeded, verifies the indication and

classifies the emergency in one of the four categories. For an emergency categorized as an Alert, the designated NRP Staff member will take all those immediate actions necessary to correct and/or mitigate the situation. He will direct the activation of the Emergency Organization as s'own in Figure 3-2. As soon as practicable after the initiation of an Alert, the necessary organizations and agencies will be notified. He will ensure that the Warning Point is notified within 30 minutes of the initiation of the Alert.

7.1.3 Activation of Emergency Organization for a Site Emergency

The designated NRP Staff member, when informed that an Emergency Action Level has possibly been exceeded, verifies the indication and classifies the emergency in one of the four categories. For an emergency categorized as a Site Emergency, the designated NRP Staff member will take all those immediate actions necessary to correct and/or mitigate the situation. He will direct the activation of the Emergency Organization as shown in Figure 3-2. Immediately after the initiation of a Site Emergency, the necessary organizations and agencies will be notified. He will ensure that the Warning Point is notified within 15 minutes of the initiation of a Site Emergency.

7.1.4.1 Activation of Emergency Organization for a General Emergency

The designated NRP Staff member, when informed that an Emergency Action Level has possibly been exceeded, verifies the indication and classifies the emergency in one of the four categories. For an emergency categorized as a General Emergency, the designated NRP Staff member will take all those immediate actions necessary to correct and/or mitigate the situation. He will direct the activation of the Emergency Organization as shown in Figure 3-2. Immediately after the initiation of a General Emergency, the necessary organizations and agencies will be notified. He will ensure that the Warning Point is notified within 15 minutes of the initiation of a General Emergency.

7.2 Assessment Actions

The Emergency Director shall make assessments necessary to determine the extent of the emergency and the possibility of escalation to a more serious class. The Health Physicist shall have the responsibility for assessing the amount of radioactivity released or threatened to be released and reporting the assessment to the Emergency Director. The means by which instrument readings may be correlated with quantities of released radionuclides are contained in Appendix B.

7.2.1 Release Rate Determination with Normal Instruments Inoperable

In the event that facility assessment instrumentation is either inoperable or off-scale, grab samples of air and filters through which air has passed would be analyzed by multi-channel analyzers and gas-flow proportional counters.

These samples will yield the concentrations of activity in air at a specific point. Knowing the Dilution Factor at that point and the Stack Flow Rate, one can calculate the release in Ci/sec. Similar sampling and measurement would be used for liquid assessment.

7.2.2 On-Site Dose Rates

On-site radiation dose rates will be determined by portable survey instruments. On-site contamination surveys will be made by swipes or portable survey instruments.

7.2.3 On-Site Personnel Doses

Permanent employees are issued a film badge and a personal, self-reading dosimeter. There are extra badges and dosimeters, as well as a dosimeter charger, in each Emergency Locker. Additional badges and dosimeters are available from the Campus Radiological Protection Office.

7.3 Notification

The Emergency Director will utilize the notification message format provided by the implementing procedures, filling in the required information and directing its communication by the Emergency Coordinator to the organizations and personnel also listed in those procedures (Note: For reasons of security, the format for reporting and the call

list are provided separate from this plan). Both are kept by telephone locations in the Nuclear Reactor Program office area. Notification should be made to these organizations and persons in the order of their listing, except that the failure to reach any one of them should not prevent or delay the transmittal of the information to those lower on the list. A request for emergency assistance (fire, ambulance, etc.) early in the emergency is not a substitute for the more complete notification of the formated notification message. Follow-up emergency notification in this format will be authorized by the Emergency Director whenever changing emergency conditions require it. In the case of the initial notification, a call-back repeat of the message will be accomplished to verify the message's contents. In the absence of the principal, alternate, or interim Emergency Coordinator, any of the Designated NRP Personnel may begin initial notification when authorized by the Emergency Director.

The Public Information Manager is identified as the official University spokesperson for the emergency. It is of the utmost importance that this single spokesperson concept be carried out infact to avoid even minimal contradictions of detailed analysis. This person must closely coordinate news releases with the Emergency Director, the University administration, and governmental public relations officials to insure this accuracy. The spokesperson is responsible for arranging interviews, for statements quoted in press releases, for other announcements, and for presiding at formal press conferences (though others may answer most of the questions). Other Employees, other than the Emergency Director, are to make no statements without first checking its accuracy with the spokesperson.

7.4 Corrective Actions

In the event of a facility emergency, NRP personnel shall attempt to control it with the means available until emergency aid arrives, provided this can be accomplished without serious risk to personnel in-

volved. The Emergency Director will coordinate the activities to minimize the uncontrolled releases of radioactive materials. The PULSTAR Operations Manual contains emergency procedures for Reactor Operator response, which include scrams, evacuations, and initiation confinement.

7.4.1 Notification of Unusual Events

In cases justifying the declaration of a Notification of Unusual Events, corrective actions may include the shutdown of the reactor and assistance from fire, medical, or security personnel.

7.4.2 Alert

In cases justifying the declaration of an Alert, corrective actions may include, reactor shutdown or scram, initiation of confinement or evacuation, and the assistance of fire, medical, or security personnel.

7.4.3 Site Emergency and General Emergency

The corrective actions for a Site Emergency and General Emergency are generally the same in nature as those for an Alert. The immediacy of these actions and the nature of followup actions will vary in accordance with the specific nature of the event.

7.5 Protective Actions

7.5.1 Evacuation

The reactor facility may be evacuated of all personnel by the cyclic sounding of klaxon horns. Klaxon horns are arranged in two (2) groups. The first group is located within the Reactor Building and the second group is located throughout the BEL complex. The second group is connected to the alarm system by a BEL/Rx Bldg. switch on the Radiation Alarm Panel which is under the supervision and control of the licensed Reactor Operator. This switch is turned to Rx Bldg. during periods when a licensed Operator is in the BEL complex (normally during working hours) and is turned to BEL after working hours, on weekends, and on holidays when a licensed Operator is not on duty. These horns may be activated by:

a. Any one the of six designated radiation detection channels.

b. Manually by the PULSTAR Operator.

c. By the switch in the basement hall near the doors to the Reactor Bay.

Upon hearing the warning for an evacuation, all personnel not in the Reactor Bay will evacuate the facility via the nearest exit and assemble outside the North-central doors of the BEL. Personnel in the Reactor Bay will evacuate to the change room and contact control.

7.5.2 Aid to Affected Personnel

During an emergency condition, NRP personnel may be required to enter contaminated or dangerous areas to rescue injured or trapped personnel. The Emergency Director with the advice of the Health Physicist or Emergency Coordinator will assess the potential radiation hazards and authorize rescue operations accordingly.

7.5.3 Use of Emergency Supplies

Emergency lockers containing protective clothing and emergency equipment are located in the foyer of the BEL and in the Change Room (See Section 8).

7.5.4 Contamination Control

Measures will be taken to reduce the contamination of floors or other surfaces, and access will be controlled to areas that do become contaminated. The spread of contamination from this source will be minimized.

The protective action values for the following are:

Decontamination of personnel	When contaminated
Decontamination of personnel wounds	When contaminated
Decontamination of supplies	When supplies are needed during the emergency or when value dictates. Otherwise discard/dispose to burial.
Decontamination of instruments	When contaminated
Decontamination of equipment	When contaminated

7.5.5 Decontamination and First Aid

Emergency Medical Technicians are available on call through the North Carolina State University. The Health Physicist and his staff will be responsible for the decontamination of all individuals involved in an emergency other than those transported for medical treatment.

7.5.6 Medical Transportation

Injured personnel shall be transported by the Wake County Emergency Services ambulance services. Each ambulance is staffed by Emergency Medical Technicians and is capable of transporting contaminated victims. A member of the emergency staff trained in radiological safety will accompany any contaminated person to the hospital.

7.5.7 Medical Treatment

Rex Hospital shall provide facilities to accept and treat contaminated injured victims. The hospital has emergency procedures for this situation.

7.5.8 Exposure Levels

The total absorbed doses whole-body (rem) to be permitted at this facility during an emergency are:

1.	Rescue of personnel (lifesaving)	75 rem
2.	Taking corrective actions	25 rem
3.	Performing assessment actions	3 rem
4.	Providing first-aid	0.5 rem
5.	Providing ambulance service	0.1 rem
6.	Providing medical treatment	0.1 rem

7.6 Emergency Health Physics

Radiation protection records are maintained by the Campus Radiological Protection Office. A complete listing of Health Physics Equipment is provided in Section 8.

7.7 Penetration Planning

Penetration of the BEL Complex after an evacuation will proceed for the following purposes and in this sequence:

1. Building Search for Personnel
2. Personnel Rescue (May be concurrent with Search)
3. Radiation Survey
4. Reentry of the Reactor Building
5. Recovery Operations

7.7.1 Teams

Each of these penetrations shall be made by a "team" of not less than two (2) members of the NRP staff, equipped with one radio, one survey instrument, personnel dosimetry, and protective clothing (according to the situation).

7.7.2 Objectives

The objectives of each team shall be:

1. Building Search: To verify the complete evacuation of the BEL within 30 minutes after initiation of an emergency event and to report the location of injured personnel. (Note: Search and rescue operations have a minimum-time urgency simply because of the need to be sure all personnel have evacuated the BEL).
2. Personnel Rescue: Used only to remove injured personnel.
3. Radiation Survey: To make a radiation survey of specified areas and entry ways into the reactor building. (Note: All personnel team actions shall be completed prior to initiating each subsequent team action. Time urgency relating to subsequent team action is only for the purpose of minimizing the dose received by personnel.
4. Reentry: To penetrate the reactor building to obtain additional situation information to mitigate the cause of the incident.
5. Recovery Operations: The planning of activities or sequences of events necessary to return the reactor to its normal operating condition and the execution of this plan.

7.7.3 Radiation Exposure

Personnel involved in any operation under this plan should endeavor to keep their radiation exposure to a minimum. The maximum dose permitted shall satisfy the requirements of 10CFR20.

7.7.3.1 Guidelines

Guideline dose limits are as follows:

1. Personnel search team outside Reactor Building 10 mr/person.
2. Personnel search team within the Reactor Building 100 mr/person.
3. To investigate cause of evacuation 250 mr/person.
4. To temporarily correct cause 500 mr/person (more only with the approval of the Emergency Director).

7.7.3.2 Emergency Dose

The Emergency Dose for Radiation Workers of 25 rem once in a lifetime shall not be used unless there has been full consultation among the Health Physicist, the Emergency Director, the Emergency Coordinator, and the affected personnel, and an agreement reached that the circumstances of the situation merit this emergency exposure.

7.7.4 The Reactor Building Penetration

The Reactor Building Penetration point shall be determined by the Emergency Director on the basis of available information. The early emergency penetration of the control room, if only for radiation and reactor system information, may be desirable. Relocation to the control room of emergency control may be affected as soon as definitive information that the exposure dose rate in the control room will permit (not more than 25 mrem/hr).

7.7.5 Return of Personnel

Occupants of BEL who have been evacuated may be permitted to return to the normal work areas only after the emergency situation has stabilized and the determination made that a nuclear hazard no longer exists.

Return of Recovery Personnel into the Reactor Building should be dependent upon radiation levels that are stable or decreasing and the observation that radioactive releases have ceased or are under control.

EMERGENCY ORGANIZATION FOR AN UNUSUAL EVENT

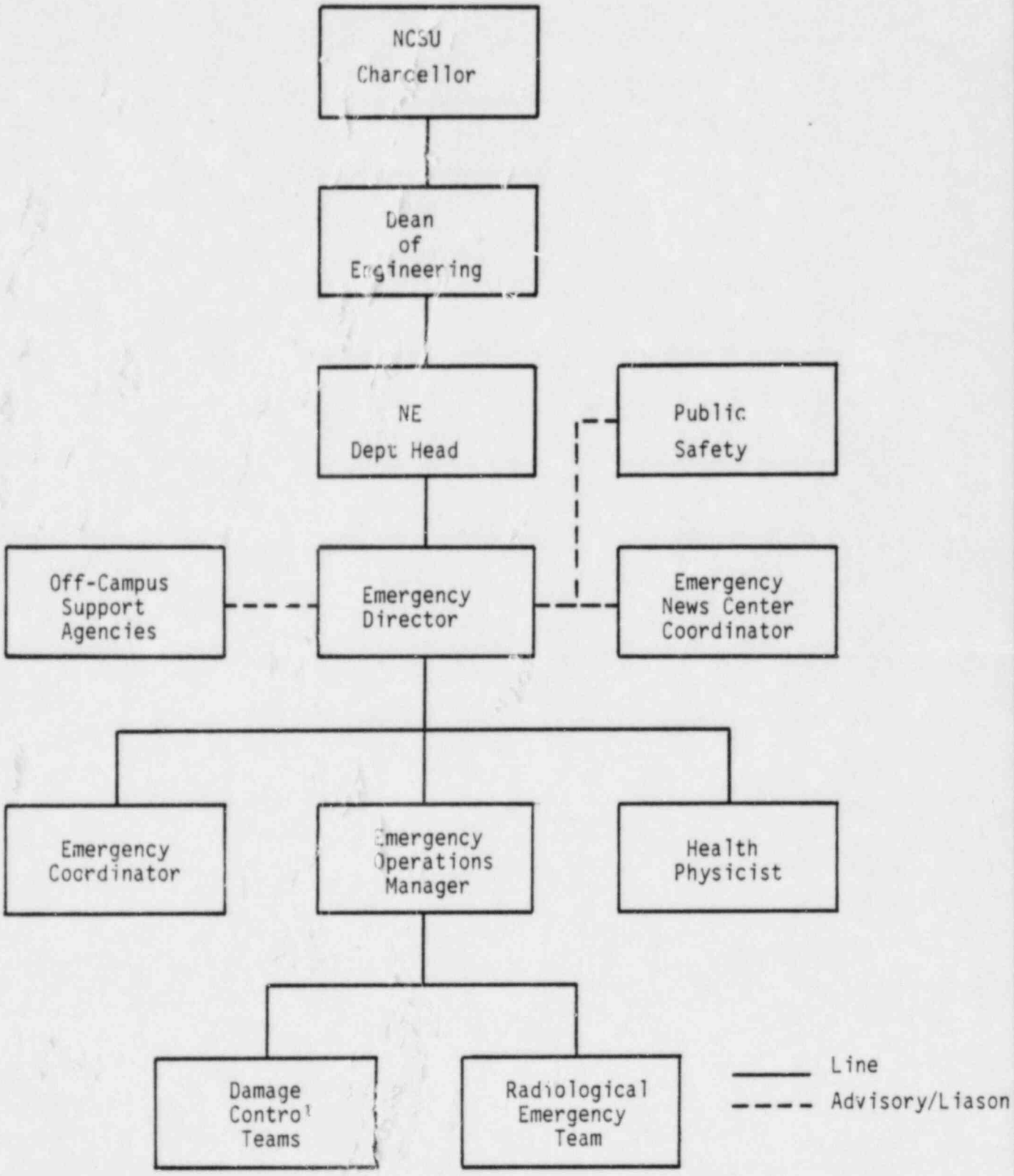


Figure 7 - 1

8.0 EMERGENCY FACILITIES AND EQUIPMENT

To facilitate the control of the numerous actions required in an emergency situation, several facilities have been designated as operating centers for the PULSTAR Emergency Organization. These facilities are supplied with the equipment necessary to perform their intended functions. In addition, specialized equipment has been installed or been pre-positioned throughout the facility to aid the Organization in emergency analysis and control.

8.1 Emergency Facilities

The locations presented in the following paragraphs are those from which the Emergency Organization will operate while correcting the emergency situation and accomplishing the subsequent recovery.

8.1.1 PULSTAR Control Room

The PULSTAR Control Room is the central facility from which reactor control is exercised. It contains instrumentation and controls necessary for operation of the research reactor. It is equipped to give warning of a potential emergency condition and to provide continuing evaluation of such a situation. Equipment is available for both internal and off-site communications. It is supplied with emergency power in cases where off-site electricity is lost.

8.1.2 Emergency Support Center

The Emergency Support Center is composed of those offices normally occupied by the Nuclear Reactor Program staff. It has voice communication capabilities to link it with the Control Room. The Center is directly adjacent to, but outside of, the PULSTAR reactor confinement. The Emergency Support Center will be activated whenever the PULSTAR Emergency Plan is implemented. If, by reason of emergency evacuation, the Emergency Support Center cannot be occupied, its location will be transferred to the foyer of the BEL complex. Likewise, if the foyer should become uninhabitable, the Emergency Support Center will be transferred to an adjacent University building.

8.2 Emergency Equipment and Systems

A variety of instrumentation, systems, and equipments are necessary to allow the Emergency Organization to respond to potentially serious situations.

3.2.1 First-Aid and Decontamination

First aid kits are located in the emergency lockers in the foyer and change room. The change room also contains showers and supplies required for personnel decontamination. Stretchers are located in the Reactor Bay and the foyer.

8.2.2 Communications Systems

To insure proper notification of all personnel in an emergency situation, several means of primary and backup communications are provided.

8.2.2.1 Intercom System

The Intercom System provides the primary basis for communications between the Control Room and remote stations in the Burlington Engineering Laboratories. The Master Station located on the reactor console may select any one or all of the following stations:

1. Director, NRP
2. Reactor Operations Manager
3. Reactor Health Physicist
4. Operations
5. Neutron Activation Analysis Laboratory
6. Reactor Bridge
7. Reactor Bay (NW Door)
8. Mechanical Equipment Room
9. Change Room
10. Radiochemistry Laboratory (B105, BEL)

The Master Station and the first eight remote stations are modified to provide two (2) features: first, the Master Station cannot monitor a remote station without that station's knowledge; and second, it allows those stations "hands-off" operation when needed.

8.2.2.2 Public Address System

The Public Address System is an auxiliary means of communication to the bay. It is used in evacuating the confinement area of Burlington Engineering Laboratories if the normal evacuation system should fail, for general annunciations, and for locating persons in an emergency. The microphone is located on the control console. The exterior public address system in an emergency is provided by security car loudspeaker systems and Police and NRP bullhorns.

8.2.2.3 Telephone System

NCSU utilizes the CENTREX telephone system which allows communication between stations on campus. It is interfaced with the commercial lines to allow both local and long distance dialing. Special features of the system include the conference call and call-transfer capabilities.

8.2.2.4 Radio System

Radio transceivers are utilized for emergency communications and for contact between casualty control teams within the Burlington Facility. UHF transceivers are available in the Control Room. These are handheld devices capable of maintaining communications anywhere in the facility. For emergency communications between Burlington and other on-campus sites, citizens band (CB) radios are available in the foyer Emergency Locker. Additionally, the University security force can provide emergency radio communications.

8.2.3 Radiological Assessment Equipment

The radiological assessment equipment described in this section provides the Emergency Organization the information necessary to make accurate estimates of the radiological consequences of an accident. The equipment is stocked in convenient locations for quick response. It serves, in part, to supply the information for the initiation of protective actions. This equipment is calibrated in accordance with the manufacturers recommendations.

8.2.3.1 Emergency Equipment Lockers

Emergency lockers containing accident assessment and personnel protective equipment are located in the foyer of the Burlington

Engineering Laboratories and in the Change Room in the basement. In addition, the Radiation Protection Officer maintains a locker of equipment for his use in the Radiation Protection Office. The contents of these lockers are given in Tables 8-1 through 8-3. All portable Health Physics instruments and dosimeters in these emergency kits are inspected, repaired, and calibrated quarterly by the Health Physics' or Radiation Protection Office staff.

8.2.3.2 Survey and Sampling Equipment

Table 8-4 lists all the types of radiological monitoring equipment available at the PULSTAR facility and the uses of each.

8.2.3.3 Radiation Monitoring System

Table 8-5 lists the locations, setpoints, and associated alarms for the detectors that make up the radiation monitoring system. This installed equipment is used for monitoring area, air, waste water, and personnel. With the exception of the personnel monitors, these channels have readout modules in the Control Room. Additionally, the air and area monitors are connected to a multi-point recorder. This recorder operates continuously to maintain a historical record of radiation levels.

8.2.3.4 Meteorological Monitoring

In the unlikely event of a radioactive release to the environment, the meteorological information necessary for estimating off-site exposures is provided by the National Weather Service at the Raleigh-Durham Airport.

8.2.3.5 Campus Monitoring System

The Campus Monitoring System is used to monitor the many non-nuclear systems that keep the campus operating. The monitoring system is comprised of numerous and various types of sensors throughout the buildings on campus. These sensors are monitored by the Honeywell-Selectographic Data Center located in the Morris Building. When a malfunction occurs and an alarm is triggered, the Data Center automatically prints out the sensor code along with the date and

time. Since the Data Center is under a twenty-four (24) hour surveillance, no time is lost in responding to an alarm. The Campus Monitoring System has installed several sensors in the main building of Burlington Engineering Laboratories. These sensors are used for the following:

1. Failure of main electrical service.
2. Operation of main building Chiller Pump and Chill Water Temperature.
3. Operation of main building Hot Water Pump for Reheat Coils.
4. Operation of main building Return Air Fans.
5. Operation of main building Supply Air Fans.
6. Failure of main building Air Fans.
7. Fire in building.

8.2.3.6 Fire Alarm System

The Fire Alarm System for the Burlington Engineering Laboratories is composed of various thermal detectors and manual switches. Detection by these sensors or actuation of the manual switches activates relays in the Master Control Panel that sounds the buildings audible alarms and transmits this data to the Campus Monitoring System. On receipt of an alarm in the Reactor Building, a firebell is activated and a light enunciation is made on the Fire Alarm Enunciator located on the North Wall of the Control Room.

8.2.3.7 Security Alarm System

The specifics of the Security Alarm System are of a classified nature and are presented in the NCSU PULSTAR Physical Security Plan.

8.2.3.8 Analytical Laboratories

The North Carolina State University Nuclear Reactor Program has established a Nuclear Measurements and Analysis Division to provide Nuclear services (neutron activation analysis, neutron radiography, etc.) to State, Federal and commercial users. Together with the normal Health Physics laboratories, it offers the broadest range of analytic methods for the classification and measurement of any radionuclides in the case of an accident.

8.2.3.9 Primary Instrumentation

Information on reactor temperature, water level, flow, power level, and other primary indications is presented on the reactor panel in the Reactor Control Room.

8.2.3.10 Auxiliary Electrical System

Auxiliary power is supplied by a natural gas internal combustion generator located outside the confinement areas in Room 1103 (Figure 2-2). This power source is furnished only to provide a more convenient and orderly shutdown of activities in case of loss of the commercial power. The auxiliary generator is started manually from the process control section of the reactor console through the use of a battery pack at the generator. In the event of the loss of normal power, the reactor operator can manually place the three prime circuits on auxiliary power. The switches which control the transfer of these circuits to auxiliary power are located in the Control Room. These circuits are Confinement Fan #1, Confinement Fan #2, and Control Room Distribution Panel.

EMERGENCY EQUIPMENT FOYER

white coveralls

Waterproof Anti-C, full set, medium, large

Disposable Anti-C, full set

Spare yellow cloth Anti C hoods.

Heavy duty Anti-C boots.

Rubber Anti-C gloves.

flashlight and batteries

self rising dosimeters.

dosimeter charger

film badges

clip board w/emergency plan

key - change room emergency locker; basement; Co-60 safety switch; R-3 fan room; room 3131 roof fan.

boxes chemical cartridges

round ultra filter cartridge, type H

boxes respirator filters

full face respirators

half face respirator

axe

portable radiacs

walkie-talkie

Scott air-pak

Air splint kit

Bull horn w/batteries

Red flags (emer.)

Emergency flares

Disposable Anti-C Boots

Rubber Anti-C gloves

Heavy duty boots

Heavy duty gloves

Rolls radcon tape

Filter paper (smears)

Boundary ribbon (RADCON)

Radiation area signs

Caution signs

Gallon RADIAC wash

Personnel decon kit
a. disposal gloves
b. paper towels
c. solution "A" bottles 1,2 & 3
d. solution "B" bottles 1 & 2
e. hand scrub brush

Box disposable gloves

paper towels (pack)

disposable overalls

disposable caps

disposable boots

plastic drop cloths (9 x 12)

Bucket

Fab detergent

sponges

scrub brush

Bab-O cleanser

Hand brush

100 ft. 1/8" cord

plastic bags

Table 8 - 1

EMERGENCY EQUIPMENT
CHANGE ROOM

- Decon Kit
  - Soap
  - Brush
  - Pkg. Towels
  - Lanalin
  - gloves
- Cutie Pie Ion Chamber mR/hr
- End Window G. M. mR/hr & CPM
- Civil Defense Ion Chamber r/hr
- Geiger 5 (GM) mR/hr
- First Aid kit
- Full-face Mask w/canister
- Filter cartridge (R520)
- Kimwipes
- Dosimetry Film Packs
- Rad Tape
- Direct Readout Dosimeters
- Dosimeter Charger
- Magenta Rope/Tap
- 1" Masking Tape
- 8" Crucible
- Whatman #2 Filter Paper
- Filter Cartridges #84305
- Rad Signs and Tags
- Emergency Log Book
- Scissors
- Bullhorn
- Emergency Locker Key
- Clip Board
- Coveralls
- Plastic Waste Bags
- 24" Crucible
- Sets of Anti - "C"

Table 8 - 2

EMERGENCY EQUIPMENT
RADIATION PROTECTION OFFICE

- Hi-Range Survey Meter
- Smears
- HiVol Air Sampler & Filters
- LoVol Air Samper & Filters
- One Liter Bottle
- Soil Sample Box
- Radiation Area Sign
- Radioactive Materials Sign
- Rope
- Lined Writing Pad
- Extension Cord
- Flashlight
- Batteries (D Cell)
- Tape
- Gloves (outer/inner)
- Shoe Covers
- Head Cover
- Anti C's
- Copy of Emergency Plan
- Film Badges
- Tool Box
- Stretcher
- Scott Air Pack

Table 8 - 3

RADIOLOGICAL MONITORING EQUIPMENT

MAKE	MODEL	APPLICATION
Eberline	RM-14, Monitor	Personnel Monitoring (GM)
Eberline	PAC-4G Alpha Counter	Survey Portable (Gas Flow)
Picker	G. M.	Survey, Portable (GM)
RAY-D-TEC	Rad Gun	Survey, Portable (Ion Chamber)
Victoreen	Thyac 490	Survey, Portable (GM)
Victoreen	Thyac 491	Survey, Portable (GM)
Ludlum	Geiger 5	Survey, Portable (GM)
Victoreen	Cutie Pie, 740	Survey, Portable (Ion Chamber)
Victoreen	Radector III, 2035	Survey, Portable (Ion Chamber)
Victoreen	Radector III, 2036	Survey, Portable (telescoping Ion Chamber)
Jordan	Rad Gun	Survey Portable (Ion Chamber)
Victoreen	488B	Survey Portable (B^{10}) neutron spectrum
Eberline	PMC-4B	Personnel Monitoring Walk thru Frame (11, GM's)
Eberline	PNR-4	Survey, Portable neutron Dose (BF_3)
Eberline	Teletector, 1112	Survey, Portable (GM's)
Eberline	Pic-6	Survey, Portable (Ion)
Victoreen	497	Survey, Portable (Ion)

Table 8 - 4

RADIATION MONITORING SYSTEM

Monitor	Detector Location	Setpoint		Detector Type	Comments
		Alert	Alarm		
Control Room	On Walls Between Windows	2.5 mR/hr	25 mR/hr	Dual Coaxial Ion Chambers	Alert causes "Radiation Alert" on Reactor Control Console Alarm causes Evacuation
Pool	Over Pool	10 mR/hr	100 mR/hr		
West Wall	West Reactor Bay Wall	10 mR/hr	100 mR/hr		
Primary Demin.	M.E.R. Mounted on Demineralizer	50 mR/hr	100 mR/hr		Alert causes "Radiation Alert" Annunciation. Also has Local Readout and Alarm
VAMP	Over Pool	2.5 mR/hr	NA	G. M. Tube	Local Audible and Visual Alarm
Stack Gas	Stack Sampling Unit	As Noted On Readout Modules		G. M. Tube	Alert causes "Radiation Alert" Annunciation on Reactor Control Console Alarm causes Evacuation
Particulate				Beta Scintillator	
Aux. G. M.	Exhaust Duct			G. M. Tubes	
Filter G. M.	Exhaust Filter Bank				Alert causes "Radiation Alert" Annunciation.
CAM	South Reactor Bay Wall	Full Scale		Beta Scintillator	Local Audible and Visual Alarm
Waste Tank No. 1,2,3	Dry Well in Each Tank	As Noted on Readout Modules		Gamma Scintillator	No console Annunciation
Hand and Foot	Outside Control Room Door	None		G. M. Tubes	Local Meter and Audible Count Rate
Portal	Basement Lab Corridor	Pre-Set		G. M. Tubes	Local Audible and Visual Alarm

Table 8 - 5

9.0 RECOVERY

9.1 General

After the Emergency Director has declared that the emergency condition has passed, steps will be taken to recover from the incident. All recovery action will be preplanned in order to minimize the radiation exposure and other hazards to recovery personnel. The overall goals of the recovery effort are to assess the consequences of the emergency and perform clean-up and repair operations. This effort includes the marshalling of University resources and interfacing with outside agencies.

9.2 Recovery Organization

Activation of the Recovery Organization will be initiated by the Nuclear Engineering Department Head after consultations with the Emergency Director. The Recovery Organization will then be established as presented in Figure 9-1 for the recovery of the facility. The Recovery Organization may begin to draw plans for the recovery of the facility while the emergency is still in progress. However, these efforts will not be permitted to interfer with or detract from the efforts to control the emergency situation. The Recovery Center will be those offices formerly designated as the Emergency Support Center.

9.2.1 Recovery Manager

The Recovery Organization will be under the direction of the Recovery Manager. The Emergency Director will assume the duties of the Recovery Manager upon the activation of the Recovery Organization. The Recovery Manager has the authority to authorize the return of personnel.

9.2.2 Reactor Operations Manager

The Reactor Operations Manager is responsible for the implementation of PULSTAR Recovery Activities with the objective of maintaining a safe shutdown condition and controlling sources of radioactivity in the facility. The Emergency Operations Manager will revert to the position of Reactor Operations Manager upon the activation of the Recovery Organization. The Reactor Operations Manager will report to the Recovery Manager during the recovery phase.

9.2.3 Technical Analysis Manager

The Technical Analysis Manager is responsible for analysis and development of plan procedures to support the recovery operation and to maintain the PULSTAR in a safe shutdown condition in a manner which minimizes the effect on the health and safety of the public. The Reactor Engineer will assume the duties of Technical Analysis Manager upon the activation of the Recovery Organization. The Technical Analysis manager will report to the Recovery Manager and provide technical support as needed.

9.2.4 Radiological Control and Waste Manager

The Radiological Control and Waste Manager is responsible for providing radiation protection and waste disposal plans consistent with the recovery operation. The Health Physicist will assume the duties of the Radiological Control and Waste Manager upon the activation of the Recovery Organization.

9.2.5 Advisory Support

The Advisory Support staff function consists of those senior technical personnel who will serve on the Recovery Manager's staff. Typically they will consists of the Nuclear Engineering Department and the Nuclear Regulatory Commission representatives. This group provides day-to-day support to the Recovery Manager and his staff and should be in attendance at all meetings of the Recovery Organization.

9.2.6 Design and Construction Support

The Design and Construction Support staff coordinates the design and construction activities of construction forces and outside vendors. Personnel will be contracted or chosen from advisory positions to fill these vacancies. The makeup of the staff will be decided upon at the commencement of the recovery phase by the Recovery Manager, taking into account the requirements imposed by the emergency.

9.2.7 Recovery Coordinator

The Emergency Coordinator will assume the duties of the Recovery Coordinator upon the activation of the Recovery Organization. He will continue those duties of communications and radiological monitoring and assessment as are required for interaction with off-campus agencies. The Recovery Coordinator will inform all other Emergency Response Organizations of reentry recovery plans and of the organizational changes imposed by activation of the Recovery Organization. This notification will be made at the commencement of the recovery operations and as often as necessary thereafter to those individuals and organization previously notified of the emergency.

9.3 Recovery Procedures

Recovery procedures will be drafted by the Recovery Organization and approved by the Recovery Director for each operation prior to its initiation. These procedures will include at a minimum the consideration of contamination and radiation levels.

NCSU
RECOVERY ORGANIZATION

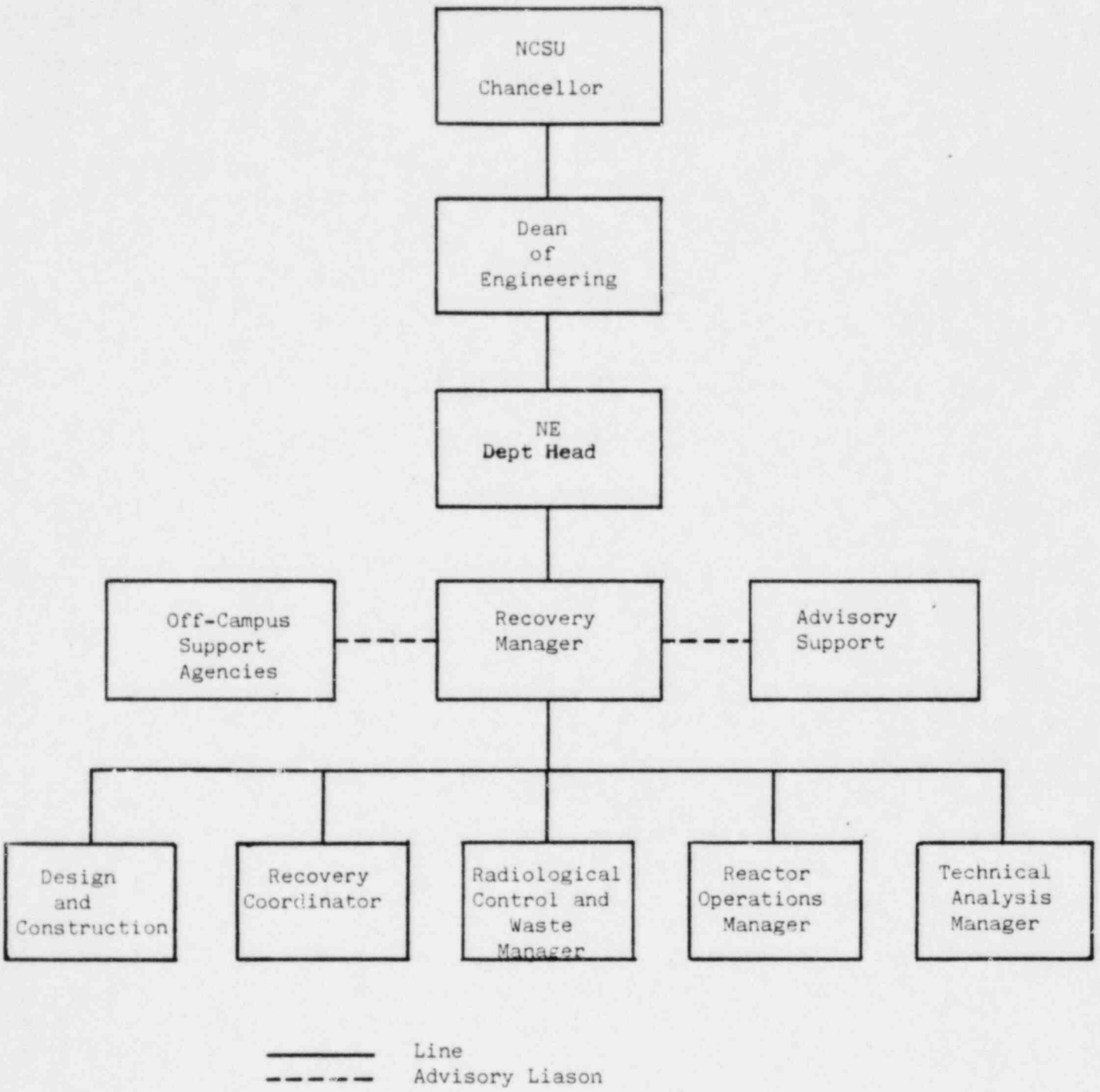


Figure 9 - 1

10.0 MAINTAINING EMERGENCY PREPAREDNESS

Emergency preparedness at the PULSTAR research reactor will be maintained by:

a. Preparing the Emergency Organization members for proper emergency response action through training, drills, and exercises.

b. Periodic review and update of the PULSTAR Radiological Emergency Plan and its implementing procedures.

c. Periodic inventory and calibration of emergency equipment and instrumentation.

10.1 Organizational Preparedness

Organizational preparedness is maintained through an integrated training program that includes general orientation of all Nuclear Engineering Department personnel at the Burlington facility and detailed training of individuals and groups required to perform specific functions and actions during an emergency condition.

10.1.1 Training

The training program is designed to familarize appropriate individuals with the Emergency Plan and the procedures that implement the plan. It is recognized that other training (i.e. Regulatory Guide 8.29, Reactor Operator Requalification) also provide information related to Emergency Planning and these are not reproduced here. Specific training subjects for initial training and biennial retraining are discussed below. Personnel identified as alternates or interims for a position will also receive training for that position.

10.1.1.1 Emergency Director

The Emergency Director training emphasizes organization and management; that is, the command and control responsibilities of the Emergency Director. The Emergency Director is responsible for managing the efforts of others and therefore must be familiar with the key functions to be

performed by each element of the Emergency Organization. Typical topics include:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.
3. Interpretation of data and how it relates to emergencies and their classifications.
4. Emergency Communication procedures.
5. Capabilities and services to be provided by support organizations and agencies.
6. Emergency Radiation exposure control.
7. Record keeping.

10.1.1.2 Emergency Operations Manager

The Emergency Operations Manager is responsible for managing the activities of the Reactor Operators and the Damage Control Teams. His training involves indoctrination in the following:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.
3. Capabilities and services to be provided by support organizations and agencies.

10.1.1.3 Emergency Coordinator

The Emergency Coordinator training includes:

1. Emergency Organization.
2. Emergency Communication procedures.
3. Emergency Classes and Emergency Action Levels.

10.1.1.4 Reactor Operators

The Reactor Operators' training includes instructions in the following areas:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.
3. Record keeping.
4. Emergency Operating Procedures.

10.1.1.5 Damage Control/Radiological Emergency Teams

Training of the Teams includes:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.
3. Emergency Operating Procedures
4. The use of radiation detection devices.
5. Familiarization with damage control equipment.
6. Record keeping.
7. Contamination and Decontamination.

10.1.1.6 Reactor Support Manager

The Reactor Support Manager training covers the same topics as the Emergency Coordinator.

10.1.1.7 Administration and Logistics Manager

The Administration and Logistics Manager training includes all those areas covered by that for the Emergency Director.

10.1.1.8 Health Physicist

The Health Physicist training includes:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.
3. Emergency radiation Exposure Criteria.
4. Capabilities and services to be provided by support organizations and agencies.

10.1.1.9 Nuclear Engineering Department Training

All Nuclear Engineering Department personnel not subject to specific training requirements for Emergency Organization support will participate in general Emergency Plan training to include:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.

10.1.1.10 Radiation Protection Office (RPO)(Environmental Monitoring Team)

Personnel attached to the RPO will be trained in:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.

3. Interpretation of data and how it relates to emergencies and their classification.
4. Emergency radiation exposure criteria.

10.1.1.11 Campus Security

The Campus Security training includes:

1. Emergency Organization.
2. Facility familiarization.
3. Emergency Classes and Emergency Action Levels.
4. Emergency Communication procedures.
5. Principles of radiological safety and the effects of radiation.
6. The use of radiation detection devices.

10.1.1.12 Information Services Office

Information Services Office training includes:

1. Emergency Organization.
2. Emergency Classes and Emergency Action Levels.
3. Emergency Communications procedures.
4. Capabilities and services to be provided by support organizations and agencies.
5. Principles of radiological safety and the effects of radiation.

10.1.1.13 Off-Site Organizations

For those organizations providing emergency services, i.e. Rex Hospital, Wake County Emergency Services, Raleigh Fire Department, training will be provided for by the Nuclear Reactor Program personnel. Training will include as appropriate:

1. Principles of radiological safety and the effects of radiation.
2. The use of radiation detection devices.
3. Facility familiarization.
4. Contamination and Decontamination.

10.1.2 Drills and Exercise

Drills and exercises will be conducted periodically to test the adequacy of the Plan and the implementing procedures and the preparation and training of the emergency personnel. Each drill and exercise scenario will include the following:

1. The basic objective or objectives of the exercise.
2. The date, time period, place, 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 assistance, rescue of personnel, use of protective clothing, deployment of radiological monitory teams, and public information activities.
6. Arrangements for qualified observers.

These scenarios will be forwarded to the observers not less than one week prior to the date of the event.

10.1.2.1 Drills

Emergency drills are supervised instruction periods for testing, developing, and maintaining skills in a particular operation. Personnel will participate in annual drills that are supervised and evaluated by a qualified instructor. These drills shall include:

1. Communication drills: A system check to test the readiness of the communications network between the University and the local, State and Federal governments.
2. Fire drills: Fire drills will be held in accordance with the Safety Analysis Report.
3. Medical emergency drills: Medical emergency drills involving a simulated contaminated individual and use of the local support agencies (i.e. ambulance and medical treatment facilities).
4. Radiological monitoring drills covering contamination control methods and procedures, dose rate measurements, non-essential personnel evacuation, and record keeping.

10.1.2.2 Exercises

An exercise is an event that tests the integrated capability of major response organizations. An emergency exercise will be conducted annually and will be based on a scenario which is ultimately declared at least as a site emergency. The scenario will be varied from year to year such that all elements of the reactor, county and State plans and emergency organizations are tested within a five year period. Every fifth year, the exercise will be expanded to involve 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 insure a realistic participation by those involved. Each annual exercise scenario will include a list of performance objectives and a description of the expected response. Specific tasks to be evaluated are:

1. Condition recognition and reporting.
2. Assessment.
3. Off-site notification.
4. Off-site response.
5. Site response coordination.
6. Corrective actions.
7. Protective actions.
8. Record Keeping
9. Monitoring
10. Reactor Operations

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 (including Plan/Procedure revision) and the schedules for performing them, and will evaluate the corrective actions taken.

10.1.3 Emergency Planning Coordinator

The Reactor Engineer is the North Carolina State University PULSTAR Emergency Planning Coordinator. He is responsible for coordinating on-site and off-site radiological emergency response planning. He requests the relevent individuals to prepare and maintain the applicable implementing procedures and assures that these procedures are properly implemented. He is also responsible for performing the following planning functions:

1. Interfacing with Federal, State, county, and local planners.
2. Revising and updating the plan biennially and in response to new Federal regulations, modifications identified during exercises and drills, and changes in hardware and personnel.
3. Coordinating the biennial exercise and 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.
6. Maintaining and negotiating agreements for State and county response agencies, Federal assistance agencies, and medical and fire support agencies.
7. Maintaining Emergency Plan records.

Training for the Emergency Planning Coordinator will be the same as that for the Emergency Director.

10.2 Review and Update of the Plan and Implementing Procedures

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

10.2.1 Plan Revision

The Emergency Planning Coordinator is responsible for coordinating the updating of the Plan and its implementing procedures. He schedules a biennial review of the Plan by the Radiation Protection Council. Any proposed changes to the Plan due to regulatory revisions, experiences of drills and exercises, or other requirements and reviews by the Director, Nuclear Reactor Program, are approved by the Radiation Protection Council. Approved changes to the Plan and Procedures will be distributed to all organizations and individuals with responsibilities for implementation of the plan within 30 days of the revision. Revised pages will be dated and marked to show where changes have been made.

10.2.2 Off-Site Agreements

Emergency response agreements with supporting organizations are revised and updated by the cognizant organization at least every two years and incorporated into the biennial revision.

10.3 Maintenance and Inventory of Emergency Equipment and Supplies

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

10.3.1 Emergency Equipment and Supplies

A listing of the emergency equipment and supplies to be inventoried are included in the implementing procedures. This listing provides information on location and availability of emergency equipment and supplies. An inventory of all emergency equipment and supplies is held on a quarterly basis and after use in an emergency, drill or exercise. During this inventory, radiation monitoring equipment is to be checked to verify that required calibration and locations are in accordance with the inventory lists.

10.3.2 Medical Equipment and Supplies

At least twice each year and immediately after use in an emergency, drill or exercise the contents of emergency medical equipment and supplies will be inventoried, inspected, replaced, replenished, and/or sterilized as necessary.

10.4 Radiation Protection Council

The Radiation Protection Council is a standing committee comprised of North Carolina State University personnel that provides timely and continued review of all radiation protection needs of the North Carolina State University campus. The Radiation Protection Council must review all substantive changes to the NCSU PULSTAR Emergency Plan and implementing Procedures.

APPENDIX A

LETTERS OF AGREEMENT

Rex Hospital 4420 Lake Boone Trail/Raleigh, North Carolina 27607

October 20, 1982

Mr. D. W. Morgan, Associate
Radiation Protection Officer
North Carolina State University
Box 5344
Raleigh, North Carolina 27650

Dear Bill:

Rex Hospital has your NCSU Pulstar Emergency Plan on file in my office. Our Hospital has a written External Emergency Plan which is a plan for expansion of the Hospital's facilities and services to receive and care for casualities that cannot be handled through normal routine. There is specific reference in our Plan for handling casualities which involve radiation contamination.

Our Hospital agrees to serve as a participant in the NCSU Pulstar Emergency Plan. We are capable and willing to provide support by receiving and treating casualities.

Please contact me if you have any questions.

Sincerely yours,

James W. Whichard

James W. Whichard
Director of Materials

JWW:ss

cc: Executive Director
Associate Director
Director of Human Resources

STATE OF NORTH CAROLINA
DEPARTMENT OF HUMAN RESOURCES
Division of Facility Services
P. O. BOX 12200 RALEIGH 27605-2200

JAMES B. HUNT, JR.
GOVERNOR

SARAH T. MORROW, M.D., M.P.H.
SECRETARY

I. O. WILKERSON, JR.
DIRECTOR

TELEPHONE
AC 919/733-4283
Radiation Protection

October 21, 1982

INTEROFFICE MA L
L.T. Caruthers, R.S.O.
N.C. State University
214 David Clark Labs
Raleigh, North Carolina

Dear Mr. Caruthers:

The purpose of this letter is to reaffirm the Radiation Protection Section's role in the unlikely event of radiological emergencies or incidents with offsite consequences at N.C. State University. This specifically includes the occurrence of such events at the university's Pulstar Reactor Facility.

In the event of an incident or emergency involving actual or potential offsite consequences, the Radiation Protection Section is responsible for responding and for taking whatever actions are necessary for the protection of the public and the environment from radiation hazards. The actions of the Radiation Protection Section would include direct radiation monitoring environmental sampling, laboratory analysis of samples for radioactivity content, and recommendation of needed protective actions.

During such response, all Radiation Protection Section resources would be available as necessary. These resources include fixed laboratory analysis capability out of our Raleigh based environmental laboratory, mobile radiation laboratory with extensive communications capability, all section staff, a wide variety of portable measurement and analystical equipment for radioactivity analysis, and other resources available to the section through any interagency or other agreements.

In the event of a situation which would require a response by two or more State agencies, it should be noted that such response would be under the general coordination and control of the Department of Crime Control and Public Safety.

continued-

In the event that such coordination and control is not necessary, this will further confirm that the abovementioned resources would still be made available as necessary.

Sincerely yours,

Dayne H. Brown, Chief
Radiation Protection Section

DHB:lwr

cc: Tom Pugh, Director, Division of Emergency Management, DCC&PS
James C. Cuddington, Radiological Safety Officer, Radiation Protection Section

TO: R. G. Cockrell, Director
Nuclear Reactor Program
North Carolina State University

FROM: Fire Chief,
Raleigh Fire Department
City of Raleigh

SUBJECT: Services to be provided to North Carolina State University in support of the PULSTAR Reactor Emergency Plan.

The Raleigh Fire Department agrees to provide fire protection to North Carolina State University's PULSTAR Reactor in the event of implementation of the PULSTAR Reactor Emergency Plan. This agreement will remain in effect for the two (2) year period from 3 November 1982 to 3 November 1984.

In the event that the Raleigh Fire Department desires to terminate this agreement prior to the expiration date, 60-day written notification will be provided to North Carolina State University.

R. E. Kuth Chief

Signature/Title

11-1-82

Date

APPENDIX B

B. EFFLUENT RADIONUCLIDE MEASUREMENTS

B.1 Gaseous Effluent

The PULSTAR gaseous effluent discharge channel is monitored by four detection systems.

Channel	System	Detector
4	Particulate	Beta Scintillator
5	Stack Gas	Thin-Wall GM
6	Auxiliary GM	Thin-Wall GM
NA	Filter	Thin-Wall GM

Each of these detection systems use the same electronics - display equipment: Victoreen, Model 842-1, Log Ratemeter. The pulses from the detector are converted by the ratemeter into a logarithmic analog signal whose amplitude is related to the pulse repetition rate. The analog signal is displayed on the panel meter which has a five decade range to 10^6 cpm full scale. The ratemeter provides three alarm indications: a Fail Alarm (green light); Alert (amber light), and Alarm (red light). The "Fail" indicates a power failure or the equipment is inoperative. The Alerts and Alarms are audible on the reactor console with the Alarm on either Channel 4, 5, or 6, capable of sounding the Evacuation Horns automatically.

The Beta Scintillator is the Victoreen, Model 841-1, Continuous Air Sampler with filter.

The Thin-Wall GM detector (Channels 5, 6, and Filter GM) is the Victoreen, Model 843-5.

The filter GM Channel is a spare detection system.

The sensitivity of these channels is as follows:

Channel 4 - Particulate

$cpm/\mu Ci/cm^3 = (1.76\ E6)(F)(E)$

F = Flow rate in SCFM

E - cpm/μCi on Filter

(Note: The air flow rate through the Channels 4 and 6 is 10 SCFM). This formula is to be used with the curve furnished by Victoreen

Instrument Div. of VLN of cpm/ Ci on the filter vs maximum beta energy.

Channel 5 - Stack Gas		
AR-41	1.04 E8	cpm/μCi/cm^3
Kr-85	3.9 E7	cpm/μCi/cm^3
Xe-133	5.59 E7	cpm/μCi/cm^3

Channel 6 - Auxiliary GM		
Ar-41	4 E8	cpm/μCi/cm^3
Kr-86	1.2 E8	cpm/μCi/cm^3
Xe-133	4.7 E6	cpm/μCi/cm^3

B.2 Waste Liquid Effluent

There are three (3) 904 gallon liquid waste holding tanks associated with the PULSTAR reactor and the Burlington Engineering Laboratories. All water from the reactor building is collected by these tanks. Normal procedure is to fill two tanks and retain one as a spare. These tanks are each monitored by a Victoreen, Model 843-3, (NaI) Gamma Scintillation Detector and the Victoreen, Log Ratemeter described above. The full tanks are sampled and counted for gross beta-gamma activity. The concentration is determined by

$$\frac{\text{CPM}}{(\text{Counter Efficienty})(2.22\ \text{E6}\ \frac{\text{DPM}}{\text{Ci}})(\text{cm}^3\ \text{sample})} = \frac{\mu\text{Ci}}{\text{cm}^3}$$

APPENDIX C

LIST OF EMERGENCY PROCEDURES

1.1	Introduction
2.1	Definitions
3.1	Organization
5.1	Emergency Classification
6.1	Activation and Response Unusual Event
6.2	Activation and Response Alert
6.3	Activation and Response Site Emergency
6.4	Activation and Response General Emergency
7.1	Assessment
7.2	Notification
7.3	Protective Actions
8.1	Emergency Facilities
8.2	Emergency Support Center
9.1	Recovery
10.1	Training Administration
10.2	Personnel Training
10.3	Drills
10.4	Exercises
10.5	Reviews and Changes