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ONS STATION DIRECTIVE 2.9.1 (LP) (TS)

APPROVAL [signature]

DATE 8/20/81

REVISED DATE 4/14/82

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

STATION ASSEMBLY AND EVACUATION PROCEDURE

I. PURPOSE

This directive provides procedures to be used when responding to station assembly and preparatory to evacuation from the station if a radiological emergency is declared.

II. REFERENCES

A. Oconee Nuclear Station Emergency Plan

B. NUREG-0654, FEMA. - Rep-1, Rev. 1, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants

C. Technical Specifications 6.4.2

III. DESCRIPTION

It is the intent of this directive to identify preplanned responses necessary to quickly and professionally respond to a station assembly and for evacuation from the station if a radiological emergency is declared. By being prepared, the effects of an evacuation from the station can be minimized and can facilitate faster action by station management and personnel.

IV. PROCEDURE

A. Procedure for Conducting a Station Assembly

1.1 A Station Assembly encompasses the assembly of all onsite personnel at designated assembly points for the purpose of accounting for personnel within station boundaries. Reasons for initiating a Station Assembly would include:

A) A test of response time and procedures employed in completing an accounting of onsite personnel.

B) A station incident occurs and:

1) Portions of the Protected area may require evacuation or

2) A station evacuation may be required, or

3) Portions of the Emergency Planning Zone may require evacuation.

1.2 A station assembly is initiated by activating the Personnel Assembly Signal in the Units 1 & 2 Control Room. This signal is a warble signal which is heard over the Public Address (PA) System. The Shift Supervisor is responsible for initiating a Station Assembly and will assure that the following announcement is made throughout the station twice each time it is made.

This is a station assembly. This is a station assembly. All visitors outside security are to report to the Receptionist Lobby. All visitors inside security are to report to the Security Lobby. All other badged personnel shall report to your supervisor in the area designated on the back of your security badge.

If any particular area of the plant is found to be radiologically unsafe during an emergency, and a site assembly is held, warnings should be sounded through the public address system the "safe" corridors to use.

The alarm and announcements shall be continued for a duration long enough to ensure all onsite personnel are aware of the Station Assembly and are responding.

1.3 Action Plan for onsite personnel in responding to a Station Assembly Alarm.

1.3.1 Each person (except those noted in 1.3.4 below) shall assemble with their supervisor. Assembly points for personnel onsite at Oconee Nuclear Station are identified in Table A-1. Additionally, these locations are on the back of the security badge for those personnel inside security.

1.3.2 During normal working hours on Monday through Friday (except holidays) each supervisor shall be responsible for accounting for all personnel reporting to him. Station Superintendents and the Senior Supervisors of various organizations working at Oconee (e.g., SSD, QA) shall make an accountability report to the Station Manager for their areas of responsibility. Security will make an accountability report for in-plant visitors. When reports from all areas are received, the Station Manager will notify the Shift Supervisor that all persons have been accounted for.

Table A-2 is available to aid in accounting for onsite personnel. Each reporting supervisor is to report location, his name, telephone number, number of people assembled, and any missing persons.

1.3.3 During the hours not covered by 1.3.2 above, an accountability report should be made by the designated responsible person in each functional work group present at the Station to the Shift Supervisor. The Senior Guard Force representative will report visitors.

1.3.4 Persons working in Radiation Control Areas in protective clothing should leave their work areas and go to the appropriate change room. In the change room, they should contact the appropriate persons as designated by 1.3.2 or 1.3.3 above for personnel accountability reporting. Judgment should be used concerning the advisability of changing clothes and reporting to normal assembly areas.

NOTE: In case of a Reactor Building evacuation alarm, the reporting requirements in 1.3.4 above apply.

1.4 Action plan for Station Security

1.4.1 When alerted of a Station Assembly requirement, the Security Shift Lieutenant will be responsible for initiating a patrol of the general station areas within station boundaries, both inside and outside of the restricted area, to assure that personnel in remote and noise restrictive areas are aware of the Station Assembly requirement.

1.4.2 Security will restrict traffic in and out of the station during Site Assembly. Should Site Assembly be initiated during high traffic ingress and egress, normal traffic flow will not be restricted.

1.5 Action plan for Shift Health Physics Representative

1.5.1 Account for Health Physics personnel as directed in 1.3 above.

1.5.2 Provide assistance to personnel exiting contaminated areas or the Protected Area, as necessary, with proper frisking and contamination control.

1.5.3 If Health Physics supervisory personnel are not onsite, direct available Health Physics personnel in controlling or monitoring the radiological situation as required.

1.6 Action Plan for Shift Supervisor/Station Manager (Emergency Coordinator)

1.6.1 Receive Accountability reports from onsite supervisors using Table A-2 as an aid.

1.6.2 Direct necessary actions to account for any missing personnel. Emergency Coordinator will dispatch

Search and Rescue Team(s) that may be composed of personnel from Security, Safety and/or Operations, and Health Physics.

1.6.2.1 Health Physics will be responsible for monitoring and will be in charge.

1.6.2.2 Security will provide radio support and will be in a position to open controlled access doors.

1.6.2.3 Safety and/or Operations will provide medical support.

1.7 When personnel accountability has been completed following a Station Assembly, one of the following will occur.

1.7.1 If the requirement for an assembly no longer exists, permission to return to normal duties will be given by the Shift Supervisor/Station Manger or:

1.7.2 Plant conditions may require evacuation of the station and implementation of an emergency organization or;

1.7.3 Other instructions will be given by the Emergency Coordinator.

B. Procedure for Conducting a Station Evacuation

1.0 A station evacuation shall be conducted when any unplanned radiological condition may result in whole body doses or internal exposures in excess of 10CFR20 limitations for areas outside the Radiation Control Area. Unplanned radiological releases contained within various portions of the Radiation Control Area may require evacuation of local areas only.

1.1 Station Evacuation levels are as listed below.

A. All members of the general public, and other persons who are not subject to occupational radiation exposure at Oconee Nuclear Station must be evacuated if they are likely to be exposed to doses in excess of:

1) External Radiation Level > 2 mrems in any one hour

2) Airborne Radioactivity > 1 x mpc for an unrestricted area (10CFR20, Appendix B, Table II)

B. Personnel subject to occupational radiation exposure at Oconee Nuclear Station must be evacuated if they are likely to be exposed to unplanned doses in excess of:

1) External Radiation Level > 2.5 mrem/hr, 100 mrems/week, or 1250 mrems in a quarter

2) Airborne Radioactivity > equivalent amount inhaled for 40 hours/week for 13 weeks at 1 mpc (10CFR20 Section 20.103 and Appendix B, Table 1)

2.0 When it is determined that a station evacuation is necessary, the station evacuation alarm will be sounded. This alarm is a continuous, single-tone siren that can be heard throughout the station. Evacuation will be by designated preplanned routes which avoid contaminated locations or other locations that may be affected by the emergency situation. Evacuation routes, assembly locations, and other pertinent information shall be passed over the PA system or by telephone.

3.0 When directed, evacuees will evacuate using personal cars to the greatest extent possible. Remote assembly locations, and entrance/exit routes will be provided with evacuation instructions. (Enclosure B-1)

Should personal cars be unavailable due to contamination, bus transportation will be made available. The Shift Supervisor/ Station Manager (Emergency Coordinator) is responsible for arranging bus transportation as required.

Health Physics will survey evacuees and vehicles for contamination at designated locations as directed by the Shift Supervisor or Technical Support Center. Decontaminants and extra clothing will be provided for by Health Physics at designated survey locations. Fire hydrants may be used for decontamination of vehicles leaving the site.

4.0 Station evacuations are activated only after station personnel have been assembled through a Station Assembly.

A. Various groups of personnel at the station are considered nonessential to the safe operation of the station and would be evacuated when directed. Groups of personnel in this category include:

Substation Maintenance	Wometco
SMS	Chem-Nuclear
SSD	Vendors (other than HP)
QA	General Office personnel
Visitors	Duke personnel (other than ONS)
B&W	All others (not listed in B&C below)
Design Engineering	
Keowee	
Visitors Center	

B. The following groups of personnel are considered essential to the safe operation of the station. When a requirement exists to evacuate the station, these essential personnel

will be provided instructions as to where to report to assist in the safe operation of the station. Groups of personnel in this category include:

Operations	Licensing and Projects
Health Physics	NRC
Health Physics Vendors	Southern Security
Biologists	Resident B&W Representative

C. The following groups of personnel ma; selectively be identified as essential to the safe operation of the station. When a requirem-nt exist to evacuate the station, station management will identify which of the following personnel will be required to aid in the operation of the station. The remaining personnel will be instructed to evacuate. Groups of personnel in this category include:

Administration
Maintenance
Chemistry
Performance
K-Mac

5.0 After the initial evacuation of the station has been completed, adjustments to station staffing requirements will be made as the situation warrants by the Station Manager or his designee. Control of station activities will be through the Technical Support Center.

TABLE A-1
SITE ASSEMBLY LOCATIONS

DUKE OCONEE NUCLEAR STATION PERSONNEL

Section	Assembly Point
Station Manager/Superintendents: and Assigned Clerks	Respective Offices
Administrative Services:	
Administrative Services	Administration Clerical Office
Training	Training Office
Safety	Training Office
Medical	Training Office
Contract Services	Contract Service's Offices
Maintenance:	
I&E Engineers	I&E Engineers Offices
I&E Supervisors & Technicians	I&E Shops
Mechanical Maintenance Engineers	Mechanical Maintenance Engineers Office
Mechanical Maintenance Supervisors & Technicians	Maintenance Shop
Planners	Planning Office
Materials	Materials Office
Operations: All	Control Rooms/Unit 1 & 2 Operating Engineer Office
Technical Services:	
Licensing & Projects	Licensing & Projects Office
Performance (All)	Performance Engineers Office
Health Physics (All)	Health Physicist Office
Chemistry (All)	Station Chemist Office
Environmental	Environmental Office
Quality Assurance: All	Quality Assurance Office
Training Services: All Personnel at Training Center	Oconee Training Center

DUKE NON-OCONEE NUCLEAR STATION PERSONNEL

Administration Visitors: All	Administration Clerical Office
Operations Visitors: All	Units 1 & 2 Operating Engineers Office
SMS: Those Inside Security	Sheet Metal Shop
Those Outside Security	SMS Office
Station Support Division:	SSD Office
Keowee: All	Keowee Hydro Station
Visitors' Center: All	Visitors' Center Office

TABLE A-1
SITE ASSEMBLY LOCATIONS

DUKE NON-OCONEE NUCLEAR STATION PERSONNEL (Continued)

Section	Assembly Point
Substation Maintenance:	Substation Maintenance Office
Quality Assurance: All	QA Office
Chemistry: All	Station Chemist Office
Health Physics: All	Health Physicist Office
Design Engineering: All	Projects Office
Maintenance Visitors:	Service Building Mezzanine (I&E, Mechanical Maintenance, or Planning Office)

NON-DUKE OCONEE NUCLEAR STATION PERSONNEL

Southern Security:	Main Guard House
K-Mac: Those Inside Security	Canteen South End, Turbine Building
Those Outside Security	K-Mac Office
Chem-Nuclear:	Station Chemist Office
B&W Resident Engineer:	Control Room
NRC: All	Licensing & Projects Office
Wometco: All	Administration Building Canteen

NON-DUKE, NON-OCONEE NUCLEAR STATION PERSONNEL

Health Physics Vendors:	
Rad-Services	Health Physicist Office
NUMANCO	Health Physicist Office
Babcock & Wilcox Personnel:	B&W Offices, Trailer
Visitors:	
Inside Security with Permanent Badge	Receptionist Lobby
Inside Security with Escort	Security Lobby, Administration Building
Outside Security	Receptionist Lobby

OTHER PERSONNEL OUTSIDE PROTECTED AREA

All personnel not identified above will report to the Receptionist Lobby between 0800 - 1630, Monday through Friday. On weekends, holidays, and after hours, report to Security Lobby.

TABLE [illegible]2

STATION PERSONNEL ACCOUNTABILITY

DATE ______

GROUP	REPORTING NAME	TELEPHONE NUMBER	Number PEOPLE
Administration			
Contract Services:			
K-Mac			
Southern Security			
Training & Safety:			
Administrative Services:			
Wometco			
Visitors' Center:			
Keowee Hydro:			
Station Visitors:			
Receptionist Lobby			
Security Lobby			
Others:			
TIME:	TOTAL ADMINISTRATION GROUP		
Operations			
Operators On-Shift:			
Engineers/Staff:			
Training Center:			
B&W Personnel:			
Others:			
TIME:	TOTAL OPERATIONS GROUP		
Maintenance			
Planning & Materials:			
I&E:			
Mechanical Maintenance:			
System Maintenance Support:			
Substation Maintenance:			
Others:			
TIME:	TOTAL MAINTENANCE GROUP		

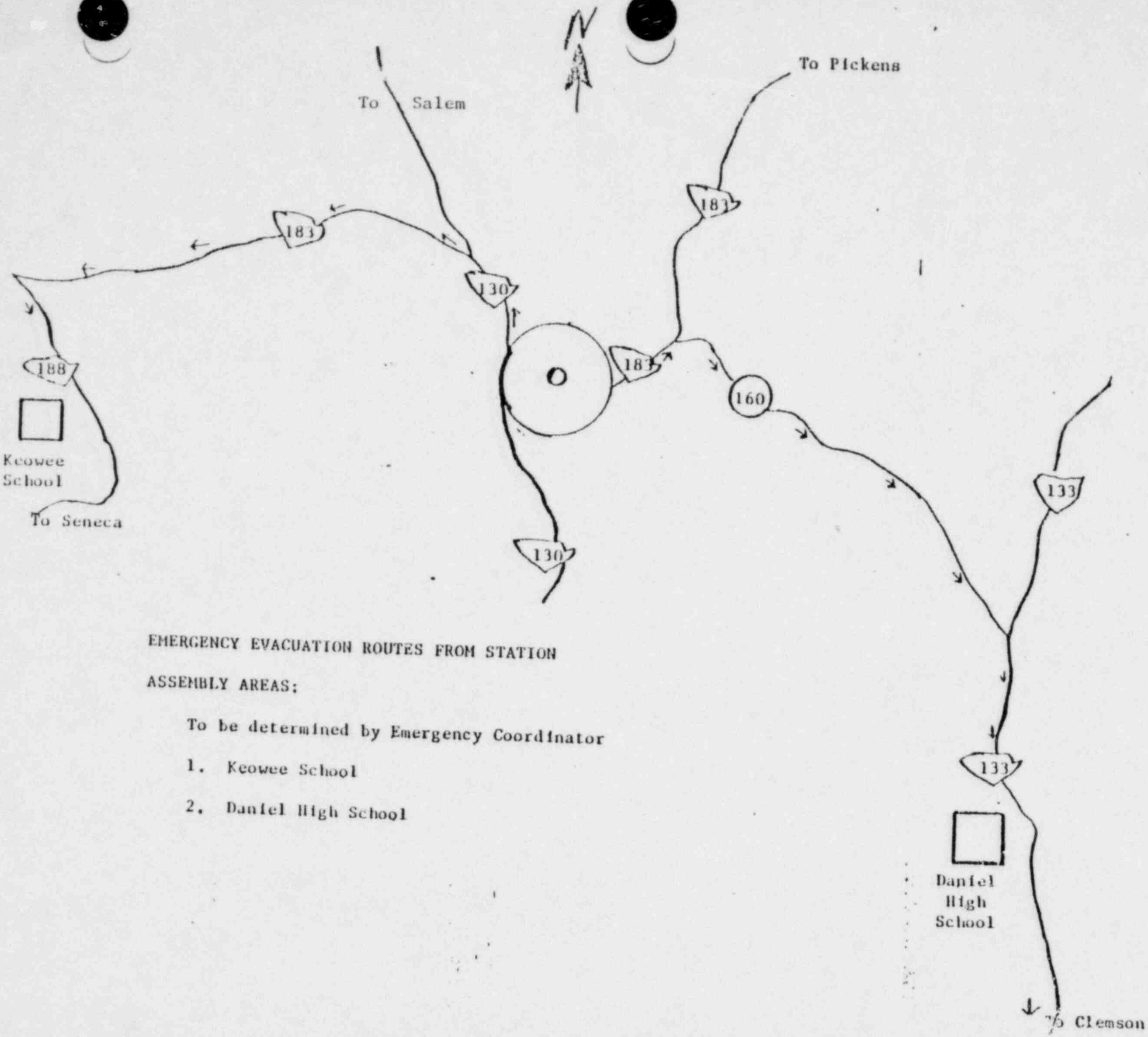
GROUP	REPORTING NAME	TELEPHONE NUMBER	NUMBER PEOPLE
Technical Services			
Performance:			
Environmental:			
Licensing & Projects:			
Design Engineering			
NRC			
Health Physics:			
Chemistry:			
Others:			
TIME:	TOTAL TECHNICAL SERVICES GROUP		
Quality Assurance			
TIME:	Quality Assurance Total:		
Station Support Division			
TIME:	Station Support Division Total:		
Others:			
	Others Total:		

BEGINNING TIME: ______ ENDING TIME: ______ TOTAL PEOPLE ON-SITE: ______

Unaccounted Personnel	Group	Action Taken	Person Reporting	Telephone

REMARKS:

MAJOR REVISION



EMERGENCY EVACUATION ROUTES FROM STATION

ASSEMBLY AREAS:

To be determined by Emergency Coordinator

1. Keowee School
2. Daniel High School

INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: PT/0/B/2000/04
Change(s) 0 to
0 Incorporated

(2) STATION: Oconee

(3) PROCEDURE TITLE: Procedure for Establishment and Inspection of the Technical Support Center

(4) PREPARED BY: William A. Jennings DATE: 4/21/82

(5) REVIEWED BY: Rick Rogers DATE: 4/21/82

Cross-Disciplinary Review By: ________ N/R: RR

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ________ (SRO) Date: ________

By: ________ Date: ________

(7) APPROVED BY: Tony B. Owen Date: 4/25/82

(8) MISCELLANEOUS:

Reviewed/~~Approved~~ By: R. T. Bond Date: 4/23/82

Reviewed/Approved By: ________ Date: ________

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

PROCEDURE FOR ESTABLISHMENT

AND INSPECTION OF THE

TECHNICAL SUPPORT CENTER

1.0 Purpose

This procedure provides for the establishment of the Technical Support Center and for quarterly inspection of emergency equipment and supplies necessary to activate the Technical Support Center and specifies the inspection frequency and documentation requirements.

2.0 References

2.1 Oconee Nuclear Station Emergency Plan

2.2 NUREG 0654, FEMA-REP-1, REV., Criteria for Preparation and Evaluation of Radiological Emergency Plans and Preparedness in Support of Nuclear Power Plants.

3.0 Time Required

3.1 Varied/quarterly test.

4.0 Prerequisite Test

4.1 Not applicable

5.0 Test Equipment

5.1 Not applicable

6.0 Limits and Precautions

6.1 Maintain record of all documentation for a minimum of five years.

6.2 Ascertain availability of the phone line to be checked.

7.0 Required Station Status

7.1 Not applicable

8.0 Prerequisite System Conditions

8.1 Not applicable

9.0 Test Method

9.1 All emergency supplies, equipment, and telephone numbers that would be used upon activation of the Technical Support Center are to be inspected and/or reviewed on a quarterly basis.

10.0 Data Required

10.1 Not applicable

11.0 Acceptance Criteria

11.1 Periodic quarterly inspection of supplies and emergency equipment and quarterly review of telephone directories must comply with the regulations as specified in the Oconee Nuclear Station Emergency Plan and as required by NUREG 0654.

12.0 Procedure

Time/Date
Name

_____12.1 The Emergency Preparedness Coordinator or his/her designee shall use enclosures listed in 13.0 as a guide to inspect the following emergency equipment and supplies:

_____12.1.1 Verify all items for the Technical Support Center Telephone Communication System on Enclosure 13.2 are available and operational.

_____12.1.2 Verify that the Emergency Telephone Directories are current.

_____12.1.3 Verify that all supplies as designated in Enclosure 13.1 are on hand for the activation of the Technical Support Center.

_____12.1.4 Verify that all drawings located in the Technical Support Center are up to date. Use 13.7 as a guide.

_____12.2 The Emergency Preparedness Coordinator or his/her designee shall use enclosures listed in 13.0 as a guide for setting up the Technical Support Center during an emergency, drill, and/or exercise:

_____12.2.1 Each Superintendent shall be responsible for having his emergency telephone system switched to the Technical Support Center and/or Operational Support Center.

_____12.2.1.1 The phones for the Technical Support Center/ Operational Support Center shall be set up according to the Check-Off List in Enclosure 13.2.

_____12.2.2 Follow Check-Off List for setting up the Technical Support Center, Enclosure 13.6, to determine that equipment, supplies, documents, manuals, procedures are in place.

Time/Date
Name

_____ 12.2.3 All supplies shall be inspected after the emergency, drill and/or exercise and replenished as necessary.

13.0 Enclosures

13.1 Inventory List Checkoff

13.2 Check-off List for Setting up the Phone System in the Technical Support Center

13.3 General Arrangement of Technical Support Center

13.4 General Arrangement of Operational Support Center

13.5 Emergency Telephone Switching Diagram

13.6 Check off List for Setting up the Technical Support Center

13.7 Drawings in the Technical Support Center

TECHNICAL SUPPORT CENTER
INVENTORY LIST
ENCLOSURE 13.1

	Date Name	
13.1.1	_____	24 Telephones
13.1.2	_____	Drawings (Enclosure 13.6)
13.1.3	_____	2 Base Station Radios (a) Battery - Check dates and/or replace
13.1.4	_____	Telephone Directories
		_____ 25 Station Directories
		_____ 5 Corporate Directories
		_____ 25 Emergency Telephone Directories
		_____ 1 NRC Directories
		_____ 2 Local Municipal Directories
13.1.5	_____	4 Reams Copy Machine Paper
13.1.6	_____	1 Box Telecopier Paper
13.1.7	_____	20 Pads (writing)
13.1.8	_____	1 Bottle Nashua X-D 3159A Developer
13.1.9	_____	2 Boxes Pencils
13.1.10	_____	4 Bottles Nashua 3100 Dry Imager
13.1.11	_____	2 Boxes Ball Point Pens
13.1.12	_____	1 7½ volt hand-held light
13.1.13	_____	' Staplers
13.1.14	_____	2 Boxes Staples
13.1.15	_____	1 Box Chalk
13.1.16	_____	1 Eraser
13.1.17	_____	4 Grease Pencils
13.1.18	_____	2 Logbooks
13.1.19	_____	1 Package Rubber Bands
13.1.20	_____	1 Box Colored Magic Markers
13.1.21	_____	50 Bottles KI Tablets
13.1.22	_____	1 Box 12" Printer Paper
13.1.23	_____	1 Box Diskettes

NOTE: Emergency supplies (minimum quantities inventoried) will be restocked after any emergency or after any drill or exercise where the Technical Support Center was activated.

OCONEE NUCLEAR STATION

PT/0/B/2000/04

ENCLOSURE 13.2

CHECK-OFF LIST FOR SETTING UP THE PHONE SYSTEM IN THE TECHNICAL SUPPORT CENTER AND OPERATIONAL SUPPORT CENTER

Date/Time
Name

_____13.2.1 Contact the following members of the Emergency Response Organization. Make them aware that the phone line will be switched to the Technical Support Center/Operational Support Center and that the line will be out of service for approximately 2 hours. After everyone has been notified, switch phone lines in accordance with directions given on Enclosure 13.5.

_____1669	VAX	_____1670	VAX
_____1105	S&C	_____1108	NRC Res. Insp.
_____1138	Data Evaluator	_____1140	B&W
_____1417	Environmental	_____1244	Communicator
_____1177	H.P. Supvr.	_____1212	Administration
		_____1233	Clerical Support
_____1409	Performance	_____1227	Maintenance
_____1229	L&P	_____1219	I&E
_____1220	Chemistry	_____1216	P&M
_____1210	Operations	_____1223	M.M.
_____1213	Tech. Serv.	_____1211	Station Manager
_____1234	Station H.P.	_____882-7076	Station Manager
_____NRC Red Phone		_____HPN Black Phone	
_____Duke Ringdown		_____1151 Medical	

_____13.2.2 Secure key from Shift Supervisor to Technical Support Center Cabinet. Check each phone to make sure that a dial tone exists and that the line is operable -- incoming and outgoing.

_____13.2.3 Note any problems encountered and list below.

____

____

____

_____13.2.4 Lock telephone boxes.

_____13.2.5 Return telephone systems to normal service.

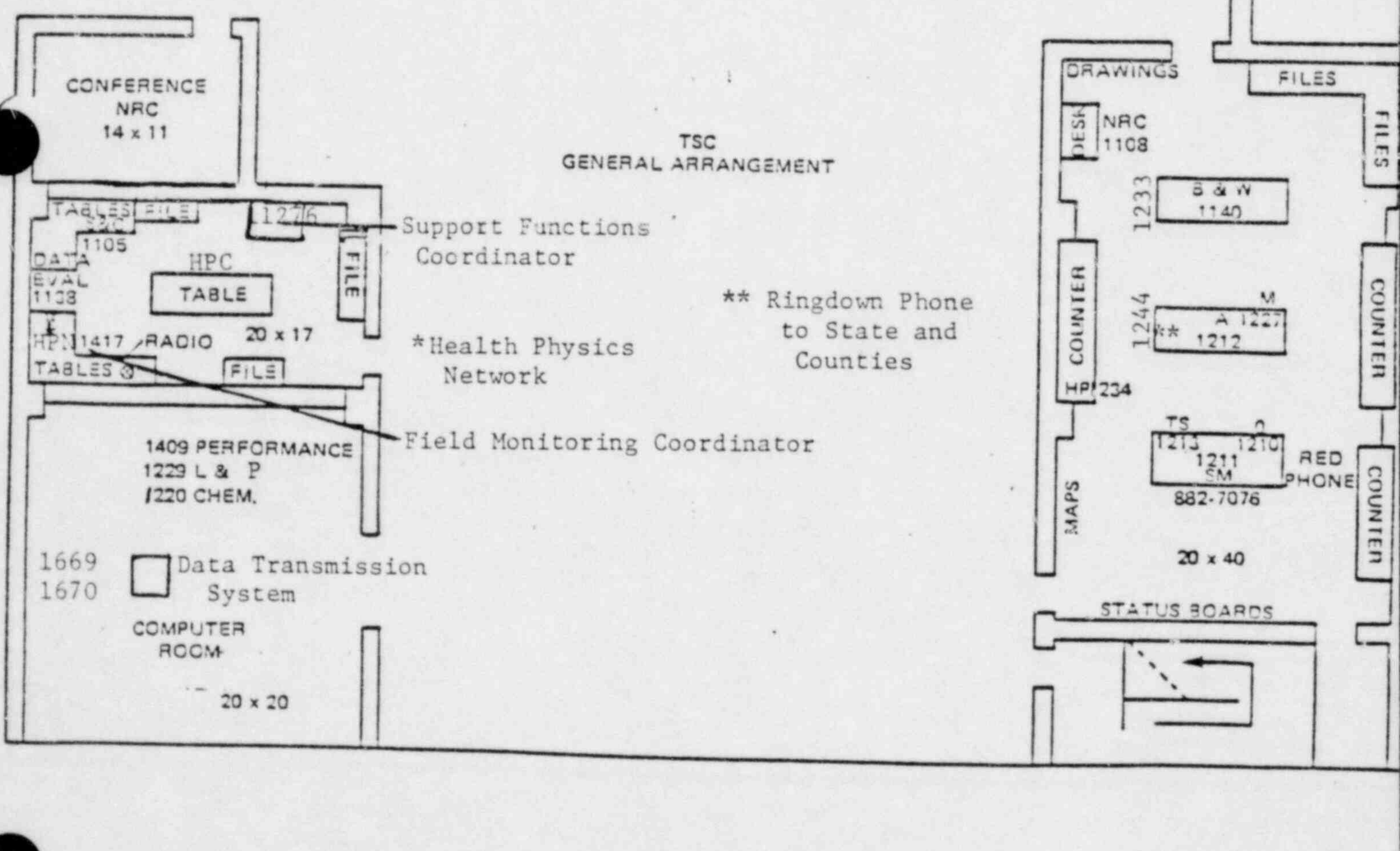
DUKE POWER COMPANY
EMERGENCY RESPONSE FACILITIES
OCONEE NUCLEAR STATION

Enclosure 13.3

TECHNICAL SUPPORT CENTER

Communication System Includes:
Outside Line (Southern Bell System)
ONS Switchboard
Microwave
Radio
Computer (OAC, VAX, TSO)
Telecopier
ENS (Red Phone)
HPN (Health Physics - NRC)
Ringdown phone to Offsite Agencies (State FEOC, Oconee EOC, Pickens EOC)

UNIT 1&2 CONTROL ROOM



DUKE POWER COMPANY

EMERGENCY RESPONSE FACILITIES

OCONEE NUCLEAR STATION

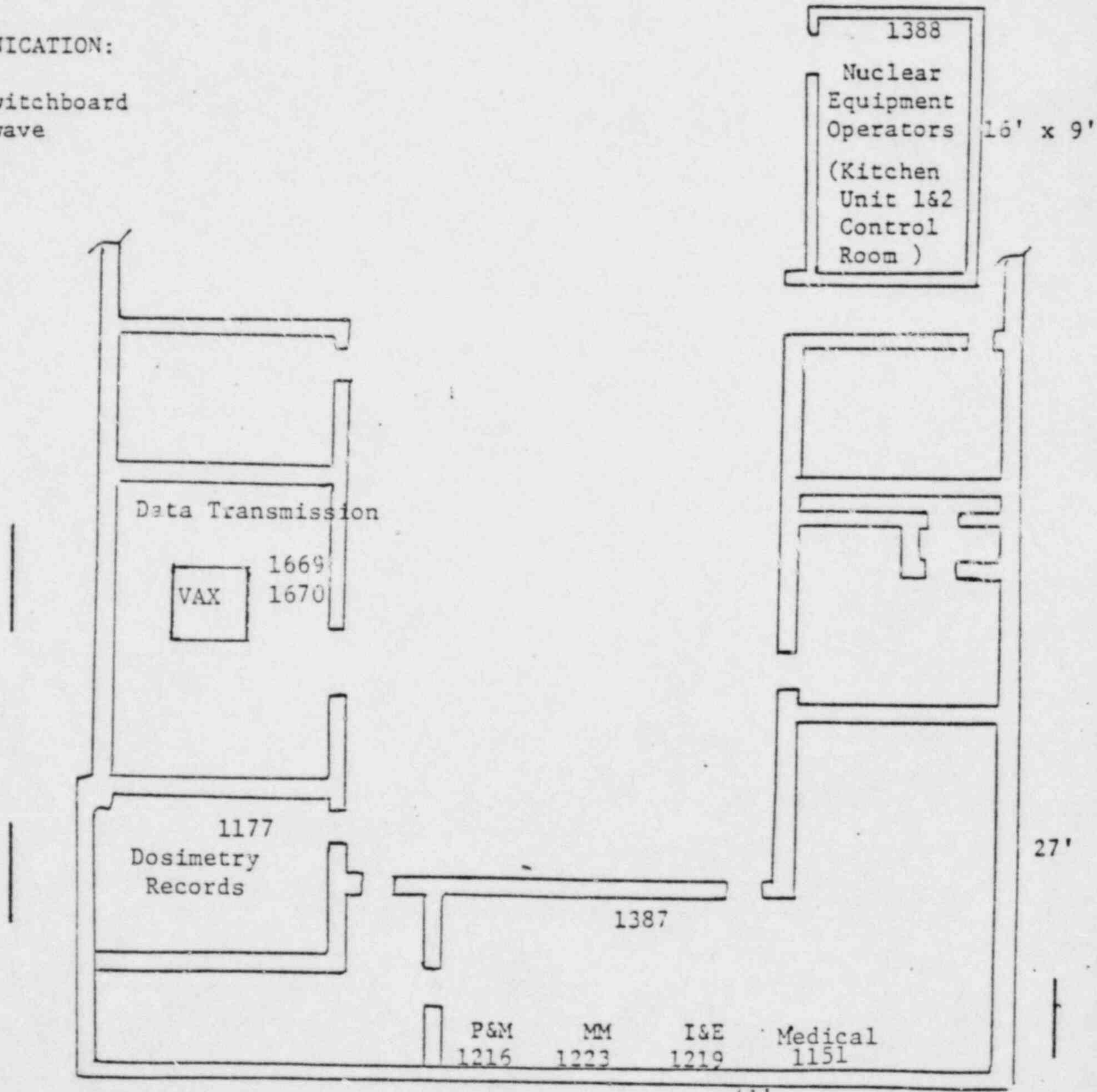
Enclosure 13.4

OPERATIONAL SUPPORT CENTER*

Location: Unit #3 I & E Shop

COMMUNICATION:

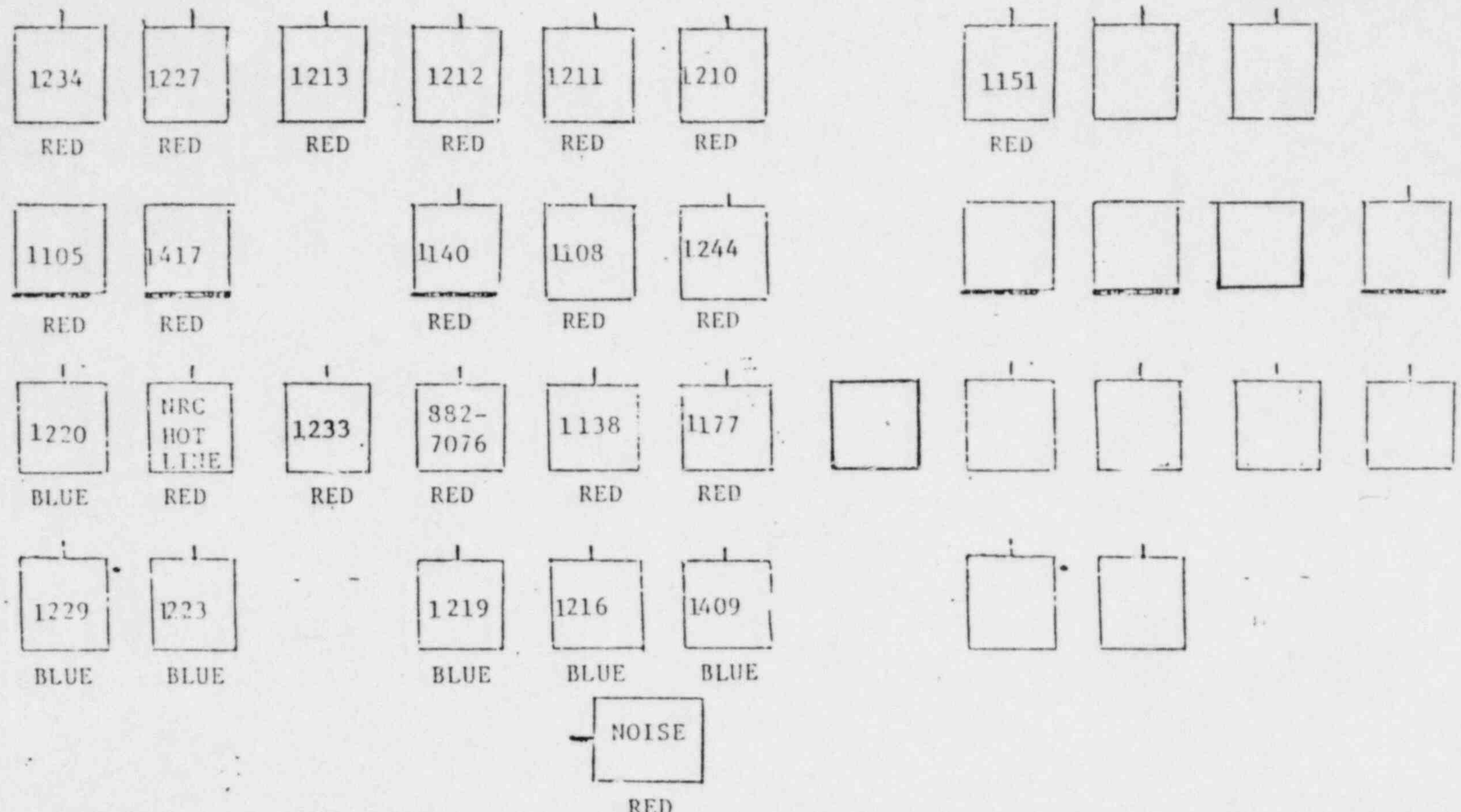
ONS Switchboard
Microwave



*The areas designated as the Operational Support Center has the same ventilation and shielding as the Control Room. Provisions for protective clothing and breathing apparatus have been established.

EMERGENCY TELEPHONE SWITCHING DIAGRAM

ENCLOSURE 13.5



Emergency Telephone Switching Diagram
Phones Marked With

1. Red - Indicate switches thrown at onset of TSC activation
2. Blue - Indicate switches thrown as needed in TSC

To Switch All Phones Marked Red Or Blue To:

a. Unit 1 & 2 TSC throw switch to the right →.
b. Unit 3 throw switch to left ←.

OCONEE NUCLEAR STATION

Check-off list for setting up the Technical Support Center

ENCLOSURE 13.6

Date/Time
Name

_____13.6.1 Set up phones - (Determine that phones have been switched in the telephone roon)

_____13.6.2 Set up radio.

_____13.6.3 Check off list of Documents needed.

_____Emergency Plan & Implementing Procedures

_____Crisis Management Plan

_____Pickens & Oconee Emergency Plan

_____Technical Specifications

_____FSAR

_____General Arrangement Drawings

_____Emergency Planning Zone maps and nomographs

_____Safety related structures, systems and components

_____Station Directives

_____Administrative Policy Manual

_____Various I&E Drawings

_____Site Drawings

_____Emergency Procedures

_____Plant Operations Drawings

_____Fire Plan

_____13.6.4 Paper & pads, pencils & pens, notebooks.

_____13.6.5 Set up TSC Logbook - record names of people in Technical Support Center

_____13.6.6 Determine if everyone has been called that is a part of the emergency response organization.

_____13.6.7 Notification Procedures

_____Message forms

_____Authentication Procedures

OCONEE NUCLEAR STATION

Check-off list for setting up the Technical Support Center

ENCLOSURE 13.6 (Cont'd)

Date/Time
Name

_____Crisis Telephone Directory

_____13.6.8 Contact Security - make sure Security is at the Control Room entrances.

_____Sign people in and out at that point.

_____13.6.9 Set up Data Displays for information update in TSC, HPC, OSC.

_____Assign someone to keep the information posted.

13.6.10 VAX system on line and operable.

_____ Plant Data system

_____ ODCAR system

13.6.11 Transmission of information

_____ Telecopier

_____ Copier

_____13.6.12 Drawings listed on Enclosure 13.6 taken out of cabinet and placed in TSC.

_____13.6.13 Operational Support Center

_____ Personnel in place

_____ Supplies/first aid kits available

_____ Survey instruments available

_____ Dosimetry

_____ Protective Cabinet

DRAWINGS IN TECHNICAL SUPPORT CENTER

ENCLOSURE 13.7

Date/Time
Name

DRAWING NUMBER		TITLE	
0-1	_____	13.7.1	Site Plan
0-2	_____	13.7.2	General Plan
0-3	_____	13.7.3	Plot Plan
0-5	_____	13.7.4	General Arrangement, Plan Elevation 758 + 0
0-6	_____	13.7.5	General Arrangement, Plan Elevation 771 + 0
0-7	_____	13.7.6	General Arrangement, Plan Elevation 783 + 9
0-8	_____	13.7.7	General Arrangement, Plan Elevation 796 + 6
0-9	_____	13.7.8	General Arrangement, Plan Elevation 809 + 3
0-10	_____	13.7.9	General Arrangement, Plan Elevation 822 + 0
0-11	_____	13.7.10	General Arrangement, Plan Elevation 838 + 0
0-12-A	_____	13.7.11	General Arrangement, Cross Section
0-12-B	_____	13.7.12	General Arrangement, Cross Section
0-12B-V	_____	13.7.13	General Arrangement, Cross Section
0-12-C	_____	13.7.14	General Arrangement, Longitudinal Section
0-13	_____	13.7.15	General Arrangement, Turbine Basement
0-14	_____	13.7.16	General Arrangement, Turbine Mezzanine
0-15	_____	13.7.17	General Arrangement, Turbine Operating Floor
0-16	_____	13.7.18	General Arrangement, Auxiliary 758 + 0
0-17A	_____	13.7.19	General Arrangement, Auxiliary 771 + 0
0-17B	_____	13.7.20	General Arrangement, Auxiliary 771 + 0
0-18A	_____	13.7.21	General Arrangement, Auxiliary 783 + 9
0-18B	_____	13.7.22	General Arrangement, Auxiliary 783 + 9
0-18C	_____	13.7.23	General Arrangement, Spent Fuel Pool
0-460	_____	13.7.24	Unit 1 Reactor Building Basement 777 + 6
0-461	_____	13.7.25	Unit 1 Reactor Building Ground Floor 797 + 6

Date/Time
Name

DRAWING NUMBER		TITLE	
0-462	_____	13.7.26	Unit 1 Reactor Building Intermediate Floor 825 + 0
0-463	_____	13.7.27	Unit 1 Reactor Building Operating Floor 844 + 6
0-464	_____	13.7.28	Unit 1 Reactor Building Shielding 861 + 6
0-465	_____	13.7.29	Unit 1 Reactor Building Sectional View North
0-466	_____	13.7.30	Unit 1 Reactor Building Sectional View East
0-467	_____	13.7.31	Unit 1 Reactor Building Sections
0-468	_____	13.7.32	Unit 1 Reactor Building Accessible Areas
0-1013	_____	13.7.33	General Arrangement Turbine Building - Basement
0-1014	_____	13.7.34	General Arrangement Turbine Building - Mezzanine
0-1015	_____	13.7.35	General Arrangement Turbine Building - Operating Floor
0-1460	_____	13.7.36	Unit 2 Reactor Building Basement 777 + 6
0-1461	_____	13.7.37	Unit 2 Reactor Building Ground 797 + 6
0-1462	_____	13.7.38	Unit 2 Reactor Building Intermediate 825 + 0
0-1463	_____	13.7.39	Unit 2 Reactor Building Operating Floor 844 + 6
0-1464	_____	13.7.40	Unit 2 Reactor Building Top of Shielding 861 + 6
0-1465	_____	13.7.41	Unit 2 Reactor Building Sectional View South
0-1466	_____	13.7.42	Unit 2 Reactor Building Sectional View East
0-1467	_____	13.7.43	Unit 2 Reactor Building Section
0-1468	_____	13.7.44	Unit 2 Reactor Building Accessible Areas
0-2460	_____	13.7.45	Unit 3 Reactor Building Basement 777 + 6
0-2461	_____	13.7.46	Unit 3 Reactor Building Ground Floor 797 + 6
0-2462	_____	13.7.47	Unit 3 Reactor Building Intermediate Floor 825 + 0
0-2463	_____	13.7.48	Unit 3 Reactor Building Operating Floor 844 + 6
0-2464	_____	13.7.49	Unit 3 Reactor Building Top of Shielding 861 + 6
0-2465	_____	13.7.50	Unit 3 Reactor Building Sectional View South
0-2466	_____	13.7.51	Unit 3 Reactor Building Sectional View East
0-2467	_____	13.7.52	Unit 3 Reactor Building Section

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DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/0/A/2004/03C
Change(s) NA to
NA' Incorporated

(2) STATION: Oconee Nuclear Station

(3) PROCEDURE TITLE: Post Accident Determination of Chloride by Specific Ion Electrode Using Beckman 4500 Meter

(4) PREPARED BY: Bruce Fender DATE: 4/23/82

(5) REVIEWED BY: [signature] DATE: 4/23/82

Cross-Disciplinary Review By: [signature] N/R: ______

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: Tony B. Owen Date: 4/26/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

POST ACCIDENT DETERMINATION OF CHLORIDE BY SPECIFIC

ION ELECTRODE USING BECKMAN 4500 METER

1.0 Discussion

1.1 Scope

This procedure describes the specific ion electrode method for the post accident determination of chloride ion concentration ([Cl^-]) in the RCS when fuel damage is estimated to be greater than 1%.

1.2 Principle

The chloride ion-sensitive electrode is a solid-state ion sensor. The electrode uses a HgS/Hg_2Cl_2 sensing crystal at the tip of the electrode. A potential is developed by chloride ions across this crystal in much the same manner as a glass electrode responds to hydrogen ions. The potential varies with the chloride ion concentration. At 25°C it exhibits a 59 mV decrease in potential for each ten-fold increase in chloride ion concentration. A plot of mV vs. chloride concentration is prepared from standards of known chloride concentration. The chloride concentration of unknown samples can then be determined from this curve. A typical calibration curve is shown in Enclosure 6.4.

1.3 Limits

1.3.1 This method is applicable in the range of 0.05 ppm to 1.00 ppm Cl^-.

1.4 Interferences

1.4.1 Exposing the chloride electrode to a pH > 7 will produce an oxide film on the sensing crystal reducing the electrode sensitivity. Accurate measurements can be made from pH 1 to 7. Treating all samples, standards and soak solutions with ISA will reduce the pH to ~ 2 and prevent the oxide film formation.

1.4.2 Variations in total ionic strength will affect the chloride electrode response. Maintaining a constant total ionic strength over a wide concentration range by treating all samples and standards with ISA will enhance the electrode sensitivity and accuracy.

1.4.3 Ions which form very insoluble salts with mercury (such as S^{-2}, I^-, Br^-, CNS^-) or chromates will poison the sensing crystal reducing the electrode sensitivity. However none are expected to be present at the concentrations necessary for the poisoning to occur.

1.5 Precautions

1.5.1 DO NOT ATTEMPT ANY PHASE OF ANALYIS WITHOUT HEALTH PHYSICS COVERAGE!

1.5.2 Radiation exposure to an individual during all phases of analysis should be limited so as not to exceed a quarterly accumulative exposure of 3 rems whole body; 7.5 rems skin of wholebody; or 18 3/4 rems extremities respectively. All personnel will need prior authorization from TSC to knowingly exceed any exposure limit. The exposure received may require an occupational exposure penalty and/or a medical decision as to whether an individual can continue in radiation work.

1.5.2.1 If necessary to remedy a situation immediately hazardous to life and property, the Planned Emergency Exposure for Duke Power Personnel will not exceed 5 rems wholebody; 30 rems skin of wholebody; or 75 rems extremities.

1.5.2.2 If necessary to save lives or prevent loss of life and/or extensive damage to property (voluntary basis only), the Planned Emergency Exposure for Duke Power Personnel will not exceed 25 rems wholebody; 150 rems skin of wholebody; or 375 rems extremities.

1.5.2.3 For Outside Services Personnel the Planned Emergency Exposure will not exceed 5 rems wholebody; 30 rems skin of wholebody; 75 rems extremities; or 15 rems other single organ.

1.5.3 Radiation levels of the lab area shall be measured continuously during all phases of analysis.

1.5.3.1 Air activity should be determined by use of installed air monitors or through the use of portable air sampling equipment.

1.5.3.2 Area dose rates should be established by the use of installed radiation monitors or by portable radiation survey instrument.

1.5.3.3 Portable shielding, remote handling equipment, video equipment, etc., should be used where practical during sample preparation and sample analysis.

1.5.4 Samples and standards shall be stirred during measurement using a magnetic stirrer to reduce electrode response time.

1.5.5 Since electrode potentials are affected by changes in temperature, samples and standards should not differ more than ± 5°C.

NOTE: Temperature and slope controls are inoperative in the mV and mV abs mode.

1.5.6 Samples containing more than 1 ppm chloride should be diluted to less than 1 ppm using demin water.

1.5.7 Mercuric salts are poisonous! Gloves shall be worn when handling the chloride electrode.

1.5.8 Never store both electrodes together in the same solution.

1.5.9 The electrodes need not be immersed more than one (1) inch for accurate readings. However, they maybe immersed further to obtain more rapid temperature equilibrium.

1.5.10 Always keep the reference electrode filling solution levels higher than the level of solution being measured.

1.5.11 Never operate the reference electrode with the filling hole obstructed.

1.5.12 This procedure shall be done in a fume hood and/or other precautions shall be taken to avoid the release of gaseous activity.

2.0 Apparatus

2.1 Beckman 4500 Digital pH/mV Meter

2.2 Chloride Electrode (Graphic Controls PHI91100 or equivalent)

2.3 Double Junction Reference Electrode (Graphic Controls PHE54473 or equivalent)

2.4 Beckman 583540 Multiple Electrode Selector

2.5 Electrode Holder

2.6 Magnetic Stirrer and Teflon-Coated Stirring Bars

2.7 Stopwatch, Clock or Timers

2.8 150 ml Glass Beakers

2.9 Eppendorf Pipettes with appropriate tips: 50, 100, 250, 500, 1000 μℓ

2.10 Graduated Cylinder, 100 ml

2.11 Thermometer

2.12 Polishing Kit (Graphic Controls PHA76518 or equivalent)

2.13 1 liter volumetric flask (as needed)

2.14 Erlenmeyer flask or as equivalent

2.15 Parafilm for covering beakers

2.16 Analytical balance

2.17 Shielded Sample Container

2.18 Sample Tongs

2.19 Carboy - ~ 1 gal.

3.0 Reagents

3.1 Ionic Strength Adjustment Solution (ISA Solution) - slowly add about 63 mls (± 1 ml) of concentrated nitric acid to about 437 mls (± 1 ml) of demin water. Mix thoroughly. Stable for six (6) months.

3.2 Chloride stock standard solution (100 ppm Cl^-) - use purchased (Orion 94-17-07 or equivalent) 100 ppm Cl^- standard or prepare as follows: dry sodium chloride (NaCl) to constant weight at ~ 105°C. Dissolve 0.1649 g (± 0.0001) of the dry NaCl in demin water and dilute to 1 liter in a volumetric flask and mix. Purchased standard is stable indefinitely. Prepared standard is stable for six (6) months.

3.3 Double Junction Reference Electrode Filling Solutions

3.3.1 Upper filling solution - use the upper filling solution supplied (Graphic Controls PHB1322 or equivalent) with the double junction reference electrode. Stable indefinitely.

3.3.2 Lower filling solution - use the lower filling solution supplied (Graphic Controls PHB1326 or equivalent) with the double junction reference electrode. Stable indefinitely.

4.0 Procedure

4.1 Initial Condition

4.1.1 Evaluate the use of portable shielding, remote handling equipment, video equipment, etc., to minimize the exposure to personnel, in the lab for the analysis.

4.1.2 Request HP to perform a constant radiation survey during the analysis.

4.1.3 Determine and use the required respiratory equipment and protective clothing to prevent or minimize internal exposure in any Planned Emergency situation. Use high range and/or extremity dosimetry if required by HP.

4.1.4 Prepare one (1) carboy (~ 1 gal.). Label as "Post Accident Lab Waste". This container must be shielded and used as interim liquid waste disposal container for all liquid analytical waste.

4.1.5 Prepare a shielded work area in a fume hood. This area must be used for handling the sample when it is removed from the shielded sample container.

4.1.6 Prepare a waste disposal container for all solid analytical waste. Label as "Post Accident Lab Waste".

4.1.7 Ensure both chambers of the reference electrode are filled.

4.1.8 Insure that the chloride electrode and the reference electrode is connected to back of multiple elctrode selector (MES). Place Cl^- channel of the MES inservice.

4.1.9 Place the mV meter in STANDBY and in the mV mode of operation.

4.1.10 Prepare a sample dilution using the post-accident sample panel or by the manual method described in Enclosure 6.5. Ensure 100 ml of diluted sample for the analysis.

4.2 Concentration Measurements.

4.2.1 Place the mV meter in STANDBY.

4.2.2 If necessary, polish the chloride electrode as follows:

4.2.2.1 Wet the cloth-covered acrylic polishing block with demin water and shake off excess water.

4.2.2.2 Place a small amount of alumina powder on the polishing block to form a polishing paste.

4.2.2.3 Using light pressure and circular motion polish the surface of the sensing crystal for ~ 30 seconds.

4.2.2.4 Rinse the electrode thoroughly with demin water.

4.2.2.5 Soak the electrode in 100 ml of demin water containing 1 ml of ISA solution for about 20 minutes to pre-condition the sensing crystal.

4.2.3 Rinse the elctrodes with demin water.

4.2.4 Immerse electrodes and thermometer into 99 ml of demin water containing 1 ml of ISA solution and a stirring bar.

4.2.5 Adjust stirring rate so that there is no vortex and release the mV meter from STANDBY.

4.2.6 Record the temperature of the calibration solution.

4.2.7 Add 50 µℓ of 100 ppm Cl^- standard (0.05 ppm). Wait 2 minutes, then adjust the MES controls so that the display reads + 500 mV.

4.2.8 Add an additional 100 µℓ of 100 ppm Cl^- standard (0.15 ppm). Wait 2 minutes and record the mV reading.

4.2.9 Add an additional 100 µℓ of 100 ppm Cl^- standard (0.25 ppm). Wait 2 minutes and record the mV reading.

4.2.10 Add an additional 250 µℓ of 100 ppm Cl^- standard (0.50 ppm). Wait 2 minutes and record the mV reading.

4.2.11 Add an additional 500 µℓ of 100 ppm Cl^- standard (0.99 ppm). Wait 2 minutes and record the mV reading.

4.2.12 Place the mV meter in STANDBY.

4.2.13 Plot the data obtained in 4.2.7 thru 4.2.11 on semi-log graph paper as shown in Enclosure 6.1. Record the temperature of the calibration solution, measured in section 4.2.6, on this graph.

NOTE: There should be $\underset{-}{\sim}$ 14 mV between the 0.05 ppm and the 0.15 ppm CL^- standards.

4.2.14 Place the mV meter in STANDBY.

4.2.15 Rinse the electrodes with demin water.

4.2.16 Add 1 ml of ISA solution to 100 ml of the sample dilution.

4.2.17 Immerse electrodes, thermometer, and a stirring bar into sample/ISA solution. Adjust stirring rate so that there is no vortex.

4.2.18 Check the temperature of the sample and compare to that listed on the calibration curve. The temperature should be within ± 5°C of that listed on the calibration curve.

4.2.19 Release the mV meter from STANDBY. Wait 2 minutes and compare the mV reading to the calibration curve.

4.2.19.1 If the sample concentration is > 1.00 ppm repeat 4.2.14 thru 4.2.19 using a more dilute sample.

4.2.19.2 If the sample concentration is < 1.00 ppm but > 0.05 ppm apply the necessary dilution factor and record on the calibration curve.

4.2.19.3 If the sample concentration is < 0.05 ppm consider repeating 4.2.14 thru 4.2.19 using a less dilute sample or apply the necessary dilution factor to < 0.05 and record the "less than" value on the calibration curve.

4.2.20 Place the mV meter in STANDBY and either repeat sections 4.2.15 to 4.2.19 for additional Cl^- measurements or proceed to 4.2.21.

4.2.21 Rinse the electrodes with demin water and store the electrodes as follows:

4.2.21.1 Store the Cl^- electrode in 100 ml of demin water containing 1 ml of ISA solution.

4.2.21.2 Store the reference electrode in a separate portion of demin water.

4.3 Waste Disposal

4.3.1 Dispose of all liquid analytical waste in the "Post Accident Liquid Lab Waste" carboy. This container must be shielded and used as an interim liquid waste disposal container for all liquid analytical waste.

4.3.2 Dispose of all solid analytical waste in the "Post Accident Solid Lab Waste" container.

4.3.3 Request HP to designate an area where both post accident lab waste containers may be stored until final disposal.

4.3.4 In the event an area is grossly contaminated and cannot be decontaminated, evaluate the need for shielding or protectvie covering to prevent the spread of airborne activity.

4.4 Dose Exposure Evaluation

4.4.1 Evaluate the exposure to all personnel involved and complete all records, internal-body burden analysis, etc., as required. The exposure received may require an occupational exposure penalty. Higher doses will require a medical decision as to whether an individual can continue in radiation work.

5.0 <u>References</u>

5.1 Beckman Model 4500 Digital pH Meter Instruction Manual (1976)

5.2 Graphic Controls PHI9100 Chloride Electrode Instruction Manual

5.3 I. Sekerka, J. F. Lechner, and L. Harrison, Analysis for Chloride Ion in High Purity Water and Heavy Water of Pressurized Reactors and Cooling Systems by Ion Selective Electrode (1977)

5.4 BAW Water Chemistry Manual, BAW-1385 (1975)

5.5 NUREG-0737

5.6 DPC System Health Physics Manual

5.7 Radiological Health Handbook, U.S. Dept. of HEW (1970)

5.8 Radiation Safety Technician Training Course, H.J. Moe, ANL-7291 Rev. 1 (1972)

6.0 Enclosures

6.1 Shield Thickness

6.2 $\bar{E}$, A, and R valves for 1% Failed Fuel and DBA

6.3 Conversion Factors

6.4 Typical Calibration Curve

6.5 Manual Sample Dilution

ENCLOSURE 6.1

SHIELD THICKNESS

The following equations can be used as an aid in determining shielding requirements for a sample of RCS after an accident.

given: $I = I_o e^{-\mu x}$ where: $\mu = \mu_m \rho$

$$I/I_o = e^{-\mu_m \rho x}$$

$$\ln(I/I_o) = -\mu_m \rho x$$

(eq. 6.1.1) $$x = \frac{\ln(I_o/I)}{\mu_m \rho}$$

where: x = thickness of absorber (cm)

μ = linear attenuation coefficient (cm^{-1})

μ_m = mass attenuation coefficient (cm^2/g) @ the energy level (Mev) of the source

ρ = density of the absorber material (g/cm^3)

I_o = source intensity w/zero thickness of the absorber (mR/hr or R/hr)

I = source intensity w/an x thickness of the absorber (mR/hr or R/hr)

given: (HVL) $I/I_o = 1/2 = e^{-\mu_m \rho x}$

$$\ln(1/2) = -\mu_m \rho x$$

(eq. 6.1.2) $$x = \frac{0.693}{\mu_m \rho}$$

A half value layer (HVL) is that thickness (x) of an absorber that will reduce the intensity of the Source to 1/2 of its initial value. As a general rule we add one HVL to our absorber thickness calculations for conservatism:

(eq. 6.1.3) $$x_{total} = \frac{\ln(I_o/I) + 0.693}{\mu_m \rho}$$

ENCLOSURE 6.2

$\bar{E}$, A and R Values for 1% Failed Fuel and DBA

1% Failed Fuel:

$\bar{E} \sim 0.34$ MeV/dis. A ~ 0.293 mCi/ml

R = 0.18 mR/hr-mCi @ 1m for $\bar{E} \sim 0.34$ MeV

100% Failed Fuel or Design Basis Accident (DBA)

$\bar{E} \sim 1.14$ MeV/dis. A ~ 1.324×10^5 μCi/ml

R = 0.58 R/hr-Ci @ 1m for $\bar{E} \sim 1.14$ MeV

A direct proportion should exist between $\bar{E}$ and R for any failed fuel value greater than 1% and less than 100%.

ENCLOSURE 6.3

CONVERSION FACTORS

Source Activity - (A)

1 Curie (Ci) = 3.7×10^{10}dis./sec. = 2.22×10^{12}dpm

1 mCi = 3.7×10^{7}dps = 2.22×10^{9}dpm

1 μCi = 3.7×10^{4}dps = 2.22×10^{6}dpm

$$\frac{R}{hr\text{-}Ci} = \frac{mR}{hr\text{-}mCi}$$

Density - (ρ)

(ρ) for elements and common materials can be found on pg 65 and 66 of the "Radiological Health Handbook." ρ for lead (Pb) = 11.35g/cm3

Mass Attenuation Coefficient - (μ_m)

(μ_m) for elements and common materials at varying energy levels (MeV) for the source can be found on pg. 137 thru 139 of the "Radiological Health Handbook."

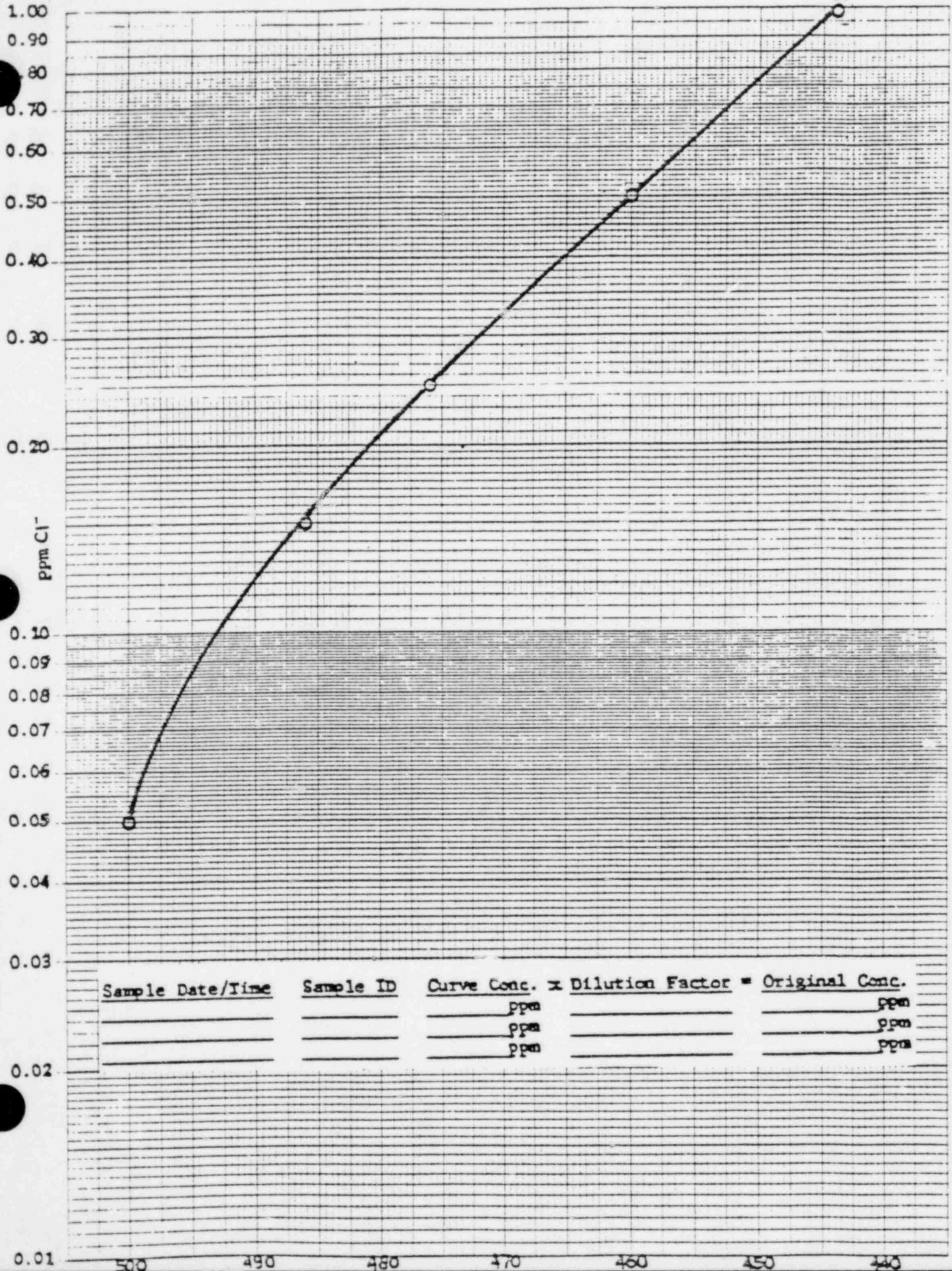
Distance - (d)

given: $I_o/I = d^2/d_o^2$

where: I_o = Source intensity (mR/hr or R/hr) @ distance (d_o)
I = Source intensity (mR/hr or R/hr) @ distance (d)

1 m. = 3.281 ft. = 39.37 in.

1 ft.= 0.305 m 3 ft. = 0.914 m



Sample Date/Time	Sample ID	Curve Conc. x	Dilution Factor =	Original Conc.
		ppm		ppm
		ppm		ppm
		ppm		ppm

ENCLOSURE 6.5

MANUAL SAMPLE DILUTION

6.5.1 Place a magnetic stirrer in the shielded work area.

6.5.2 Partially fill a glass volumetric flask with demin water and place on the magnetic stirrer in the shielded work area.

6.5.3 Using tongs remove the sample from the shielded sample container and place in the shielded work area.

6.5.4 Using a pipette transfer enough sample to the volumetric flask to produce the desired dilution.

6.5.5 Fill the volumetric flask to the mark with demin water, insert a stirring bar and cap.

6.5.6 Using tongs place the sample back into the shielded sample container.

6.5.7 Stir the diluted sample for ~ 5 min and allow to remain in the shielded work area until ready for analysis or disposal.

6.5.8 Repeat 6.5.1 thru 6.5.7 for additional samples.

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DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/0/A/2004/02E
Change(s) NA to
NA Incorporated

(2) STATION: Oconee Nuclear Station

(3) PROCEDURE TITLE: Post Accident Determination of Boron Concentration Using Carminic Acid

(4) PREPARED BY: Bruce Fowler DATE: 4/23/82

(5) REVIEWED BY: [signature] DATE: 4/23/82

Cross-Disciplinary Review By: [signature] N/R: ______

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: [signature] Date: 4/26/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

POST ACCIDENT DETERMINATION OF BORON CONCENTRATION

USING CARMINIC ACID

1.0 Discussion

1.1 Scope

This procedure describes the colormetric method for the post accident determination of boron concentration ([B]) in the RCS when fuel damage is estimated to be greater than 1%.

1.2 Principle

In concentrated sulfuric acid, boron forms a red colored chelation complex with carminic acid by splitting off water. Due to its hygroscopic nature, sulfuric acid aids in splitting off the water and prevents the reaction from reversing. Hydrochloric acid is added to inhibit the interference of nitrates. The intensity of the red color is proportional to the concentration of boron ([B]) in the sample, that is, it obeys Beer's law.

1.3 Limits

1.3.1 This method is applicable in the range of 0.1 to 2.0 ppm B.

1.3.2 Refer to CP/O/B/2001/03 for the laboratory quality control of the spectrophotometer.

1.4 Interferences

1.4.1 Substances normally present in reactor coolant do not interfere with this test.

1.4.2 Colors at 590 nm interfere, however, none are expected.

1.5 Precautions

1.5.1 DO NOT ATTEMPT ANY PHASE OF ANALYIS WITHOUT HEALTH PHYSICS COVERAGE!

1.5.2 Radiation exposure to an individual during all phases of analysis should be limited so as not to exceed a quarterly accumulative exposure of 3 rems whole body; 7.5 rems skin of wholebody; or 18 3/4 rems extremities respectively. All personnel will need prior authorization from TSC to knowingly exceed any exposure limit. The exposure received may require an occupational exposure penalty and/

or a medical decision as to whether an individual can continue in radiation work.

1.5.2.1 If necessary to remedy a situation immediately hazardous to life and property, the Planned Emergency Exposure for Duke Power Personnel will not exceed 5 rems wholebody; 30 rems skin of wholebody; or 75 rems extremities

1.5.2.2 If necessary to save lives or prevent loss of life and/or extensive damage to property (voluntary basis only), the Planned Emergency Exposure for Duke Power Personnel will not exceed 25 rems wholebody; 150 rems skin of wholebody; or 375 rems extremities.

1.5.2.3 For Outside Services Personnel the Planned Emergency Exposure will not exceed 5 rems wholebody; 30 rems skin of wholebody; 75 rems extremities; or 15 rems other single organ.

1.5.3 Radiation levels of the lab area shall be measured continuously during all phases of analysis.

1.5.3.1 Air activity should be determined by use of installed air monitors or through the use of portable air sampling equipment.

1.5.3.2 Area dose rates should be established by the use of installed radiation monitors or by portable radiation survey instrument.

1.5.3.3 Portable shielding, remote handling equipment, video equipment, etc., should be used where practical during sample preparation and sample analysis.

1.5.4 Water droplets or smudge marks on the cuvettes will cause an error in absorbance. Ensure light path surfaces of cuvettes are clean and dry.

1.5.5 Matched cuvettes shall be used in order to correct for absorption due to the glass surfaces of the cuvette.

1.5.6 Clean cuvettes with dilute nitric acid (1 + 99), air dry, and rinse with several small portions of standard or sample before filling and reading the absorbance.

1.5.7 Samples containing more than 2 ppm B should be diluted to less than 2 ppm usign demineralized water.

1.5.8 The carminic acid solution is hygroscopic (absorbs water). Keep tightly capped except when using.

1.5.9 This procedure shall be done either in a fume hood and/or other precautions shall be taken to avoid the release of gaseous activity.

1.5.10 Maximum color development requires approximately one hour with the color intensity decreasing slightly thereafter, but is of little consequence if standards are run simultaneously with the samples.

2.0 Apparatus

2.1 Spectrophotometer suitable for measurement at 590 nanometers (nm) - (Bausch and Lomb Spectronic 70 or equivalent).

2.2 50 mm cuvettes, matched, nitric acid washed, and air dried

2.3 5 ml glass pipettes - nitric acid washed

2.4 Dispensers, preset for 5 ml and 30 ml

2.5 Dropper bottle

2.6 Disposable beakers

2.7 100 ml glass volumetric flasks - nitric acid washed

2.8 Eppendorf pipettes with appropriate tips: 10, 25, 50, 100 µl

2.9 Parafilm for covering beakers

2.10 Analytical balance

2.11 Shielded Sample Container

2.12 Sample Tongs

2.13 Poly bottles - 60ml (2 oz.) size

2.14 Carboy - ~ 1 gal.

3.0 Reagents

3.1 Carminic Acid Solution - Dissolve 0.50 g (± 0.01 g) of carminic acid in 100 mls of concentrated sulfuric acid. Mix thoroughly until solution is complete. Store in a plastic bottle. This solution is relatively stable for several days, but exercise care to prevent water absorption. Discard after seven (7) days.

3.2 Boron Standard (~ 1000 ppm B) - Standardize either the purchased or prepared standard before use per CP/O/A/2004/02A or CP/O/A/2004/02B.

3.2.1 Purchased Standard - Use Fisher SO-B-155 or equivalent. Check the expiration date before use and discard if expired.

3.2.2 Prepared Standard - Dissolve about 5.72 g (± 0.01 g) of boric acid in demin. water and dilute to 1 liter with

demin. water in a volumetric flask and mix. Stable for two (2) weeks.

3.3 Concentrated Hydrochloric Acid - Use from dropper bottle. Sp. Gr. 1.19.

3.4 Concentrated Sulfuric Acid - Sp. Gr. 1.84.

3.5 Nitric Acid (1 + 99) - Mix 1 volume of concentrated nitric acid (Sp. Gr. 1.42) to 99 volumes of water.

4.0 Procedure

4.1 Initial Conditions

4.1.1 Evaluate the use of portable shielding, remote handling equipment, video equipment, etc., to minimize the exposure to personnel, in the lab for the analysis.

4.1.2 Request HP to perform a constant radiation survey during the analysis.

4.1.3 Determine and use the required respiratory equipment and protective clothing to prevent or minimize internal exposure in any Planned Emergency situation. Use high range and/or extremity dosimetry if required by HP.

4.1.4 Prepare one (1) carboy (~ 1 gal.). Label as "Post Accident Lab Waste". This container must be shielded and used as interim liquid waste disposal container for all liquid analytical waste.

4.1.5 Prepare a shielded work area in a fume hood. This area must be used for handling the sample when it is removed from the shielded sample container.

4.1.6 Prepare a waste disposal container for all solid analytical waste. Label as "Post Accident Lab Waste".

4.1.7 Check the serial numbers of the cuvettes to ensure that they are matched. Visually check the cells for scratches, cracks, chips and discoloration. Replace or clean as necessary.

4.1.8 Clean cuvettes with dilute (1 + 99) nitric acid and air dry.

4.1.9 Prepare a 1:2000 sample dilution using the post-accident sample panel or by the manual method described in Enclosure 6.5. Ensure 5 ml of diluted sample for the analysis.

4.2 Concentration Measurements

4.2.1 Prepare a series of boron standards in 100 ml volumetric flasks by diluting measured volumes of 1000 ppm boron standard with demin. water to produce 100 ml solution of the concentrations as follows:

µl of 1000 ppm stock diluted to 100 ml	= ppm B
10 µl	0.10
25 µl	0.25
50 µl	0.50
100 µl	1.00
200 µl	2.00

4.2.2 Pipet 5 ml of demin. water (reagent blank) and each standard to separate beakers and cover.

4.2.3 Pipet 5 ml of the 1:2000 sample dilution(s) to separate beaker(s) and cover.

4.2.4 To each beaker, add 5 drops of conc. HCl and 30 ml of conc. H_2SO_4, swirl to mix and cover. Allow approximately 15 minutes for cooling (less time will be needed for cooling if an ice bath is used to cool the samples).

CAUTION: Hydrogen chloride fumes and large amounts of heat may be generated during this phase. Add the conc. H_2SO_4 slowly and exercise care.

4.2.5 Add 5 ml of carminic acid solution to each beaker and swirl to mix. Cover and allow to stand approximately 45 minutes for full color development.

4.2.6 Rinse a clean and dry 50 mm cuvette with several small portions of the reagent blank before filling the cuvette completely.

4.2.7 Set the Spec-70 wavelength to 590 nm and set the absorbance to zero with the reagent blank.

4.2.8 Record the absorbance of each reacted standard in order of increasing concentration - rinse the matched 50 mm cuvette with several small portions of each standard before filling the cuvette completely and reading the absorbance of that standard.

4.2.9 Record the absorbance of each reacted sample - rinse a clean and dry 50 mm cuvette with several small portions of each sample before filling the cuvette completely and reading the absorbance.

4.2.10 Plot the data obtained in 4.2.8 on linear graph paper as shown in Enclosure 6.4.

4.2.11 Compare the abs. reading(s) from 4.2.9 to the calibration curve.

4.2.11.1 If the sample concentration is > 2.00 ppm repeat 4.2.1 thru 4.2.11 using a more dilute sample.

4.2.11.2 If the sample concentration is < 2.00 ppm but > 0.10 ppm apply the necessary dilution factor and record on the calibration curve.

4.2.11.3 If the sample concentration is < 0.10 ppm consider repeating 4.2.1 thru 4.2.11 using a less dilute sample or apply the necessary dilution factor to < 0.10 and record the "less than" value on the calibration curve.

4.3 Waste Disposal

4.3.1 Dispose of all liquid analytical waste in the "Post Accident Liquid Lab Waste" carboy. This container must be shielded and used as an interim liquid waste disposal container for all liquid analytical waste.

4.3.2 Dispose of all solid analytical waste in the "Post Accident Solid Lab Waste" container.

4.3.3 Request HP to designate an area where both post accident lab waste containers may be stored until final disposal.

4.3.4 In the event an area is grossly contaminated and cannot be decontaminated, evaluate the need for shielding or protective covering to prevent the spread of airborne activity.

4.4 Dose Exposure Evaluation

4.4.1 Evaluate the exposure to all personnel involved and complete all records, internal-body burden analysis, etc., as required. The exposure received may require an occupational exposure penalty. Higher doses will require a medical decision as to whether an individual can continue in radiation work.

5.0 <u>References</u>

5.1 ASTM, Part 31, D 3082-79 Method A (1980)

5.2 B&W Water Chemistry Manual, BAW-1385 (1973)

5.3 NUREG-0737

5.4 DPC System Health Physics Manual

5.5 Radiological Health Handbook, U.S. Dept. of HEW (1970)

5.6 Radiation Safety Technician Training Course, H.J. Moe, ANL-7291 Rev. 1 (1972)

6.0 Enclosures

6.1 Shield Thickness

6.2 $\bar{E}$, A, and R valves for 1% Failed Fuel and DBA

6.3 Conversion Factors

6.4 Typical Calibration Curve

6.5 Manual Sample Dilution

ENCLOSURE 6.1

SHIELD THICKNESS

The following equations can be used as an aid in determining shielding requirements for a sample of RCS after an accident.

given: $I = I_o e^{-\mu x}$ where: $\mu = \mu_m \rho$

$$I/I_o = e^{-\mu_m \rho x}$$

$$\ln(I/I_o) = -\mu_m \rho x$$

(eq. 6.1.1) $$x = \frac{\ln(I_o/I)}{\mu_m \rho}$$

where: x = thickness of absorber (cm)

μ = linear attenuation coefficient (cm^{-1})

μ_m = mass attenuation coefficient (cm^2/g) @ the energy level (Mev) of the source

ρ = density of the absorber material (g/cm^3)

I_o = source intensity w/zero thickness of the absorber (mR/hr or R/hr)

I = source intensity w/an x thickness of the absorber (mR/hr or R/hr)

given: (HVL) $I/I_o = 1/2 = e^{-\mu_m \rho x}$

$$\ln(1/2) = -\mu_m \rho x$$

(eq. 6.1.2) $$x = \frac{0.693}{\mu_m \rho}$$

A half value layer (HVL) is that thickness (x) of an absorber that will reduce the intensity of the Source to 1/2 of its initial value. As a general rule we add one HVL to our absorber thickness calculations for conservatism:

(eq. 6.1.3) $$x_{total} = \frac{\ln(I_o/I) + 0.693}{\mu_m \rho}$$

ENCLOSURE 6.2

$\bar{E}$, A and R Values for 1% Failed Fuel and DBA

1% Failed Fuel:

$\bar{E} \sim 0.34$ MeV/dis. A $\sim$ 0.293 mCi/ml

R = 0.18 mR/hr-mCi @ 1m for $\bar{E} \sim 0.34$ MeV

100% Failed Fuel or Design Basis Accident (DBA)

$\bar{E} \sim 1.14$ MeV/dis. A $\sim 1.324 \times 10^5$ μCi/ml

R = 0.58 R/hr-Ci @ 1m for $\bar{E} \sim 1.14$ MeV

A direct proportion should exist between $\bar{E}$ and R for any failed fuel value greater than 1% and less than 100%.

ENCLOSURE 6.3

CONVERSION FACTORS

Source Activity - (A)

1 Curie (Ci) = 3.7×10^{10} dis./sec. = 2.22×10^{12} dpm

1 mCi = 3.7×10^{7} dps = 2.22×10^{9} dpm

1 μCi = 3.7×10^{4} dps = 2.22×10^{6} dpm

$$\frac{R}{hr\text{-}Ci} = \frac{mR}{hr\text{-}mCi}$$

Density - (ρ)

(ρ) for elements and common materials can be found on pg 65 and 66 of the "Radiological Health Handbook." ρ for lead (Pb) = $11.35 g/cm^3$

Mass Attenuation Coefficient - (μ_m)

(μ_m) for elements and common materials at varying energy levels (MeV) for the source can be found on pg. 137 thru 139 of the "Radiological Health Handbook."

Distance - (d)

given: $I_o/I = d^2/d_o^2$

where: I_o = Source intensity (mR/hr or R/hr) @ distance (d_o)

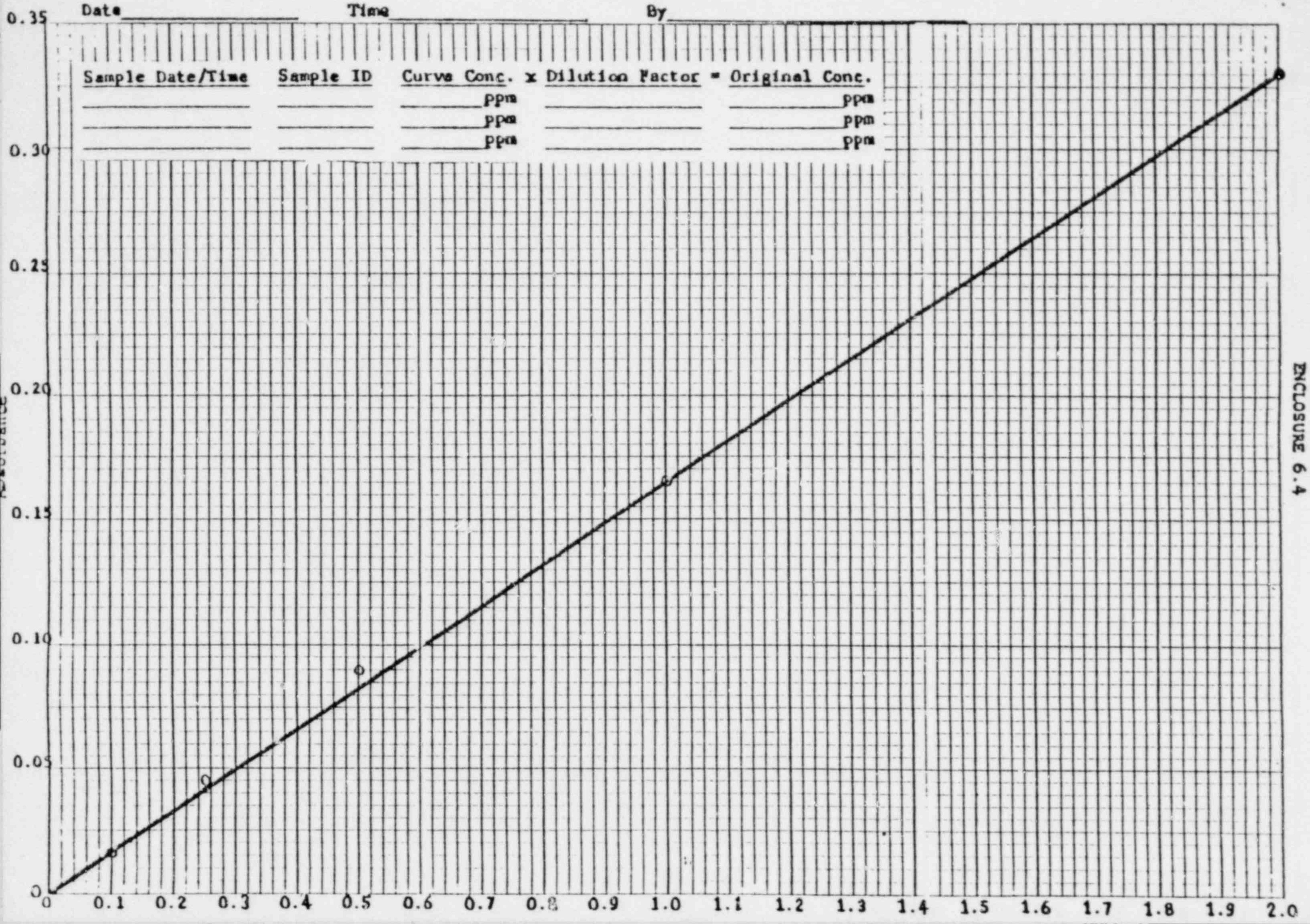
I = Source intensity (mR/hr or R/hr) @ distance (d)

1 m. = 3.281 ft. = 39.37 in.

1 ft.= 0.305 m   3 ft. = 0.914 m

Date________________ Time________________ By________________

Sample Date/Time	Sample ID	Curve Conc.	x Dilution Factor	= Original Conc.
		ppm		ppm
		ppm		ppm
		ppm		ppm



ENCLOSURE 6.5

MANUAL SAMPLE DILUTION

6.5.1 Place a magnetic stirrer in the shielded work area.

6.5.2 Partially fill a glass volumetric flask with demin water and place on the magnetic stirrer in the shielded work area.

6.5.3 Using tongs remove the sample from the shielded sample container and place in the shielded work area.

6.5.4 Using a pipette transfer enough sample to the volumetric flask to produce the desired dilution.

6.5.5 Fill the volumetric flask to the mark with demin water, insert a stirring bar and cap.

6.5.6 Using tongs place the sample back into the shielded sample container.

6.5.7 Stir the diluted sample for ~ 5 min and allow to remain in the shielded work area until ready for analysis or disposal.

6.5.8 Repeat 6.5.1 thru 6.5.7 for additional samples.

CONTROL COPY

INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/O/A/2005/02D
Change(s) NA to
NA Incorporated

(2) STATION: Oconee Nuclear Station

(3) PROCEDURE TITLE: Post Accident Determination of Gamma Isotopic Activity Y

(4) PREPARED BY: Bruce Fander DATE: 4/23/82

(5) REVIEWED BY: [signature] DATE: 4/23/82

Cross-Disciplinary Review By: [signature] N/R: ______

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: Tony B. Owen Date: 4/26/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

POST ACCIDENT DETERMINATION OF GAMMA ISOTOPIC ACTIVITY

1.0 Discussion

1.1 Scope - This procedure describes the post accident determination of gamma isotopic activity as measured by gamma ray spectrometry in the RCS when fuel damage is estimated to be greater than 1%.

1.2 Principle - Gamma interact with lithium drifted germanium diodes or Ge(Li) detectors, having an applied electric field, to produce electric charge pulses. These pulses are proportional to the energy lost by the incident gamma. Amplifiers amplify these electric pulse to produce voltage pulses. The multichannel analyzer (MCA) determines the amplitude of each voltage pulse and accumulates in a memory the number of pulses (or counts) in each amplitude band (or channel) in a given period of time. The number of counts accumulated in each channel forms a continuous curve of photopeaks called a "gamma spectrum".

The location of a photopeak in the gamma spectrum is proportional to the gamma energy of the incident gamma and is the basis for identifying a particular isotope in a sample. The area or total counts under a photopeak then represents the gamma activity of that particular isotope in the sample. Isotopes and their gamma activity are identified and calculated by computer program using the sample data stored in the MCA memory and reference data stored in a library file on magnetic disc. The results of the "pulse-height analysis" is presented on a paper printout. See Enclosures 6.1 and 6.2.

Certain conditions may require manual identification of photopeaks and calculation of gamma activity for isotopes not listed in the nuclide library as identified by computer program. The process of identifying photo peaks and calculating gamma activity is presented in this procedure.

1.3 Limits

1.3.1 The sample size and geometry must be selected such that less than 15% deadtime is encountered at the Analog to Digital Converter (ADC).

1.3.2 The lower limit of detectability is dependent on the background of the detector system in use, elapsed count time, sample size, sample geometry, detector efficiency and isotopes present.

1.4 Interferences

1.4.1 Variations in sample geometry can cause both qualitative and quantitative variations in the gamma ray spectrum. Calibration sources duplicating standard sample geometries can account for geometry effects.

1.4.2 Electronic characteristics such as deadtime, resolution and pulse pile-up degrade with increasing sample activity. Maintaining the deadtime below 15% by reducing the sample activity via decay or volume reduction and interpreting the gamma spectrum via computer program can provide easier and more reliable sample analysis.

1.5 Precautions

1.5.1 DO NOT ATTEMPT ANY PHASE OF ANALYSIS WITHOUT HEALTH PHYSICS COVERAGE!

1.5.2 Radiation exposure to an individual during all phases of analysis should be limited so as not to exceed a quarterly accumulative exposure of 3 rems whole body; 7.5 rems skin of wholebody; or 18 3/4 rems extremities respectively. All personnel will need prior authorization from TSC to knowingly exceed any exposure limit. The exposure received may require an occupational exposure penalty and/or a medical decision as to whether an individual can continue in radiation work.

1.5.2.1 If necessary to remedy a situation immediately hazardous to life and property, the Planned Emergency Exposure for Duke Power Personnel will not exceed 5 rems wholebody; 30 rems skin of wholebody; or 75 rems extremities.

1.5.2.2 If necessary to save lives or prevent loss of life and/or extensive damage to property (voluntary basis only), the Planned Emergency Exposure for Duke Power Personnel will not exceed 25 rems wholebody; 150 rems skin of wholebody; or 375 rems extremities.

1.5.2.3 For Outside Services Personnel the Planned Emergency Exposure will not exceed 5 rems wholebody; 30 rems skin of wholebody; 75 rems extremities; or 15 rems other single organ.

1.5.3 Radiation levels of the lab area shall be measured continuously during all phases of analysis.

1.5.3.1 Air activity should be determined by use of installed air monitors or through the use of portable air sampling equipment.

1.5.3.2 Area dose rates should be established by the use of installed radiation monitors or by portable radiation survey instrument.

1.5.3.3 Portable shielding, remote handling equipment, video equipment, etc., should be used where practical during sample preparation and sample analysis.

1.5.4 Ensure sample container has not leaked prior to sealing in poly bag.

1.5.5 This procedure shall be done in a fume hood and/or other precautions shall be taken to avoid the release of gaseous activity.

2.0 <u>Apparatus</u>

2.1 15 cc glass gas vials with rubber septum

2.2 Hypodermic syringe - assorted sizes

2.3 Plastic Petri Dishes (2")

2.4 Poly bottles: 50 ml, 500 ml, 1000 ml and 3500 ml.

2.5 Ge(Li) detector and multichannel analyzer (ND6600 or equivalent)

2.6 Shielded Sample Container

2.7 Sample Tongs

2.8 Carboy - ~ 1 gal.

3.0 <u>Reagents</u> - None

4.0 <u>Procedure</u>

4.1 Initial Conditions

4.1.1 Evaluate the use of portable shielding, remote handling equipment, video equipment, etc., to minimize the exposure to personnel, in the lab for the analysis.

4.1.2 Request HP to perform a constant radiation survey during the analysis.

4.1.3 Determine and use the requir d respiratory equipment and protective clothing to prevent or minimize interal exposure in any Planned Emergency situation. Use high range and/or extremity dosimetry if required by HP.

4.1.4 Prepare one (1) carboy (~ 1 gal.). Label as "Post Accident Lab Waste". This container must be shielded and used as interim liquid waste disposal container for all liquid analytical waste.

4.1.5 Prepare a shielded work area in a fume hood. This area must be used for handling the sample when it is removed from the shielded sample container.

4.1.6 Prepare a waste disposal container for all solid analytical waste. Label as "Post Accident Lab Waste".

4.1.7 Prepare a sample dilution using the post-accident sample panel or by the manual method described in Enclosure 6.6.

4.2 Preparation of Gas Samples for Counting

4.2.1 Remove about 10 cc of air from a sealed and labeled gas vial using a syringe to extract the air.

4.2.2 Insert the syringe needle through the rubber septum of the sample gas bomb. Adjust the volume of sample in the syringe to the desired volume (based on activity).

4.2.3 Quickly remove the syringe from the sample gas bomb and insert the syringe needle through the rubber septum of the gas vial, inject the sample and remove the syringe from the gas vial.

4.2.4 Seal the vial in a poly bag and store in a plastic bag. Allow the vial to remain in the shielded work area until ready for analysis or disposal.

4.3 Preparation of Liquid Samples for Counting

4.3.1 Transfer the desired volume of the sample dilution (based on activity) to a labeled poly bottle. The Ge(Li) system is calibrated for 50 ml, 500 ml, 1000 ml and 3500 ml geometries.

4.3.2 Seal the poly bottle in a poly bag and store in a plastic bag. Allow the poly bottle to remain in the shielded work area until ready for analysis or disposal.

4.4 Waste Disposal

4.4.1 Dispose of all liquid analytical waste in the "Post Accident Liquid Lab Waste" carboy. This container must be shielded and used as an interim liquid waste disposal container for all liquid analytical waste.

4.4.2 Dispose of all solid analytical waste in the "Post Accident Solid Lab Waste" container.

4.4.3 Request HP to designate an area where both post accident lab waste containers may be stored until final disposal.

4.4.4 In the event an area is grossly contaminated and cannot be decontaminated, evaluate the need for shielding or protective covering to prevent the spread of airborne activity.

4.5 Dose Exposure Evaluation

4.5.1 Evaluate the exposure to all personnel involved and complete all records, internal-body burden analysis, etc., as required. The exposure received may require an occupational exposure penalty. Higher doses will require a medical decision as to whether an individual can continue in radiation work.

5.0 References

5.1 BAW Water Chemistry Manual, BAW-1385 (1973)

5.2 BAW Radiochemistry Manual, BAW-1410 (1975)

5.3 ASTM, Part 31, D3649-78

5.4 ASTM, Part 31, ANSI/ASTM D2459-72

5.5 NUREG-0737

5.6 DPC System Health Physics Manual

5.7 Radiological Health Handbook, U.S. Dept. of HEW (1970)

5.8 Radiation Safety Technician Training Course, H.J. Moe, ANL-7291 Rev. 1 (1972)

6.0 Enclosures

6.1 Title Page of ND6600 Print-out

6.2 Summary Page of ND6600 Print-out

6.3 Shield Thickness

6.4 $\bar{E}$, A, and R valves for 1% Failed Fuel and DBA

6.5 Conversion Factors

6.6 Manual Sample Dilution

```
*****************************************************************
*****************  13 NOV 1980 12:41:13 AM  *****************     (NOTE 1)
*****************************************************************

CHEM.    2 LPI CRUD          SRWP 4  .   (NOTE 2)                ENCLOSURE 6.1

 MPLE DATE:    7NOV80 1820:00
 MPLE IDENTIFICATION:   CRUD FILTER
TYPE OF SAMPLE:   SOLIDS
SAMPLE QUANTITY:     100.0000         UNITS:   ML
SAMPLE GEOMETRY:   FILTER AT 6CM
EFFICIENCY FILE NAME:   EFF.CFILT6
*****************************************************************
                                       *
ACQUISITION DATE: 13NOV80    29:37 * FWHM(1332)           1.856
PRESET TIME(LIVE):        600.  SEC  * SENSITIVITY:         5.000
ELAPSED REAL TIME:        644.  SEC  * SHAPE PARAMETER :  35.0 %
ELAPSED LIVE TIME:        600.  SEC  * NBR ITERATIONS:     10.
                                       *
*****************************************************************
                                       *
DETECTOR: GELI-C                       * LIBRARY:NUCL.MASTER
DATE CALIBRATED:   12NOV80    29:45 * ENERGY TOLERANCE:   1.750KV
KEV/CHNL:         0.5004218            * HALF LIFE RATIO:    8.00
OFFSET:          -0.1842307 KEV        * ABUNDANCE LIMIT:  80.00%
                                       *
*****************************************************************
                                       *
COLLECTED BY:                          * COUNTED BY:
                                       *
RWP/SRWP/LWR/GWR:                      * COMMENTS:
                                       *
 SPIRATORY EQUIP USED:                 *
 CONTROL GROUP USE)                    *
*****************************************************************

DEAD TIME:      7.33%
ACTION REQUIRED:    NONE

*****************************************************************

              ENERGY WINDOW      32.343 TO    2046.541
```

PK	IT	ENERGY	AREA	BKGND	FWHM	CHANNEL	LEFT	PW	CTS/SEC	%ERR	FIT
1	0	67.07	1451.	17278.	1.71	134.39	130	9	2.418E 00	13.1	
2	0	80.27	17243.	25599.	1.66	160.77	154	14	2.874E 01	1.5	
3	0	109.63	294.	11084.	1.24	219.45	218	6	4.900E-01	51.0	
4	0	140.56	7004.	23187.	1.73	281.25	276	12	1.167E 01	3.3	
5	0	145.32	790.	13928.	1.52	290.77	288	7	1.317E 00	21.4	
6	0	153.31	656.	16112.	2.09	306.73	304	7	1.093E 00	27.7	
7	0	162.83	9200.	27129.	1.61	325.75	320	12	1.533E 01	2.7	
8	0	176.99	2423.	20205.	1.91	354.05	350	9	4.038E 00	8.5	
9	0	273.52	610.	9725.	1.56	546.94	543	9	1.016E 00	23.2	
10	0	284.35	20076.	15503.	1.78	568.59	561	15	3.346E 01	1.1	
11	0	304.87	3257.	12620.	1.88	609.59	603	13	5.428E 00	5.2	
12	0	319.86	1954.	10192.	1.56	639.55	634	11	3.256E 00	7.7	
13	0	328.84	13920.	15892.	1.74	657.48	652	16	2.320E 01	1.5	
14	0	340.51	2337.	9485.	1.66	680.81	676	11	3.896E 00	6.2	
15	0	364.51	205590.	15875.	1.79	728.78	721	19	3.426E 02	0.2	
16	0	423.56	2152.	6074.	1.56	846.77	840	13	3.587E 00	5.6	
17	3	432.50	1577.	3280.	2.00	864.64	858	24	2.629E 00	5.7	1.56E 00
18	3	437.54	1091.	2785.	1.79	874.70	858	24	1.818E 00	7.5	
19	0	487.05	22420.	7556.	1.87	973.64	965	18	3.737E 01	0.9	
20	0	496.95	179.	3142.	1.08	993.42	990	8	2.975E-01	45.0	
[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.048E 00	13.7	

ENCLOSURE 6.1

LEGEND FOR ENCLOSURE 6.1

NOTE 1: Date print-out generated.

NOTE 2: Title of sample.

SAMPLE DATE: Date sample collected.

SAMPLE IDENTIFICATION: Description of sample container (vial, bottle or filter).

TYPE OF SAMPLE: Gas, liquid or solid.

SAMPLE QUANTITY: Number of units and unit type for sample distributed in sample container.

SAMPLE GEOMETRY: Sample container at the specified distance from the detector.

EFFICIENCY FILE NAME: Describes the efficiency curve referenced as a function of the geometry.

ACQUISITION DATE: Date data acquisition began.

PRESET TIME (LIVE): User specified count time in seconds.

ELAPSED REAL TIME: Elapsed clocktime in seconds.

ELAPSED LIVE TIME: Elapsed ADC time in seconds.

FWHM: During detector calibration, the ratio of the peak width at half its maximum height of the 1332 KeV (Co-60) peak is calculated. The Peak Search program applies this value to each peak to determine if it is a single or multiplet peak.

SENSITIVITY: The Peak Search program will ignore a peak whose height is less than the selected number of standard deviations above the average background in the region of the peak.

SHAPE PARAMETER: A channel must be greater than the average background in the region of the peak by the specified percentage to be considered as part of the peak area.

NBR ITERATIONS: To analyze multiplet peaks, the Peak Search program will successively refine the shape of the peaks (run a line thru the points) until successive "passes" over the peaks do not differ significantly or until the maximum number (NBR) of passess as specified are reached.

ENCLOSURE 6.1

DETECTOR: The user-selected detector used.

DATE CALIBRATED: Detector/ADC calibration date.

KEV/CHANL: Slope of the energy calibration curve in KeV/Channel.

OFFSET: Intercept of the energy calibration curve in KeV.

LIBRARY: Library file used for identification of peaks.

ENERGY TOLERANCE: The ND program compares the KeV of detected peaks with the KeV of known nuclides from the selected library file. A detected peak will be accepted as a known nuclide if its KeV is within (±) the selected energy tolerance of the known nuclides KeV.

HALF LIFE RATIO: For a nuclide to be considered genuine, 8 half-lives must not be exceeded between the Sample Date and the Acquisition Date.

ABUNDANCE LIMIT: The ND program will accept the identification of a nuclide having multiple gammas if the total detectable abundance exceeds the selected percentage of the nuclides absolute abundance.

ENCLOSURE 6.2

TOTAL LINES IN SPECTRUM	58	
LINES NOT LISTED IN LIBRARY	13	
IDENTIFIED IN SUMMARY REPORT	42	72.41%

FISSION GAS

NUCLIDE	HLIFE	HLSEC	DECAY	UC/UT	ERROR	%ERR
XE-131M	1.19E 01D	1.028E 06	2.264E -3	2.297E -2	6.289E -4	2.74
XE-133	5.25E 00D	4.536E 05	3.338E -3	3.115E -3	4.726E -5	1.52

ACTIVATION PRODUCT

NUCLIDE	HLIFE	HLSEC	DECAY	UC/UT	ERROR	%ERR
CR-51	2.77E 01D	2.393E 06	1.901E -3	1.645E -3	1.258E -4	7.65
MN-54	3.12E 02D	2.700E 07	1.686E -3	8.840E -5	1.100E -5	12.44
CO-58	7.08E 01D	6.117E 06	1.755E -3	5.703E -3	3.462E -5	0.61
FE-59	4.46E 01D	3.853E 06	1.809E -3	1.457E -4	2.329E -5	15.99
CO-60	5.27E 00Y	1.663E 08	1.670E -3	1.415E -4	1.247E -5	8.81
AG-110M	2.51E 02D	2.167E 07	1.691E -3	4.230E -4	1.263E -5	2.99

HALOGEN FISSION PRODUCT

NUCLIDE	HLIFE	HLSEC	DECAY	UC/UT	ERROR	%ERR
I-131	8.04E 00D	6.947E 05	2.623E -3	3.294E -2	7.806E -5	0.24
I-133	2.08E 01H	7.488E 04	1.119E -1	3.218E -2	1.142E -3	3.55

FISSION PRODUCT

NUCLIDE	HLIFE	HLSEC	DECAY	UC/UT	ERROR	%ERR
ZR-95	6.40E 01D	5.528E 06	1.764E -3	1.276E -4	1.616E -5	12.66
NB-95	3.52E 01D	3.037E 06	1.849E -3	2.312E -4	1.514E -5	6.55
RU-103	3.93E 01D	3.400E 06	1.828E -3	2.556E -5	1.151E -5	45.04
CS-134	2.06E 00Y	6.501E 07	1.675E -3	1.186E -3	2.063E -5	1.74
CS-136	1.31E 01D	1.132E 06	2.202E -3	7.144E -4	1.683E -5	2.36
CS-137	3.02E 01Y	9.521E 08	1.667E -3	1.259E -3	1.776E -5	1.41
BA-140	1.28E 01D	1.105E 06	2.216E -3	8.845E -3	1.[illegible]1E -4	1.38
LA-140	4.02E 01H	1.448E 05	1.468E -2	4.826E -2	4.068E -4	0.84

ENCLOSURE 6.2

LEGEND FOR ENCLOSURE 6.2

TOTAL LINES IN SPECTRUM: Total number of peaks found by Peak Search program.

LINES NOT LISTED IN LIBRARY: Number of peaks not identifiable by the ND program.

IDENTIFIED IN SUMMARY REPORT: Number of peaks identified and accepted.

NUCLIDE: The nuclides identified by the ND program.

HLIFE: The half life of the identified nuclides in scientific notation with the appropriate time.

HLSEC: The half life of the identified nuclide converted to seconds in scientific notation.

DECAY: The ratio of the elapsed time between the Sample Date and the Acquisition Date to the HLSEC.

UC/UT: The activity of the identified nuclides in µCi per unit of volume or weight.

ERROR: The confidence level (standard deviation) at 1 sigma, of the activity of the identified nuclides in µCi/unit volume or weight.

% ERR: The standard deviation (± 1 sigma) in percentage.

ENCLOSURE 6.3

SHIELD THICKNESS

The following equations can be used as an aid in determining shielding requirements for a sample of RCS after an accident.

given: $I = I_o e^{-\mu x}$ where: $\mu = \mu_m \rho$

$$I/I_o = e^{-\mu_m \rho x}$$

$$\ln(I/I_o) = -\mu_m \rho x$$

(eq. 6.1.1) $$x = \frac{\ln(I_o/I)}{\mu_m \rho}$$

where: x = thickness of absorber (cm)

μ = linear attenuation coefficient (cm^{-1})

μ_m = mass attenuation coefficient (cm^2/g) @ the energy level (Mev) of the source

ρ = density of the absorber material (g/cm^3)

I_o = source intensity w/zero thickness of the absorber (mR/hr or R/hr)

I = source intensity w/an x thickness of the absorber (mR/hr or R/hr)

given: (HVL) $I/I_o = 1/2 = e^{-\mu_m \rho x}$

$$\ln(1/2) = -\mu_m \rho x$$

(eq. 6.1.2) $$x = \frac{0.693}{\mu_m \rho}$$

A half value layer (HVL) is that thickness (x) of an absorber that will reduce the intensity of the Source to 1/2 of its initial value. As a general rule we add one HVL to our absorber thickness calculations for conservatism:

(eq. 6.1.3) $$x_{total} = \frac{\ln(I_o/I) + 0.693}{\mu_m \rho}$$

ENCLOSURE 6.4

$\bar{E}$, A and R Values for 1% Failed Fuel and DBA

1% Failed Fuel:

$\bar{E} \sim 0.34$ MeV/dis. A ~ 0.293 mCi/ml

R = 0.18 mR/hr-mCi @ 1m for $\bar{E} \sim 0.34$ MeV

100% Failed Fuel or Design Basis Accident (DBA)

$\bar{E} \sim 1.14$ MeV/dis. A ~ 1.324×10^5 μCi/ml

R = 0.58 R/hr-Ci @ 1m for $\bar{E} \sim 1.14$ MeV

A direct proportion should exist between $\bar{E}$ and R for any failed fuel value greater than 1% and less than 100%.

ENCLOSURE 6.5

CONVERSION FACTORS

Source Activity - (A)

1 Curie (Ci) = 3.7×10^{10} dis./sec. = 2.22×10^{12} dpm

1 mCi = 3.7×10^{7} dps = 2.22×10^{9} dpm

1 μCi = 3.7×10^{4} dps = 2.22×10^{6} dpm

$$\frac{R}{\text{hr-Ci}} = \frac{\text{mR}}{\text{hr-mCi}}$$

Density - (ρ)

(ρ) for elements and common materials can be found on pg 65 and 66 of the "Radiological Health Handbook." ρ for lead (Pb) = $11.35 g/cm^3$

Mass Attenuation Coefficient - (μ_m)

(μ_m) for elements and common materials at varying energy levels (MeV) for the source can be found on pg. 137 thru 139 of the "Radiological Health Handbook."

Distance - (d)

given: $I_o/I = d^2/d_o^2$

where: I_o = Source intensity (mR/hr or R/hr) @ distance (d_o)
I = Source intensity (mR/hr or R/hr) @ distance (d)

1 m. = 3.281 ft. = 39.37 in.

1 ft.= 0.305 m 3 ft. = 0.914 m

ENCLOSURE 6.6

MANUAL SAMPLE DILUTION

6.5.1 Place a magnetic stirrer in the shielded work area.

6.5.2 Partially fill a glass volumetric flask with demin water and place on the magnetic stirrer in the shielded work area.

6.5.3 Using tongs, remove the sample from the shielded sample container and place in the shielded work area.

6.5.4 Using a pipette, transfer enough sample to the volumetric flask to produce the desired dilution.

6.5.5 Fill the volumetric flask to the mark with demin water, insert a stirring bar and cap.

6.5.6 Using tongs, place the sample back into the shielded sample container.

6.5.7 Stir the diluted sample for ~ 5 min. and allow to remain in the shielded work area until ready for analysis as disposal.

6.5.8 Repeat 6.5.1 thru 6.5.7 for additional samples.

INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

ID No: HP/0/B/1009/13
Change(s) 2 to
N/A Incorporated

(2) STATION: Oconee

(3) PROCEDURE TITLE: Procedure for Implementation and Verification for the Availability of a Back-Up Source of Meteorological Data

(4) PREPARED BY: Sarah A. Coy DATE: 4/22/82

(5) REVIEWED BY: Charlie Yonge DATE: 4-22-82

Cross-Disciplinary Review By: ______ N/R: Cy

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: Tony B. Owen Date: 4/23/82

(8) MISCELLANEOUS:

Reviewed/~~Approved~~ By: [signature] Date: 4/23/82

Reviewed/Approved By: ______ Date: ______

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

PROCEDURE FOR IMPLEMENTATION AND VERIFICATION FOR THE AVAILABILITY OF A BACK-UP SOURCE OF METEOROLOGICAL DATA

1.0 Purpose

To provide a procedure for implementation and verification for the availability of a back-up source of meteorological data needed to make an offsite dose projection should the station's meteorological data equipment become unavailable.

2.0 References

2.1 NUREG 1.23, Proposed Revision 1* to Regulatory Guide 1.23, Meteorological Programs in Support of Nuclear Power Plants.

2.2 NUREG 0654, Annex 1 to Appendix 2, (o), Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants.

2.3 Oconee Nuclear Station Emergency Plan.

3.0 Limitations and Precautions

3.1 Maintain record of notification (Enclosure 5.1) for a minimum of two years. This procedure will be superseded as acceptable backup measures are developed by Oconee Nuclear Station.

3.2 Contact the National Weather Service at the Greenville-Spartanburg Airport by telephone using Enclosure 5.1. The telephone number listed on the Enclosure is a 24 hour number.

3.3 These contacts shall be made monthly and alternate among shifts.

4.0 Procedure

4.1 Record the following meteorological information on Enclosure 5.1.

4.1.1 Wind direction (in tens of degrees).

4.1.2 Wind speed (in knots).

4.1.3 Air temperature.

4.1.4 Weather conditions (clear, partly cloudy, etc.)

4.2 Record concurrent on-site meteorological information on Enclosure 5.1.

5.0 Enclosure

5.1 Communications Check, Meteorological Data.

Enclosure 5.1
Communication Check
Meteorological Data
Back-Up Source: National Weather Service, Greenville - Spartanburg Airport
Telephone Number: 803-877-6998

Month	Time	Date	Person Calling	Wind Direction (Ten of Degrees)	Wind Speed (Knots)	Air Temperature	Weather Conditions	
Jan.				___ ___ ___	___ ___ ___	___ ___ ___	___ ___ ___	NWS / ONS
Feb.				___ ___ ___ ___	___ ___	___ ___ ___	___ ___ ___	NWS / ONS
March				___ ___ ___	___ ___	___ ___ ___	___ ___ ___ ___	NWS / ONS
April				___ ___ ___	___ ___ ___	___ ___ ___	___ ___ ___	NWS / ONS
May				___ ___ ___	___ ___ ___	___ ___ ___	___ ___ ___	NWS / ONS
June				___ ___ ___	___ ___ ___	___ ___ ___	___ ___ ___	NWS / ONS
July				___ ___ ___	___ ___	___ ___ ___	___ ___ ___	NWS / ONS
August				___ ___ ___	___ ___	___ ___ ___	___ ___ ___	NWS / ONS
Sept.				___ ___ ___	___ ___	___ ___	___ ___ ___	NWS / ONS
Oct.				___ ___ ___	___ ___	___ ___	___ ___ ___	NWS / ONS
Nov:				___ ___ ___	___ ___	___ ___	___ ___ ___	NWS / ONS
Dec.				___ ___ ___	___ ___	___ ___ ___	___ ___ ___	NWS / ONS

INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: HP/0/B/1009/15
Change(s) 4 to
N/A Incorporated

(2) STATION: Oconee

(3) PROCEDURE TITLE: Procedure for Sampling and Quantifying High Level Gaseous, Radioiodine, and Particulate Radioactivity

(4) PREPARED BY: E. D. Hough DATE: 4-29-82

(5) REVIEWED BY: Charlie Youngren DATE: 4-29-82

Cross-Disciplinary Review By: ____ N/R: ey

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ____ (SRO) Date: ____

By: ____ Date: ____

(7) APPROVED BY: T. B. Owen /E.T.B. Date: 4/29/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ____ Date: ____

Reviewed/Approved By: ____ Date: ____

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

PROCEDURE FOR SAMPLING AND QUANTIFYING HIGH

LEVEL GASEOUS, RADIOIODINE, AND PARTICULATE RADIOACTIVITY

1.0 Purpose

This procedure describes methods for collecting samples to evaluate effluent and containment noble gas and radioiodine activities during accident conditions.

2.0 References

2.1 System Health Physics Manual, Section I, M, Radioactive Waste Control Requirements

2.2 Technical Specifications Oconee Nuclear Station, Appendix A. Section 3.10 Release of Gaseous Radioactive Waste

2.3 HP/0/B/1000/60/A, Procedure for Gaseous Waste Sampling and Analysis

2.4 HP/0/B/1000/60/D, Procedure for Unit Vent Sampling and Analysis

2.5 HP/0/B/1000/57, Air Sampling, Counting and Calculating Procedure

2.6 HP/0/B/1000/60/B, Procedure for Reactor Building Gaseous Purge

2.7 HP/0/B/1000/60/H, Procedure for Changeout and Analysis of Reactor Building Iodine Cartridges and Particulate Filters

2.8 HP/0/B/1000/55, Instrument Monitoring and Survey Procedure

2.9 HP/0/B/1001/14, Procedure for Nuclear Data 6600 System Operation

2.10 HP/0/B/1006/07, Procedure for Preparation of Gas Calibration Sources

3.0 Limits and Precautions

3.1 This procedure is written for use under abnormal conditions which could involve extremely high radiation levels. Only Health Physics management should authorize the use of this procedure when needed and should provide appropriate surveillance and control of people taking the samples.

3.2 Whenever the effluent monitor goes offscale, appropriate grab samples or radiation level measurements should be taken to estimate effluent release rates and the amount of effluent released.

NOTE: No samples will be taken unless authorized by Health Physics management. When samples are taken, use protective clothing, gloves, respiratory protective equipment, portable shielding, high range dosimeters and survey instruments as determined by prejob ALARA planning.

3.3 Should effluent concentrations exceed those values specified in Enclosure 5.5, notify the emergency coordinator of possible technical specification violation.

4.0 <u>Procedure</u>

4.1 Conduct planning session. Consider the guidance provided in Enclosure 5.1 in preplanning.

4.2 Use an ion chamber to measure the radiation dose rate from the reactor building or unit vent RIA supply line.

4.3 When contact dose rate readings at Iodine RIA sample holder (RIA-44 for Vent/RIA-48 for Reactor Building) and middle point of Gaseous RIA supply line (RIA 45/46 for Vent/RIA 49 for Reactor Building) are less than 3 R/hr, collect gas and Iodine samples as described in Steps 4.4.1 to 4.4.6.

4.4 Sample Collection

4.4.1 Prepare a flow path in the following order:

NOTE: During an accident, the containment building is isolated. Contact Shift Supervisor for manual override to open valves for sampling.

Supply → particulate filter paper → CP-100G silver zeolite sample cartridge → vacuum pump → flow meter (0-80LPM) → 100 ml Argonne gas bomb → return line.

See Enclosure 5.2 for apparatus setup.

4.4.2 Collect sample. Minimum sample volume is 5 liters.

4.4.3 Upon completion, turn off sample pump, close exhaust valve of gas bomb, close intake valve of gas bomb, close supply valve, then close return valve.

4.4.4 Remove filter and cartridge; monitor sample and place in protective wrapper (poly bag). Indentify with

4.4.4.1 Start time

4.4.4.2 Stop time

4.4.4.3 Flow rate

4.4.4.4 Sample location

4.4.5 Place samples in shielding container for return to the counting laboratory.

4.4.6 If contact reading on sample is greater than .01 R/hr, Count Room personnel will make decision on counting sample.

4.5 If the dose rate at the gaseous RIA (RIA 45/46 for Vent/RIA 49 for Reactor Building) supply line is greater than 3R/hr, obtain gaseous concentration (μCi/ml) corresponding to the radiation dose rate (R/hr) from Enclosure 5.3.

4.6 If the dose rate at the Iodine RIA (RIA 44 for Vent/RIA 48 for Reactor Building) sample holder is between 3 R/hr and 15 R/hr, follow Step 4.6.1 to 4.6.5. If the dose rate exceeds 15 R/hr, no samples will be taken.

NOTE: Contact Shift Supervisor for manual override.

4.6.1 Remove charcoal cartridge from the Iodine RIA sample holder. Survey removed charcoal cartridge and save to be counted if possible.

4.6.2 Collect sample through silver zeolite cartridge for two (2) minutes. Collect data from RIA flow meter for correct volume.

4.6.3 Remove cartridge from sample holder, monitor sample and place cartridge in poly bag and put bag into a shielded container for transport to a lower background area for counting. Place new cartridge in sample holder for future use if desirable.

4.6.4 Take a contact dose rate measurement on the sample cartridge using an ion chamber. Obtain Iodine concentration (μCi/ml) corresponding to the radiation dose rate (R/hr) from Enclosure 5.4.

4.6.5 If the contact reading is below .01 R/hr, perform a gamma isotopic analysis of the sample.

4.7 Isotopic Analysis of Sample

4.7.1 Iodine + Particulate - Separate filter and cartridge and seal in wrappers. Label cartridge with data. Analyze particulate and iodine cartridge by Reference 2.9.

4.7.2 Gaseous - Gas bomb is labeled for desired data and processed for gamma spectroscopy.

4.7.2.1 Test gas bomb for excessive dead time by Reference 2.9.

4.7.2.1.1 If the dead time is greater than 15% at the 9cm geometry for gas bombs, dilute the gas sample by Ref. 210. Further dilutions may be necessary until the desired dead time value ≤ 15% is achieved.

4.7.3 Review spectral display versus printout to assure correct gamma isotopic analysis report.

4.8 Results

4.8.1 Forward MCA results to TSC for review and further distribuiton.

NOTE: For rapid assessment of technical specifications compliance, use Enclosure 5.5.

5.0 Enclosures

5.1 Guidelines for Collecting, Transporting, Analyzing, and Disposing of High Level Samples

5.2 Apparatus setup for sample collection.

5.3 Conversion of gaseous RIA supply line dose rate (R/hr) to gaseous effluent concentration (μCi/ml)

5.4 Conversion of Iodine sample dose rate (R/hr) to Iodine effluent concentration (μCi/ml)

5.5 Conversion of Vent Sample Results to Curies per second

ENCLOSURE 5.1

GUIDELINES FOR COLLECTING, TRANSPORTING, ANALYZING,

ADD DISPOSING OF HIGH LEVEL SAMPLES

1. Before entering sampling points, be aware and prepare for high radiation levels and possible airborne areas.

2. Preplan and stage sampling apparatus in a low background area.

3. Take samples expeditiously.

4. Handle samples with either the source handling tools available in the H.P. Source Room or with tongs from station supply area.

5. Transport hot samples to counting lab with good ALARA practices.

   Examples: A. sample sitting on a cart or hand truck ----- distance.

   B. Sample surrounded by a lead blanket or lead bricks (all of which are availabe in the H.P. Lab areas or supply) --- shielding.

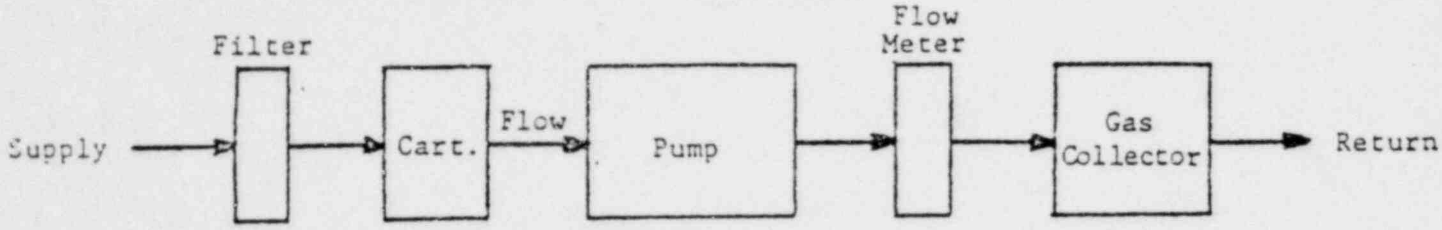
6. Contamination control should be maintained by double bagging the sample during transport and analysis.

7. Disposal or storage of the high level samples in the Counting Facility should merit the same controls as sampling, i.e., ALARA transportation, shielded storage, or storage at a remote location.

ENCLOSURE 5.2

HP/O/B/1009/15

SAMPLE COLLECTION



A) Set up sample system according to diagram.

B) Before opening supply and return valves

ENSURE

1) Tight hose fittings.

2) Correct valve positions.

3) Open flow rate meter (a couple of full turns).

4) Regulate flow rate with supply valve (when possible).

C) Turn on sample pump.

D) Shut system down if pressure or vacuum meters build up.

E) Check gas collector for build up of back pressure.

F) Sample time is an important consideration in the validity of the sample results.

G) Upon completion of sample:

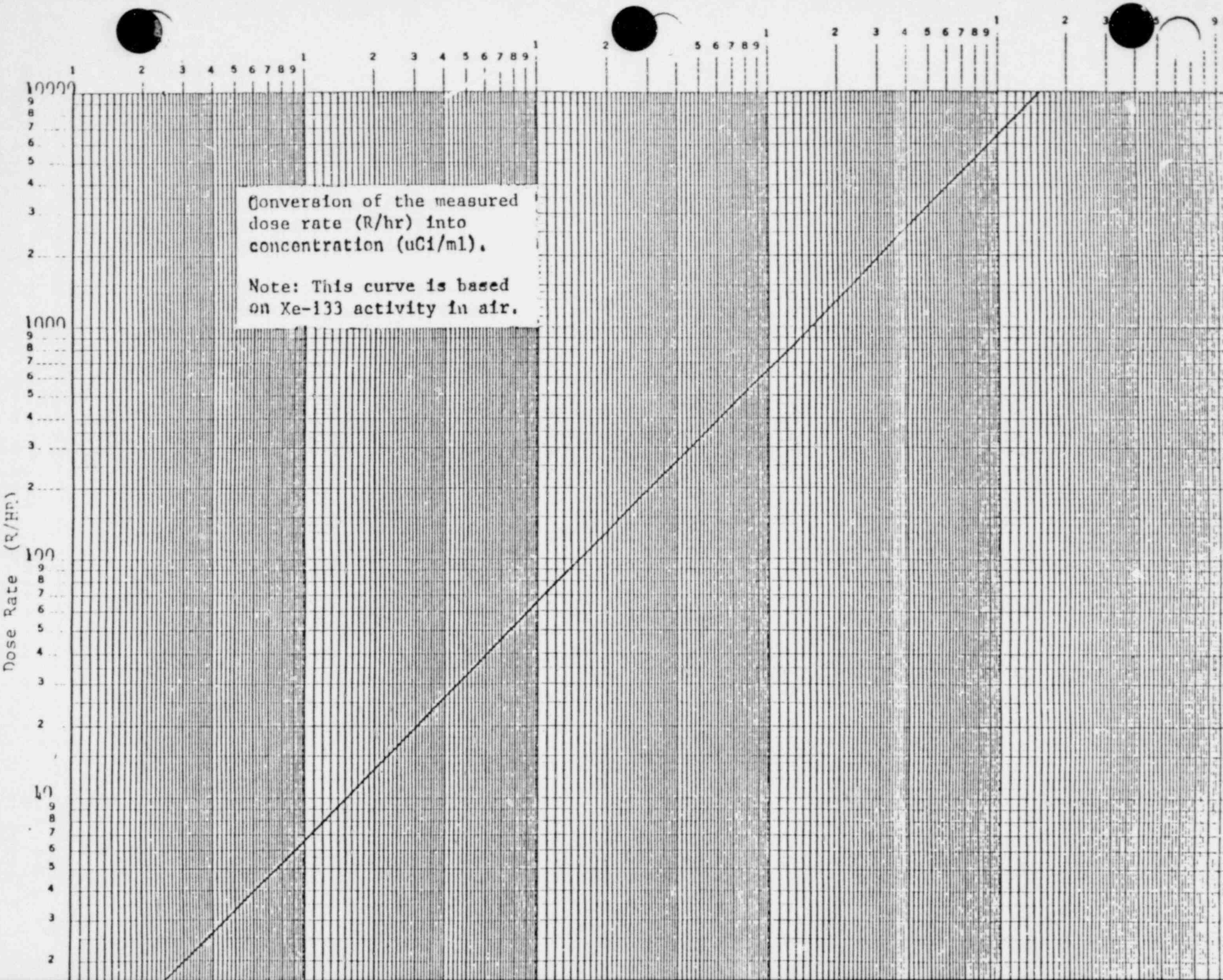
a) Turn off sample pump.

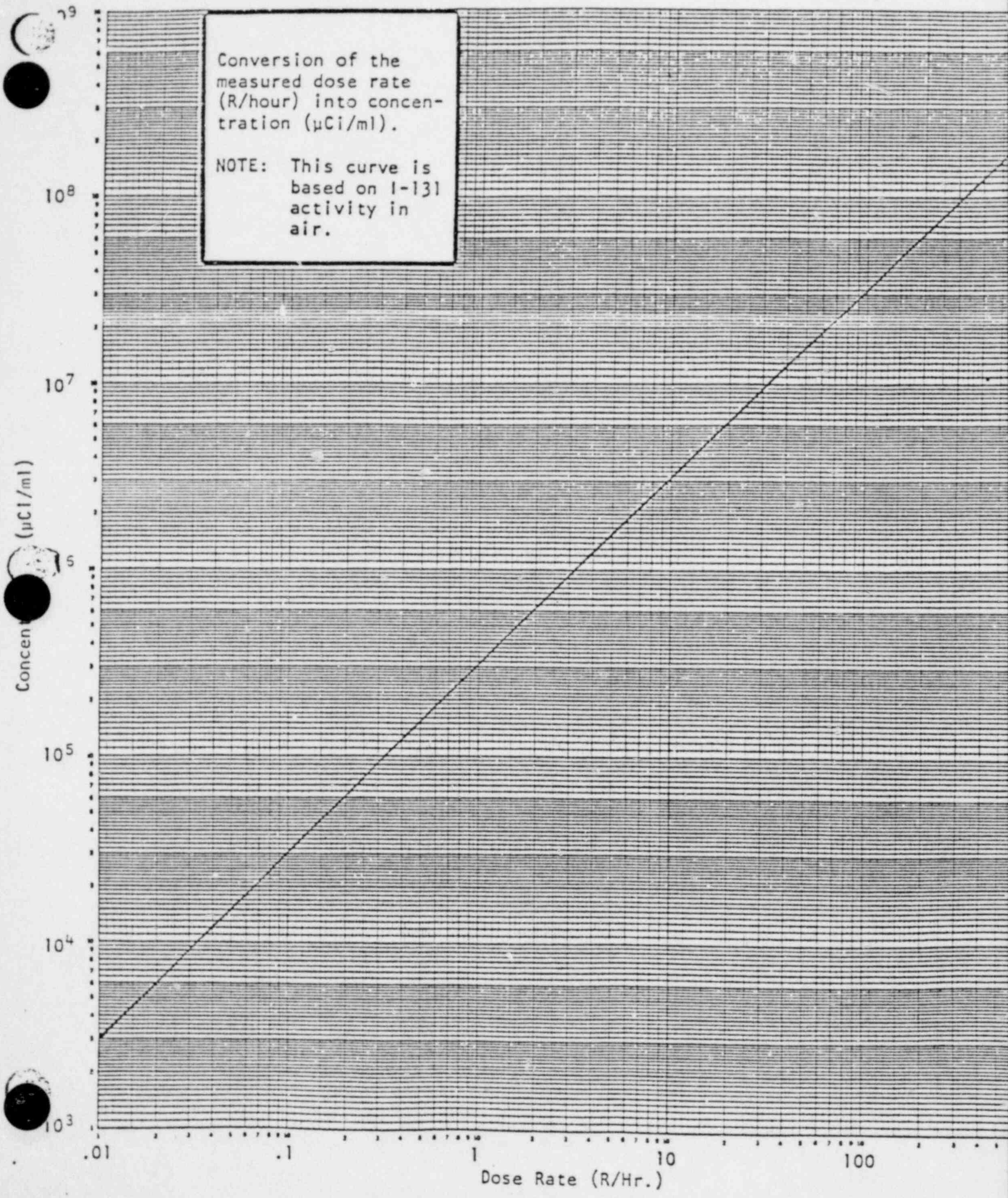
b) Close exhaust valve of gas bomb.

c) Close intake valve of gas bomb.

d) Close supply valve.

e) Close return valve.


Conversion of the measured dose rate (R/hr) into concentration (uCi/ml).
Note: This curve is based on Xe-133 activity in air.
Dose Rate (R/Hr)
10000
1000
100
10


Conversion of the measured dose rate (R/hour) into concentration (µCi/ml).
NOTE: This curve is based on I-131 activity in air.
10^9
10^8
10^7
10^6
10^5
10^4
10^3
Concentration (µCi/ml)
.01
.1
1
10
100
Dose Rate (R/Hr.)

ENCLOSURE 5.5

CONVERSION OF VENT SAMPLE RESULTS
TO VENT ACTIVITY RELEASE RATE

1) Determine vent activity release rate in Ci/sec for iodine, in Ci/sec for noble gases, and in Ci/sec for particulates by the following equation:

$Ci/sec = V_F \times Conc. \times 4.72 \times 10^{-4}$

where,

V_F = Vent flow rate in CFM

Conc. = sample concentration results in Ci/m^3

NOTE: $1\ \mu Ci/ml = 1\ Ci/m^3$

4.72×10^{-4} = conversion of ft^3/min to meters/sec

$$\frac{ft^3}{min} \times \frac{0.02832 m^3}{ft^3} \times \frac{1\ min}{60\ sec}$$

NOTE: Should any other gaseous waste releases be in process, calculate Ci/sec values as above and sum station total Ci/sec of iodine, noble gases, and particulates.

2) Average the calculated vent activity release rates over the period of a calendar quarter to determine Ci/sec/qtr for iodine, Ci/sec/qtr for noble gases, and Ci/sec/qtr for particulates by the following equation:

$$Ci/sec/qtr = Ci/sec \times \frac{\text{duration of release in seconds}}{7.88 \times 10^6}$$

where,

Ci/sec = vent activity release rates calculated in 1).

7.88×10^6 = seconds in a calendar quarter

3) Compare results to the following values:

When rate of gaseous waste release in Ci/sec when averaged over a calendar quarter exceeds:

a) iodine - 2.4×10^{-8} Ci/sec/qtr

noble gas - 3.2×10^{-3} Ci/sec/qtr

particulates - 7.0×10^{-8} Ci/sec/qtr

(Compliance with Tech. Spec. 3.10.1 required.)

b) iodine - 9.6×10^{-8} Ci/sec/qtr

noble gas - 1.28×10^{-2} Ci/sec/qtr

particulates - 2.8×10^{-7} Ci/sec/qtr

(Compliance with Tech. Spec. 3.10.2 required.)

c) iodine - 1.2×10^{-6} Ci/sec/qtr

particulates - 3.5×10^{-6} Ci/sec/qtr

(Compliance with Tech. Spec. 3.10.2 required)

d) noble gas - 8.0×10^{-2} Ci/sec/qtr

(Compliance with Tech. Spec. 3.10.2 required)

4) Should any of the above values be exceeded, notify the emergency coordinator of condition.

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: IP/0/B/1601/3
Change(s) 0 to
1 Incorporated

(2) STATION: Oconee

(3) PROCEDURE TITLE: Environmental Equipment Checks

(4) PREPARED BY: Gene Putnam DATE: 4-6-82

(5) REVIEWED BY: E. E. Holt EW DATE: 4/6/82

Cross-Disciplinary Review By: ______ N/R: EH

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: T. E. Vaughn Date: 4-8-82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

INFORMATION ONLY

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

ENVIRONMENTAL EQUIPMENT CHECKS

1.0 Purpose

1.1 To furnish a procedure for documentation of weekly data collection and equipment functional checks.

2.0 References

2.1 Duke Dwg. 0-714-D, 0-829, 0-829-A

3.0 Test Equipment Required

3.1 Portable psychrometer

4.0 Prerequisites (Sign-offs on Enclosure 11.1)

4.1 This procedure should not be performed during a gaseous waste release period.

4.2 Supervisor has reviewed and initialed all portions of this procedure which are not applicable to the activity being performed. The Supervisor's review is not required if the procedure specifies sections to be omitted.

4.3 Verify that all changes in the Control Copy are incorporated in the Working Copy.

5.0 Limits and Precautions

5.1 Use proper precautions while working with components that have high voltage or high pressure present.

6.0 Unit Status

N/A

7.0 General Description

The environmental equipment monitors the following parameters and records the information on individual chart recorders; wind speed, wind direction, air temperature, humidity, and amount of rainfall.

There are two meteorological monitoring stations for the wind speed and direction. Site #1 is located at the micro-wave tower and Site #2 is located adjacent to the river below Keowee discharge.

8.0 Major Components

	Description	Man. Ref.
8.1	Four Esterline Angus Series "A" Analog Recorders	
8.2	One Leeds and Northrup Speedomax H&W Multipoint Recorder	OM-267-514
8.3	Two Teledyne Geotech Series 40 Wind Speed Modules	OM-333-274
8.4	Two Teledyne Geotech Series 40 Wind Direction Modules	OM-333-275
8.5	Two Teledyne Geotech Series 40 AC Power Supplies	OM-333-276
8.6	One Leeds and Northrup 3-Lead Resistance Temperature Detector (RTD) Air Temperature System	
3.7	One Belfort Instrument Company Hygro-thermograph Recorder	
3.8	One Belfort Instrument Company weighing Rain Gauge Recorder	

9.0 Equipment Specifications

Wind Speed	0-30 mph ± .04 mph (60 and 90 mph selectable ranges)
Wind Direction	0-540 degrees ± 5.7^{o}
Ambient Air Temperature	-15 to 105^{o}F ± 0.7^{o}F
Temperature Differential	-30 to 30^{o}F ± 0.9^{o}F
Rainfall Gauge	0-12 in. ± .03 in. (0-6 in.) ± .06 in. (6-12 in.)

10.0 Procedure Instructions (Sign-offs on Enclosure 11.1)

NOTE: Use Control Room computer clock for all time recordings. Mark on charts all as found calibration points (R_z Found, T_z Found and F.S. Found) before adjustments are made. If adjustments are made, mark all as left calibration points (R_z Left, T_z Left and F.S. Left) on charts.

Perform as found string checks using the following procedure and complete Enclosure 11.3.a and b.

10.1 ONS Site 1

1. Check recorder zero on wind speed and direction recorders by turning translator power off. Rotate charts slowly and individually for good trace. Verify positions on recorders and note time and date. Mark "R_z Found" on each chart beside the trace.

2. Return power on translator and check wind speed and direction Lo Cal. by placing modules in the Lo Cal. position. Rotate charts slowly and individually for good trace. Verify positions on recorders. Mark "T_z Found" on each chart beside the trace.

3. Place the wind direction module in the Hi Cal. position. Rotate chart slowly and verify position on recorder. Mark "F.S. Found" on each chart beside the trace.

4. Place wind speed and direction modules in operate position. Verify normal response on recorders. Insure ink wells are full.

5. Change the charts on recorders. Document start time and date on the charts.

10.2 ONS Site 2

1. Place Control Room switch in the Lo position. Verify Lo Cal. positions on the wind speed and direction recorders. Rotate charts slowly and individually for good trace. Label chart "T_z Found".

2. Place Control Room switch in the Hi position. Verify Hi Cal. positions on the wind speed and direction recorders. Rotate charts slowly and individually for good trace. Label "F.S. Found".

3. Check recorder zero on wind speed and direction recorders by disconnecting field inputs in back of recorders and installing a jumper wire across the terminals. Label chart "R_z Found". Document time and date on charts. Rotate charts individually and slowly for good trace. Verify position on recorders.

4. Remove jumpers and reconnect field inputs to recorders.

5. Place Control Room switch to the operate position. Verify normal response on recorders. Insure ink wells are full.

6. Change charts on recorders. Document starting time and date on charts.

If all string checks are within tolerance, remove and staple together the front approval sheet, list of enclosures, and sign off sheet. Insure all equipment mentioned above is returned to service and continue.

If all string checks are not within tolerance, continue with Section 10.6.

10.3 <u>Air Temperature Recorder</u>

1. Turn off chart recorder. Document time and date on chart.

2. Remove weeks run of chart paper. Replace chart paper as necessary.

3. Restart chart and recorder. Verify proper response. Document time and date on chart.

   NOTE: If there are any problems or you think there may be something wrong with the air temperature system, please note this on the chart from Step 2.

10.4 <u>Hygro-Thermograph Recorder</u>

1. Check the temperature with a thermometer and humidity with a portable psychrometer.

2. Remove old chart from recorder noting time and date on chart.

3. Change the chart on the hygro-thermograph recorder. Document start time and date on chart.

4. Prepare recorder for another week of operation by rewinding clock mechanism, inking the pens, and aligning chart for correct time. Document the temperature and humidity readings from Step 1 on chart.

If the temperature or humidity is found, upon comparison with a thermometer and psychrometer, to be incorrect proceed to Section 10.6 for adjustment procedures.

10.5 <u>Rain Gauge Recorder</u>

1. Open the sliding door and lift the pen from the chart by pulling the pen arm shifter away from the mechanism support column.

2. Next remove the collector and empty the bucket slowly from the platform so that the gauge mechanism will not be subject to any sudden shock as the pen returns to the zero reading.

3. Replace the collector.

4. Lift the chart cylinder and remove old chart noting time and date on chart.

5. Change the chart on the rain guage recorder. Document start time and date on chart.

6. Prepare recorder for another week of operation by rewinding clock mechanism, inking the pen, and aligring chart for correct time.

7. Verify pen on zero point. If not, adjust the zero knob until zero is obtained.

8. Ink the pen, set the chart to correct time. Press the pen arm shifter all the way in and verify pen is making contact with chart.

9. Close sliding door.

10.6 Calibration Procedures

A. Wind System

1. To adjust recorder zero, ensure power supply on translator is off. The zero adjustment arm is located on the inside bottom of recorder under the chart take-up reel. Make adjustments until recorder reads zero. Mark "R_z Left" on chart beside the trace after the final adjustment.

2. To adjust the translator full scale, turn the power supply on and the translator mode switch to the Hi Cal position. Adjust the Hi Cal adjusting screw on front of module to achieve a full scale reading. Mark "F.S. Left" on chart beside the trace after the final adjustments.

3. To adjust the translator zero, turn the mode switch to the Lo Cal position. On the wind direction module adjust the Lo Cal adjusting screw on the front of the module to obtain a zero reading. Mark "T_z Left" on chart beside the trace after the final adjustment.

NOTE: The translator zero for the wind speed module should be performed in a lab since the adjustments necessary must be made internal of the translator and requires a considerable amount of time and accuracy.

If translator zero for wind speed exceeds tolerances contact the E.S.S. (Environmental Services Section).

B. Hygro-Thermograph Recorder

1. If the temperature indication is found to be incorrect an adjustment may be made by turning the thumb screw nearest the front of the case until the thermometer and instrument pen are in agreement.

2. If the humidity is found to be incorrect, wet the hairs by stroking them gently with a camel hair brush wetted with distilled water. Continue this wetting for several minutes until no further rise of the pen can be observed. When a stable position is reached, set the humidity pen to read 92% by adjusting the thumbscrew in the base of the instrument located beside the temperature setting

screw. Do not set the pen to read 100% humidity. No amount of artificial wetting seems to wet the hair to the same extent as actual exposure to saturated air. If after several checks an error is found in humidity indication, the rear adjustment thumbscrew can be used to correct error per psychrometer reading.

10.7 As Left String Checks (Enclosure 11.5a and b)

Perform as left string checks as required due to maintenance action or calibration in Section 10.2 for all strings affected following procedure steps in Section 10.1.

11.0 Enclosures

11.1 Sign-Off Sheet

11.2 Reference Data (None)

11.3 As Found String Checks

11.3.a ONS Site 1

11.3.b ONS Site 2

11.4 Calibration Data Sheets (None)

11.5 As Left String Checks

11.5.a ONS Site 1

11.5.b ONS Site 2

ENCLOSURE 11.1

IP/0/B/1601/03

SIGN-OFF SHEET

Prerequisites

_____4.1

_____4.2

_____4.3

Date Begun ____________________

Date Completed ________________

W.R.# _________________________

Unit # ________________________

Double Verification of Wires Removed and Connected

____,____10.2.1 Wires removed and jumpers installed on input to recorder.

____,_____10.2.2 Jumpers removed and wires replaced string checks.

_____11.3.a _____11.5.a

_____11.3.b _____11.5.b

Performed By ____________________________ ____________________________

____________________________ ____________________________

____
(Tech)
Init. and Date

Notified Instrument Supervisor that a tolerance of 2% was exceeded on the following components:

____
Inst. Supvr.
Init. and Date

An evaluation was made on the above problem(s) and the following corrective action taken:

Remarks: ____

____

____

ENCLOSURE 11.3.a

IP/0/B/1601/03

AS FOUND INTEGRATED STRING

VERIFICATION DATA SHEET

Item Wind, Speed & Direction

Mfg Teledyne Geotech

Type Series 40

Calibration Tolerance W/S ± 0.4 mph; W/D ± 5.0

System Environmental

Span W/S 0-30 mph; W/D 0-540°

Location Upper Meteorlogical Site (ONS Site 1)

Test Equipment Used

Item	SN

Input	Required Reading W/S	AS Found W/S	Required Reading W/D	AS Found W/D
Rz	0		0	
Lo Cal	0.6 ± .1 mph		0	
Hi Cal	N/A	N/A	Full Scale	

Equipment Removed From Service _____, _____

Equipment Returned To Service _____, _____

ENCLOSURE 11.3.b

IP/0/B/1601/03

AS FOUND INTEGRATED STRING

VERIFICATION DATA SHEET

Item Wind, Speed & Direction

Mfg Teledyne Geotech

Type Series 40

Calibration Tolerance W/S ± 0.4 mph; W/D ± 5.0

System Environmental

Span W/S 0-30 mph; W/D 0-540°

Location Lower Meteorlogical Site (ONS Site 2)

Test Equipment Used

Item	SN

Input	Required Reading W/S	AS Found W/S	Required Reading W/D	AS Found W/D
Rz	0		0	
Lo Cal	0.6 ± .1 mph		0	
Hi Cal	N/A	N/A	Full Scale	

Equipment Removed From Service _____,_____

Equipment Returned To Service _____,_____

ENCLOSURE 11.5.b

IP/0/B/1601/03

AS LEFT INTEGRATED STRING

VERIFICATION DATA SHEET

Item Wind, Speed & Direction

Mfg Teledyne Geotech

Type Series 40

Calibration Tolerance W/S ± 0.4 mph; W/D ± 5.0

System Environmental

Span W/S 0-30 mph; W/D 0-540°

Location Lower Meteorlogical Site (ONS Site 2)

Test Equipment Used

Item	SN

Input	Required Reading W/S	AS Found W/S	Required Reading W/D	AS Found W/D
Rz	0		0	
Lo Cal	0.6 ± .1 mph		0	
Hi Cal	N/A	N/A	Full Scale	

Equipment Removed From Service _____, _____

Equipment Returned To Service _____, _____

ENCLOSURE 11.5.a

IP/0/B/1601/03

AS LEFT INTEGRATED STRING

VERIFICATION DATA SHEET

Item Wind, Speed & Direction

Mfg Teledyne Geotech

Type Series 40

Calibration Tolerance W/S ± 0.4 mph; W/D ± 5.0

System Environmental

Span W/S 0-30 mph; W/D 0-540°

Location Upper Meteorlogical Site (ONS Site 1)

Test Equipment Used

Item	SN

Input	Required Reading W/S	AS Found W/S	Required Reading W/D	AS Found W/D
Rz	0		0	
Lo Cal	0.6 ± .1 mph		0	
Hi Cal	N/A	N/A	Full Scale	

Equipment Removed From Service _____,_____

Equipment Returned To Service _____,_____