DUKE POWER COMPANY

OCONEE NUCLEAR STATION

IMPLEMENTING PROCEDURES

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Form SPD-1002-1 INFORMATION ONLY

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: PT/0/B/2000/04
Change(s) 2 to CC2
2 Incorporated
CC2

(2) STATION: Oconee Nuclear Station

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

(4) PREPARED BY: Colena C. Jennings DATE: 8-9-82

(5) REVIEWED BY: Sul W. Baldwin DATE: 9 August 82

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

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: Tony B. Owen Date: 8/9/82

(8) MISCELLANEOUS:

Reviewed/~~Approved~~ By: R. T. Bond Date: 8/9/82

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. 1, 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.

Time/Date
Name

_____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.

_____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	_____	2 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.

____	VAX	____	VAX
____	S&C	____	NRC Res. Insp.
____	D.R. Evaluator	____	B&W
____	Environmental	____	Communicator
____	Dosimetry Records	____	ERP
____	Supp. Functions	____	Administration
____	Performance	____	Clerical Support
		____	Maintenance
____	L&P	____	I&E
____	Chemistry	____	OSC
____	Operations	____	M.M.
____	Tech. Serv.	____	Station Manager
____	Station H.P.	____	Station Manager
____	Red Phone	____	Black Phone
____	Ringdown	____	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 action taken.

____

____

____

_____13.2.4 Lock telephone boxes.

_____13.2.5 Return telephone systems to normal service.

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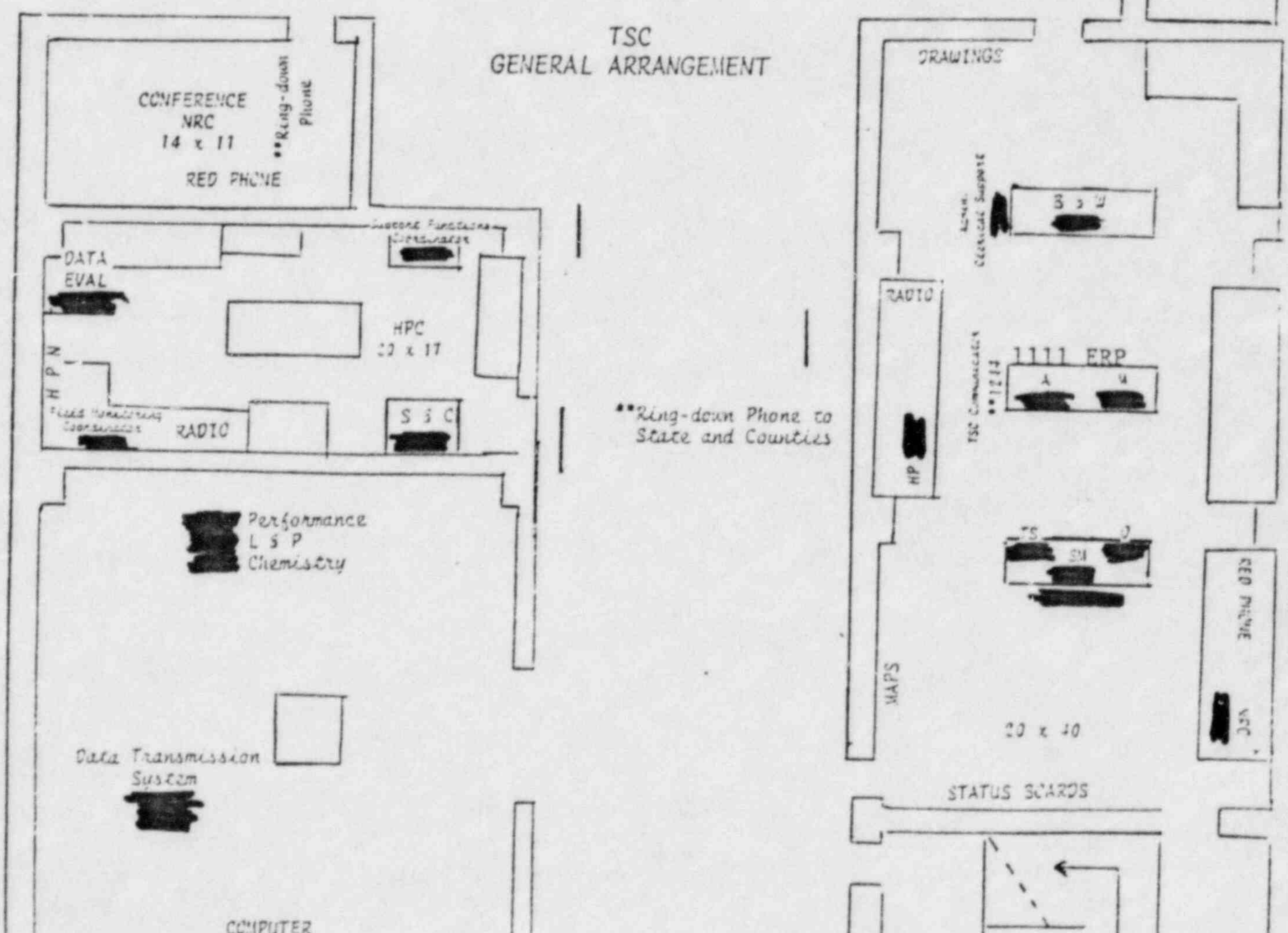
Enclosure 13.3

TECHNICAL SUPPORT CENTER
UNIT 1 & 2 CONTROL ROOM

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)



DUKE POWER COMPANY

EMERGENCY RESPONSE FACILITIES

OCONEE NUCLEAR STATION

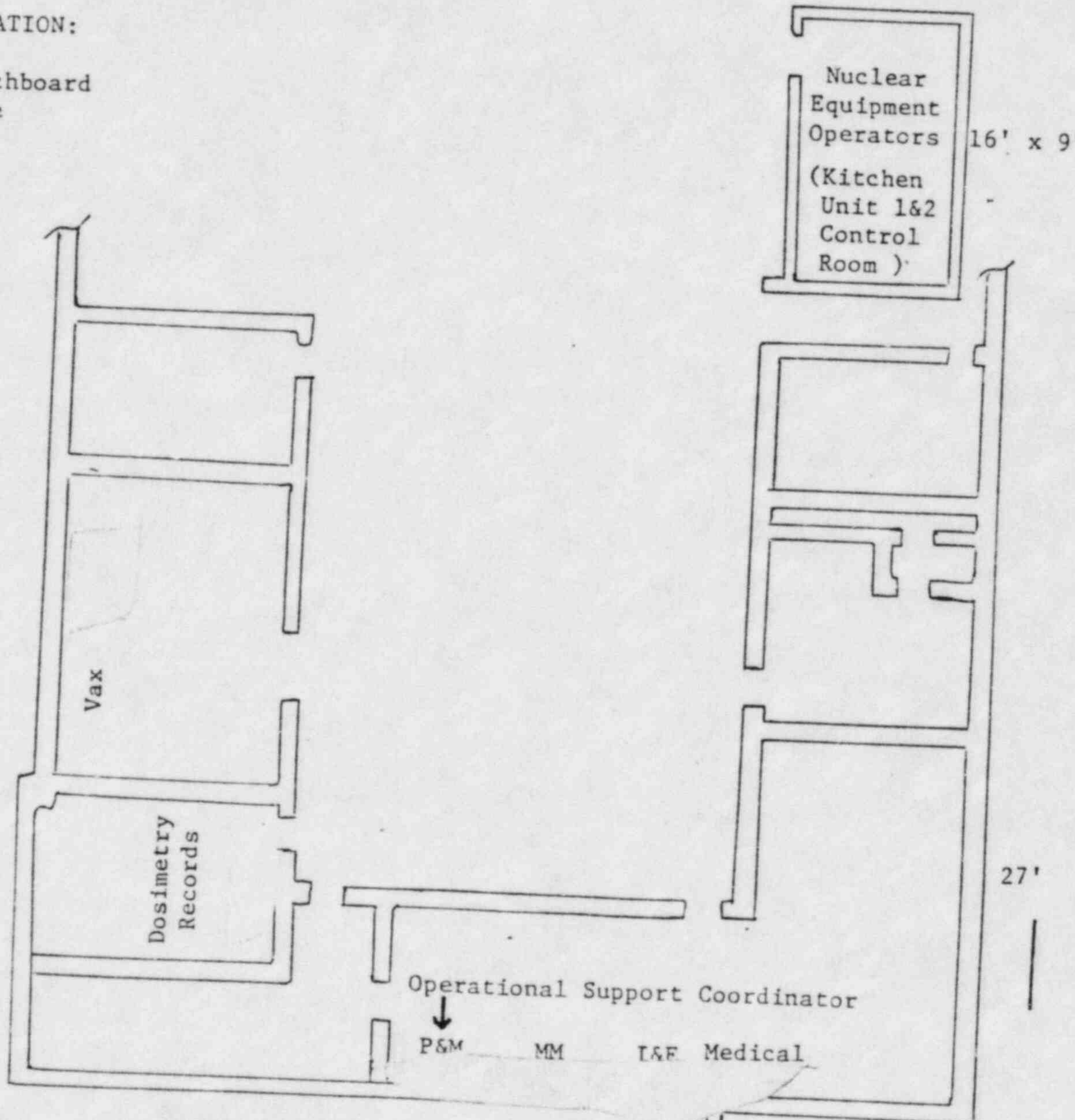
Enclosure 13.4

OPERATIONAL SUPPORT CENTER*

Location: Unit #3 I & E Shop

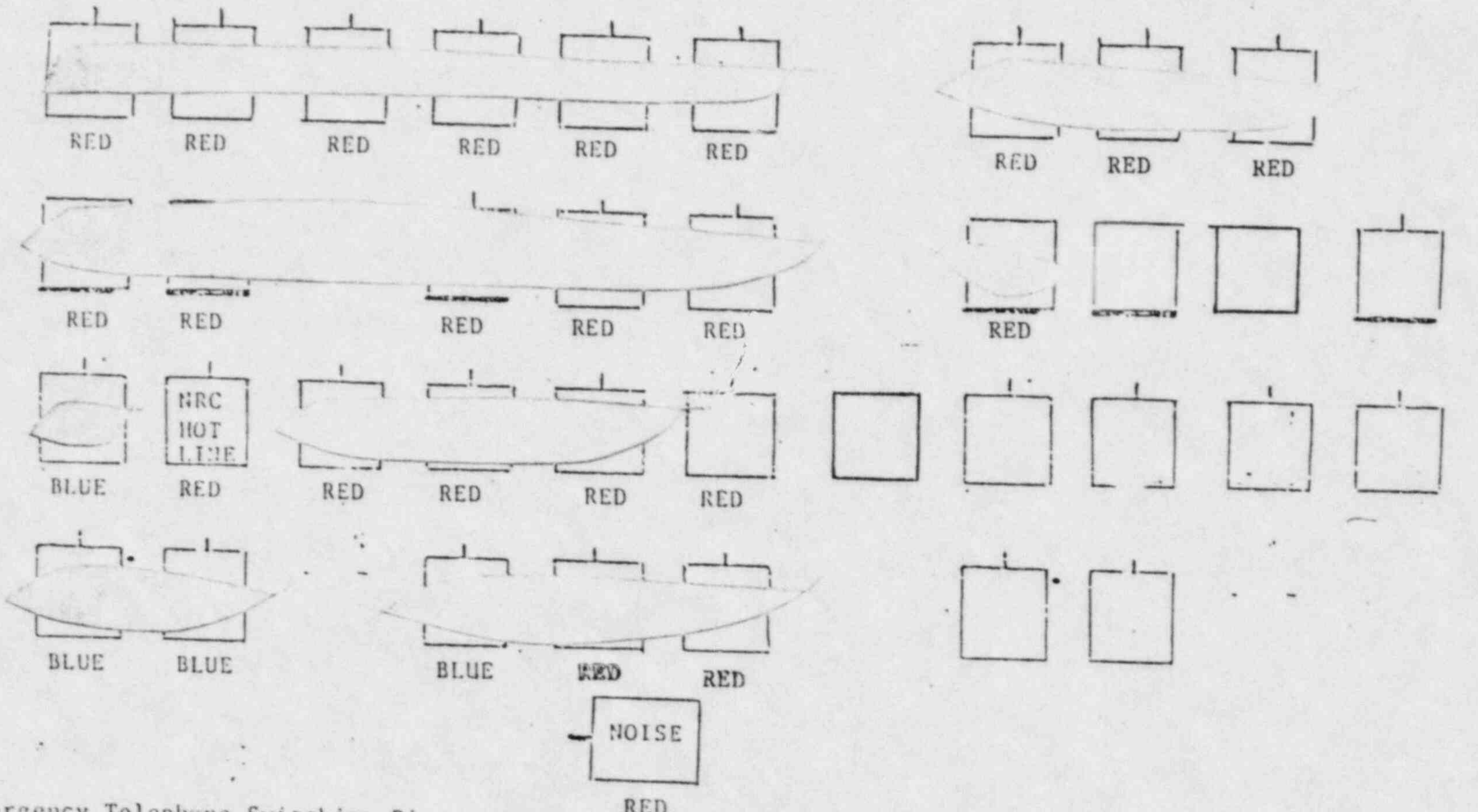
COMMUNICATION:

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.

Revision 4
August, 1982



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 ←.

Revision 4
August, 1982

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

DRAWINGS IN TECHNICAL SUPPORT CENTER
ENCLOSURE 13.7

DRAWING NUMBER	Date/ Name		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

DRAWING NUMBER	Date/ Name		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

INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/1&2/A/2002/05
Change(s) N/A to
N/A Incorporated

(2) STATION: Oconee Nuclear Station

(3) PROCEDURE TITLE: Post Accident Caustic Injection into the Low Pressure Injection System

(4) PREPARED BY: J.C. Fitts DATE: 12/30/80

(5) REVIEWED BY: D.P. Rochester DATE: 1/8/81

Cross-Disciplinary Review By: D.A. Ridgeway N/R: ——

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ____________ (SRO) Date: ____________

By: ____________ Date: ____________

(7) APPROVED BY: Tony B. Owen Date: 1/26/81

(8) MISCELLANEOUS:

Reviewed/Approved By: ____________ Date: ____________

Reviewed/Approved By: ____________ Date: ____________

D.P. Rochester 8/27/82

Tony B. Owen 8/27/82

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

POST ACCIDENT

CAUSTIC INJECTION INTO THE LOW PRESSURE INJECTION SYSTEM

1.0 Discussion

1.1 Purpose

This procedure is to provide instruction for determining the amount and method of caustic addition into the LPI System during a LOCA.

1.2 Principle

Caustic is injected into the LPI System during a LOCA to neutralize the borated water used in the Reactor Building Emergency Spray System to pH 7.0 - 8.0. The neutralization of the boric acid with caustic results in the formation of the salt sodium tetraborate. This reaction of a very weak acid with a strong base is shown below:

$$4H_3BO_3 + 2NaOH \rightarrow Na_2B_4O_7 + 7H_2O$$

The neutralization will inhibit the generation of hydrogen gas and promote a higher partition factor for iodine.

Calculations for the amount of caustic required for neutralization of the borated water are dependent on:

1. An accurate estimation of the volume of borated water being used as the core flooding coolant.

2. The boron concentration of the core flooding coolant.

3. One (1) lb. of caustic neutralizing seventeen (17) lbs. of H_3BO_3 to pH 7.5.

The equivalent weights of (1) lb. of NaOH to (17) lbs. of H_3BO_3 have been calculated from the titration curve as referenced in 5.1.

If complete volumes of the CFT's and the BWST are used, then the maximum amount of caustic required for neutralization of the borated water to pH 7.5 is 2800 pounds. The 2800 pounds has been calculated with the following considerations:

1. That both CFT's and the BWST have a total volume of 403,000 gallons with a boron concentration of 2300 ppm.

2. That the RCS has a volume of 88,000 gallons with a boron concentration of 1000 ppm.

The addition of 2800 pounds of caustic requires approximately 8 hours of actual pumping time. Considering the time required for mixing, injecting, and sampling, the pH should be adjusted to within the 7.0 - 8.0 range within 16 hours.

2.0 Limits and Precautions

2.1 Adequate precaution in handling sodium hydroxide must be taken. Personnel shall wear safety goggles, face shield, pvc gloves, and a protective apron.

2.2 Contact HP before work is begun. Follow all RWP's, SRWP's, and special HP instructions.

2.3 Refer to CP/0/B/2007/01A for action to be taken in the event of a caustic spill.

3.0 Mode of Operation

3.1 Initial Conditions

3.1.1 An emergency is in effect due to a LOCA.

3.1.2 Low Pressure Injection System in operation with the LPI pumps taking suction off the BWST.

3.1.3 Reactor Building Emergency Spray System may or may not be in operation from the BWST through spray headers.

3.1.4 Caustic Injection System aligned in normal position per Enclosure 6.3.

3.2 Conditions for Caustic Addition

3.2.1 Addition of caustic will be made upon authorization from Shift Supervisor.

3.2.2 Addition of caustic shall begin within 30 minutes after switchover to recirculation mode of core cooling. Recirculation mode is in effect when the LPI pumps' suction is isolated from the BWST and is aligned to the emergency sump.

4.0 Procedure

4.1 Take the following action prior to switchover to recirculation of core cooling.

_____4.1.1 Calculate the amount of caustic required for neutralization of the CFT's and the RCS to pH 7.5 by completing No.'s 1, 2 and 3 in Enclosure 6.1.

NOTE: The amount of caustic required for the neutralization of the BWST contents is calculated after switchover to recirculation mode of core cooling in Enclosure 6.1 No.'s 4 and 5.

_____4.1.2 Contact Health Physics for coverage at the Unit 1&2 caustic mix tank, which is located on the second floor of the Auxiliary Building adjacent to the Unit 1 freight elevator door.

_____4.1.3 Obtain the following keys from Health Physics.

1. Corridor Key
2. Freight Elevator Key
3. LPI Door Key: Room No. 118, 119

_____4.1.4 See Enclosure 6.2 for a piping sketch of the Caustic Injection System on Unit 1&2.

_____4.1.5 Check closed position or capped off line on the valves below before mixing caustic.

Valve No.	Valve Name
CA-33	Caustic Mix Tank Sample
LWD-267	Caustic Tank Outlet Drain
CA-36	Caustic Pump Suction Tell Tale
CA-37	Caustic Header to Waste Evap. Feed Tank

_____4.1.6 Fill caustic mix tank with demineralized water to 22.5 inch level (96 gallons) by operating valve DW-120.

_____4.1.7 Start caustic mix tank agitator. The agitator switch is located on the chemical addition control panel adjacent to the caustic mix tank.

_____4.1.8 Add the calculated amount of NaOH as found in 4.1.1 into the mix tank. However, do not exceed 350# NaOH per mix tank. Do not add caustic flakes too rapidly, and allow agitator to operate until all flakes are dissolved.

_____4.1.9 Check open position on the following valves.

Valve No.	Valve Name
CA-103	Caustic Recirc Block
CA-96	Caustic Recirc Block
CA-97	Caustic Recirc Block
CA-34	Caustic Mix Tank Outlet
CA-35	Caustic Pump Suction

4.2 When switchover to recirculation of core cooling has been made, Operations will authorize Chemistry to begin caustic addition.

_____4.2.1 Upon authorization, start caustic pump at maximum flow setting. The caustic pump switch is located on the chemical addition control panel. The maximum pump capacity is approximately 2 gpm.

_____4.2.2 The mix tank is in recirc. Check visually for recirc to insure pump is pumping.

_____4.2.3 Make valve alignment per Enclosure 6.4 to allow Caustic Injection into the LPI on Unit 1, and per Enclosure 6.5 for injection on Unit 2.

_____4.2.4 Pump caustic until the caustic level reaches the bottom of the gauge glass. Turn caustic pump off. Approximately 50 minutes will be required to pump one mix tank.

_____4.2.5 Calculate the amount of caustic required for the neutralization of the borated water added to the core from the BWST by completing Enclosure 6.1 No.'s 4 and 5.

_____4.2.6 Add the above calculated amount of NaOH in several mixes if required. Do not exceed 350# NaOH per mix tank. When approximately 50% of the required amount of caustic has been added, stop caustic pump and allow LPI Core Cooling recirculation time of 1-2 hours.

NOTE: The pump rate of 1 LPI pump is approximately 3500 gpm.

_____4.2.7 Contact Health Physics for coverage while sampling Reactor Building Sump or LPI System. Analyze sample for pH and ppm boron.

_____4.2.8 From results of sample, determine the required amount of NaOH needed to complete the neutralization to 7.0 - 8.0.

_____4.2.9 Repeat the necessary steps for mixing, and inject the final amount of NaOH. Allow LPI core recirculation time of 1-2 hours and sample as in 4.2.7.

_____4.2.10 If pH of sample is above 7.0, then report results to Shift Supervisor.

_____4.2.11 If neutralization to pH 7.0 to 8.0 has not been accomplished, continue NaOH addition.

_____4.2.12 When neutralization has been reached, return the Caustic Injection System to normal position per Enclosure 6.3.

5.0 References

5.1 Quantitative Chemical Analysis, Twelfth Edition, Hamilton and Simpson, p. 146.

5.2 Dwg. No. PO-110A-1 Chemical Addition and Sampling System

5.3 Dwg. No. PO-120A-1, PO-102A-2 Low Pressure Injection and Core Flooding System.

5.4 ONS Technical Specifications 6.4.1.i

6.0 Enclosures

6.1 Enclosure 6.1 - Calculations of the Amount of Caustic Required for Neutralization to pH 7.5

6.2 Enclosure 6.2 - Piping Sketch of Caustic Injection System for Unit 1 and 2

6.3 Enclosure 6.3 - Normal Valve Positions for Unit 1&2 Caustic Injection System

6.4 Enclosure 6.4 - Valve Alignment for Caustic Injection on Unit 1

6.5 Enclosure 6.5 - Valve Alignment for Caustic Injection on Unit 2

ENCLOSURE 6.1
CALCULATIONS OF THE AMOUNT OF CAUSTIC REQUIRED FOR NEUTRALIZATION TO pH 7.5

(1) The 2 CFT's have a total volume of 15,000 gal. Obtain the most recent boron results for the A&B CFT's during normal conditions. Average these concentrations and enter the average into the equation below. Calculate the # (lbs. of) H_3BO_3 in the CFT's:

$$\# \text{ CFT } H_3BO_3 = \frac{(\text{CFT Average Boron Conc., ppm})\ (\text{Volume of CFT's})\ (8.35\ \#/\text{gal})}{(1 \times 10^6)\ (0.175)}$$

$$\# \text{ CFT } H_3BO_3 = \frac{(\_\_\_\_ \text{ ppm})\ (15{,}000 \text{ gal})\ (8.35\ \#/\text{gal})}{(1 \times 10^6)\ (0.175)}$$

$\#$ CFT H_3BO_3 = _____#

(2) The RCS has a volume of 88,000 gal. The latest RCS boron results recorded during normal conditions is __________ ppm. Calculate the # H_3BO_3 in the RCS:

$$\# \text{ RCS } H_3BO_3 = \frac{(\text{RCS Boron Conc., ppm})\ (88{,}000 \text{ gal})\ (8.35\ \#/\text{gal})}{(1 \times 10^6)\ (0.175)}$$

$$\# \text{ RCS } H_3BO_3 = \frac{(\_\_\_\_ \text{ ppm})\ (88{,}000 \text{ gal})\ (8.35\ \#/\text{gal})}{(1 \times 10^6)\ (0.175)}$$

$\#$ RCS H_3BO_3 = ________

(3) Calculate the # NaOH required to adjust the borated water of the CFT's and the RCS to 7.5.

$$\# \text{ NaOH required} = \frac{(1\#\text{ NaOH})\ (\#\text{ CFT } H_3BO_3 + \#\text{ RCS } H_3BO_3)}{(17\#\ H_3BO_3)}$$

$$= \frac{(1\#\text{ NaOH})\ (\_\_\_\_\_\# + \_\_\_\_\_\#)}{17\#\ H_3BO_3}$$

= __________________________#

(4) The BWST has a total volume of 388,000 gal. The latest BWST boron results recorded during normal conditions is ____________ ppm. Obtain from Operations an estimate of the volume of borated water that has been dropped from the BWST: ____________ gal. Calculate the # H_3BO_3 added to the core from the BWST:

ENCLOSURE 6.1

$$\# \text{ BWST } H_3BO_3 = \frac{(\text{BWST Boron Conc., ppm})\ (\text{Amount of Water Added from BWST, gal})\ (8.35\ \#/\text{ gal})}{1 \times 10^6\ (0.175)}$$

$$= \frac{(\_\_\_\_\ \text{ppm})\ (\_\_\_\_\ \text{gal})\ (8.35\ \#/\text{gal})}{1 \times 10^6\ (0.175)}$$

BWST H_3BO_3 = ____________________

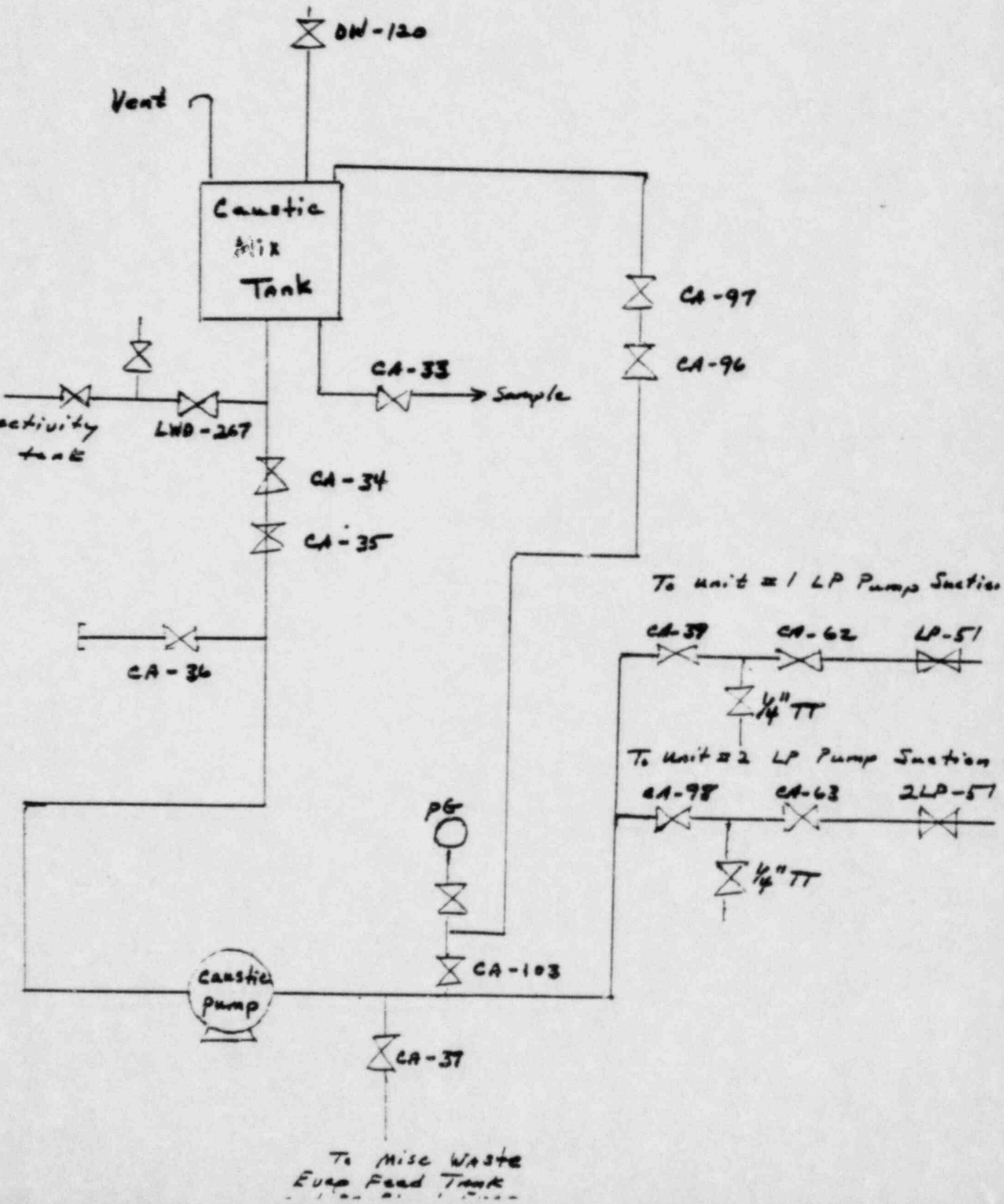
(5) Calculate the # NaOH required to adjust the borated water of the BWST to 7.5.

$$\# \text{ NaOH required} = \frac{(1\#\ \text{NaOH})\ (\_\_\_\ \#\ \text{BWST } H_3BO_3)}{17\#\ H_3BO_3}$$

NaOH required = ________________

ENCLOSURE 6.2

PIPING SKETCH OF CAUSTIC INJECTION
SYSTEM FOR UNIT 1 AND 2



ENCLOSURE 6.3
NORMAL VALVE POSITIONS FOR UNIT 1&2
CAUSTIC INJECTION SYSTEM

			Step 4.2.12	
Valve No.	Valve Name	Normal Position	Initial Date/Time	Verification Date/Time
CA-33	Caustic Mix Tank Sample	Closed		
LWD-267	Caustic Tank Outlet Drain	Closed		
CA-34	Caustic Mix Tank Outlet	Open		
CA-35	Caustic Pump Suction	Open		
CA-36	Caustic Pump Suction Tell Tale	Closed		
CA-37	Caustic Header to Waste Evap. Feed Tank	Closed		
CA-103	Caustic Recirc Block	Open		
CA-96	Caustic Recirc Block	Open		
CA-97	Caustic Recirc Block	Open		
CA-39	Caustic to Unit #1 LP Block	Closed		
CA-62	Caustic to Unit #1 LP Block	Closed		
	¼" Tell Tale between CA-39 & CA-62	Closed		
LP-51	Caustic Addition	Open		
CA-98	Caustic to Unit #2 LP Block	Closed		
CA-63	Caustic to Unit #2 LP Block	Closed		
	¼" Tell Tale between CA-98 & CA-63	Closed		
2LP-51	Caustic Addition	Open		

ENCLOSURE 6.4
VALVE ALIGNMENT FOR CAUSTIC INJECTION ON UNIT 1

Valve No.	Valve Name	Position	Initial
CA-98	Caustic to Unit #2 LP Block	Closed	
CA-63	Caustic to Unit #2 LP Block	Closed	
	¼" Tell Tale between CA-39 & CA-62	Closed	
CA-39	Caustic to Unit #1 LP Block	Open	
CA-62	Caustic to Unit #1 LP Block	Open	
LP-51	Caustic Addition	Open	
CA-103	Caustic Recirc Block	Closed	
CA-97	Caustic Recirc Block	Closed	
CA-96	Caustic Recirc Block	Closed	

ENCLOSURE 6.5
VALVE ALIGNMENT FOR CAUSTIC INJECTION ON UNIT 2

Valve No.	Valve Name	Position	Initial
CA-39	Caustic to Unit #1 LP Block	Closed	
CA-62	Caustic to Unit #1 LP Block	Closed	
	¼" Tell Tale between CA-98 & CA-63	Closed	
CA-98	Caustic to Unit #2 LP Block	Open	
CA-63	Caustic to Unit #2 LP Block	Open	
2LP-51	Caustic Addition	Open	
CA-103	Caustic Recirc Block	Closed	
CA-97	Caustic Recirc Block	Closed	
CA-96	Caustic Recirc Block	Closed	

Form SPD-1002-1

INFORMATION ONLY

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/3/A/2002/05
Change(s) N/A to
N/A Incorporated

(2) STATION: Oconee Nuclear Station

(3) PROCEDURE TITLE: Post Accident Caustic Injection into the Low Pressure Injection System

(4) PREPARED BY: J. L. Fitts DATE: 12/30/80

(5) REVIEWED BY: D. P. Rochester DATE: 1/8/81

Cross-Disciplinary Review By: GAR [illegible] N/R: —

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______________________ (SRO) Date: __________

By: ______________________ Date: __________

(7) APPROVED BY: Tony B. Owen Date: 1/26/81

(8) MISCELLANEOUS:

Reviewed/Approved By: ______________________ Date: __________

Reviewed/Approved By: ______________________ Date: __________

D. P. Rochester 8/27/82

Tony B. Owen 8/27/82

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

POST ACCIDENT

CAUSTIC INJECTION INTO THE LOW

PRESSURE INJECTION SYSTEM

1.0 Discussion

1.1 Purpose

This procedure is to provide instruction for determining the amount and method of caustic addition into the LPI System during a LOCA.

1.2 Principle

Caustic is injected into the LPI System during a LOCA to neutralize the borated water used in the Reactor Building Emergency Spray System to pH 7.0 - 8.0. The neutralization of the boric acid with caustic results in the formation of the salt sodium tetraborate. This reaction of a very weak acid with a strong base is shown below:

$$4H_3BO_3 + 2NaOH \rightarrow Na_2B_4O_7 + 7H_2O$$

The neutralization will inhibit the generation of hydrogen gas and promote a higher partition factor for iodine.

Calculations for the amount of caustic required for neutralization of the borated water are dependent on:

1. An accurate estimation of the volume of borated water being used as the core flooding coolant.
2. The boron concentration of the core flooding coolant.
3. One (1) lb. of caustic neutralizing seventeen (17) lbs. of H_3BO_3 to pH 7.5.

The equivalent weights of (1) lb. of NaOH to (17) lbs. of H_3BO_3 have been calculated from the titration curve as referenced in 5.1.

If complete volumes of the CFT's and the BWST are used, then the maximum amount of caustic required for neutralization of the borated water to pH 7.5 is 2800 pounds. The 2800 pounds has been calculated with the following considerations:

1. That both CFT's and the BWST have a total volume of 403,000 gallons with a boron concentration of 2300 ppm.

2. That the RCS has a volume of 88,000 gallons with a boron concentration of 1000 ppm.

The addition of 2800 pounds of caustic requires approximately 8 hours of actual pumping time. Considering the time required for mixing, injecting, and sampling, the pH should be adjusted to within the 7.0 - 8.0 range within 16 hours.

2.0 Limits and Precautions

2.1 Adequate precaution in handling sodium hydroxide must be taken. Personnel shall wear safety goggles, face shield, pvc gloves, and a protective apron.

2.2 Contact HP before work is begun. Follow all RWP's, SRWP's, and special HP instructions.

2.3 Refer to CP/0/B/2007/01A for action to be taken in the event of a caustic spill.

3.0 Mode of Operation

3.1 Initial Conditions

3.1.1 An emergency is in effect due to a LOCA.

3.1.2 Low Pressure Injection System in operation with the LPI pumps taking suction off the BWST.

3.1.3 Reactor Building Emergency Spray System may or may not be in operation from the BWST through spray headers.

3.1.4 Caustic Injection System aligned in normal position per Enclosure 6.3.

3.2 Conditions for Caustic Addition

3.2.1 Addition of caustic will be made upon authorization from Shift Supervisor.

3.2.2 Addition of caustic shall begin within 30 minutes after switchover to recirculation mode of core cooling. Recirculation mode is in effect when the LPI pumps' suction is isolated from the BWST and is aligned to the emergency sump.

4.0 Procedure

4.1 Take the following action prior to switchover to recirculation of core cooling.

_____4.1.1 Calculate the amount of caustic required for neutralization of the CFT's and the RCS to pH 7.5 by completing No.'s 1, 2 and 3 in Enclosure 6.1.

NOTE: The amount of caustic required for the neutralization of the BWST contents is calculated after switchover to recirculation mode of core cooling in Enclosure 6.1 No.'s 4 and 5.

_____4.1.2 Contact Health Physics for coverage at the Unit 3 caustic mix tank, which is located on the first floor of the Auxiliary Building at the Unit 3 BAMT.

_____4.1.3 Obtain the following keys from Health Physics.

1. Corridor Key
2. Freight Elevator Key
3. 3RIA-36 Key for area on Auxiliary Building second floor where valves 3CA-39, 3CA-58, 3CA-62 and 3LP-51 are located.

_____4.1.4 See Enclosure 6.2 for a piping sketch of the Caustic Injection System on Unit 3.

_____4.1.5 Check <u>closed</u> position or capped off line on the valves below before mixing caustic.

<u>Valve No.</u>	<u>Valve Name</u>
3CA-33	Caustic Mix Tank Sample
3LWD-267	Caustic Tank Outlet Drain
3CA-36	Caustic Pump Suction Tell Tale

_____4.1.6 Fill caustic mix tank with demineralized water to 22.5 inch level (96 gallons) by operating valve 3DW-120.

_____4.1.7 Start caustic mix tank agitator. The agitator switch is located on the chemical addition control panel at the Unit 3 BAMT.

_____4.1.8 Add the calculated amount of NaOH as found in 4.1.1 into the mix tank. However, do not exceed 350# NaOH per mix tank. Do not add caustic flakes too rapidly, and allow agitator to operate until all flakes are dissolved.

_____4.1.9 Check <u>open</u> position on the following valves.

<u>Valve No.</u>	<u>Valve Name</u>
3CA-103	Caustic Recirc Block
3CA-96	Caustic Recirc Block
3CA-97	Caustic Recirc Block
3CA-34	Caustic Mix Tank Outlet
3CA-35	Caustic Pump Suction

4.2 When switchover to recirculation of core cooling has been made, Operations will authorize Chemistry to begin caustic addition.

_____4.2.1 Upon authorization, start caustic pump at maximum flow setting. The caustic pump switch is located on the chemical addition control panel. The maximum pump capacity is approximately 2 gpm.

_____4.2.2 The mix tank is in recirc. Check visually for recirc to insure pump is pumping.

_____4.2.3 Make valve alignment per Enclosure 6.4 to allow Caustic Injection into the LPI on Unit 3.

_____4.2.4 Pump caustic until the caustic level reaches the bottom of the gauge glass. Turn caustic pump off. Approximately 50 minutes will be required to pump one mix tank.

_____4.2.5 Calculate the amount of caustic required for the neutralization of the borated water added to the core from the BWST by completing Enclosure 6.1 No.'s 4 and 5.

_____4.2.6 Add the above calculated amount of NaOH in several mixes if required. Do not exceed 350# NaOH per mix tank. When approximately 50% of the required amount of caustic has been added, stop caustic pump and allow LPI Core Cooling recirculation time of 1-2 hours.

NOTE: The pump rate of 1 LPI pump is approximately 3500 gpm.

_____4.2.7 Contact Health Physics for coverage while sampling Reactor Building Sump or LPI System. Analyze sample for pH and ppm boron.

_____4.2.8 From results of sample, determine the required amount of NaOH needed to complete the neutralization to 7.0 - 8.0.

_____4.2.9 Repeat the necessary steps for mixing, and inject the final amount of NaOH. Allow LPI core recirculation time of 1-2 hours and sample as in 4.2.7.

_____4.2.10 If pH of sample is above 7.0, then report results to Shift Supervisor.

_____4.2.11 If neutralization to pH 7.0 to 8.0 has not been accomplished, continue NaOH addition.

_____4.2.12 When neutralization has been reached, return the Caustic Injection System to normal position per Enclosure 6.3.

5.0 References

5.1 Quantitative Chemical Analysis, Twelfth Edition, Hamilton and Simpson, p. 146.

5.2 Dwg. No. PO-110A-3 Chemical Addition and Sampling System

5.3 Dwg. No. PO-102A-3 Low Pressure Injection and Core Flooding System.

5.4 ONS Technical Specifications 6.4.1.i

6.0 Enclosures

6.1 Enclosure 6.1 - Calculations of the Amount of Caustic Required for Neutralization to pH 7.5

6.2 Enclosure 6.2 - Piping Sketch of Caustic Injection System for Unit 3.

6.3 Enclosure 6.3 - Normal Valve Positions for Unit 3 Caustic Injection System

6.4 Enclosure 6.4 - Valve Alignment for Caustic Injection on Unit 3

ENCLOSURE 6.1
CALCULATIONS OF THE AMOUNT OF CAUSTIC REQUIRED FOR NEUTRALIZATION TO pH 7.5

(1) The 2 CFT's have a total volume of 15,000 gal. Obtain the most recent boron results for the A&B CFT's during normal conditions. Average these concentrations and enter the average into the equation below. Calculate the # (lbs. of) H_3BO_3 in the CFT's:

$$\# \text{ CFT } H_3BO_3 = \frac{(\text{CFT Average Boron Conc., ppm})(\text{Volume of CFT's})(8.35\ \#/\text{gal})}{(1 \times 10^6)(0.175)}$$

$$\# \text{ CFT } H_3BO_3 = \frac{(\_\_\_\_ \text{ ppm})(15{,}000 \text{ gal})(8.35\ \#/\text{gal})}{(1 \times 10^6)(0.175)}$$

$\# \text{ CFT } H_3BO_3 =$ ______ #

(2) The RCS has a volume of 88,000 gal. The latest RCS boron results recorded during normal conditions is __________ ppm. Calculate the # H_3BO_3 in the RCS:

$$\# \text{ RCS } H_3BO_3 = \frac{(\text{RCS Boron Conc., ppm})(88{,}000 \text{ gal})(8.35\ \#/\text{gal})}{(1 \times 10^6)(0.175)}$$

$$\# \text{ RCS } H_3BO_3 = \frac{(\_\_\_\_ \text{ ppm})(88{,}000 \text{ gal})(8.35\ \#/\text{gal})}{(1 \times 10^6)(0.175)}$$

$\# \text{ RCS } H_3BO_3 =$ ________

(3) Calculate the # NaOH required to adjust the borated water of the CFT's and the RCS to 7.5.

$$\# \text{ NaOH required} = \frac{(1\#\text{ NaOH})(\#\text{ CFT } H_3BO_3 + \#\text{ RCS } H_3BO_3)}{(17\#\ H_3BO_3)}$$

$$= \frac{(1\#\text{ NaOH})(\_\_\_\_\#\ +\ \_\_\_\_\#)}{17\#\ H_3BO_3}$$

= ____________________ #

(4) The BWST has a total volume of 388,000 gal. The latest BWST boron results recorded during normal conditions is ____________ ppm. Obtain from Operations an estimate of the volume of borated water that has been dropped from the BWST: ___________ gal. Calculate the # H_3BO_3 added to the core from the BWST:

ENCLOSURE 6.1

$$\# \text{ BWST } H_3BO_3 = \frac{(\text{BWST Boron Conc., ppm})\ (\text{Amount of Water Added from BWST, gal})\ (8.35\ \#/\text{ gal})}{1 \times 10^6\ (0.175)}$$

$$= \frac{(\_\_\_\_\ \text{ppm})\ (\_\_\_\_\ \text{gal})\ (8.35\ \#/\text{gal})}{1 \times 10^6\ (0.175)}$$

BWST H_3BO_3 = ______________________

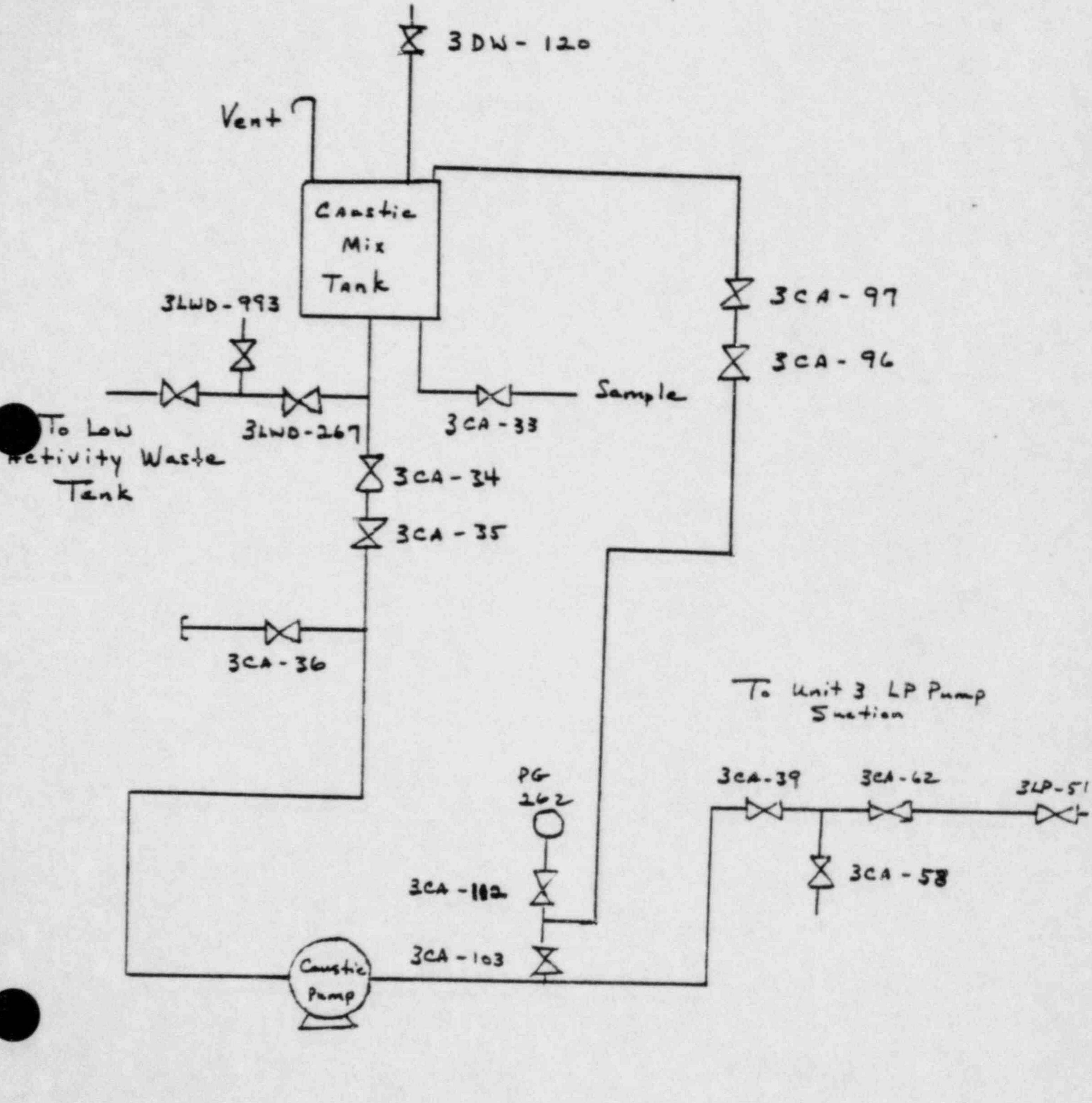
(5) Calculate the # NaOH required to adjust the borated water of the BWST to 7.5.

$$\# \text{ NaOH required} = \frac{(1\#\ \text{NaOH})\ (\_\_\_\#\ \text{BWST } H_3BO_3)}{17\#\ H_3BO_3}$$

NaOH required = __________________

ENCLOSURE 6.2

PIPING SKETCH OF CAUSTIC INJECTION
INJECTION SYSTEM FOR UNIT 3



ENCLOSURE 6.3
NORMAL VALVE POSITIONS FOR UNIT 3
CAUSTIC INJECTION SYSTEM

Step 4.2.12

Valve No.	Valve Name	Normal Position	Initial Date/Time	Verification Date/Time
3CA-33	Caustic Mix Tank Sample	Closed		
3LWD-267	Caustic Tank Outlet Drain	Closed		
3CA-34	Caustic Mix Tank Outlet	Open		
3CA-35	Caustic Pump Suction	Open		
3CA-36	Caustic Pump Suction Tell Tale	Closed		
3CA-103	Caustic Recirc Block	Open		
3CA-96	Caustic Recirc Block	Open		
3CA-97	Caustic Recirc Block	Open		
3CA-39	Caustic to Unit #3 LP Block	Closed		
3CA-62	Caustic to Unit #3 LP Block	Closed		
3CA-58	¼" Tell Tale between 3CA-39 & 3CA-62	Closed		
3LP-51	Caustic Addition	Open		

ENCLOSURE 6.4
VALVE ALIGNMENT FOR CAUSTIC INJECTION ON UNIT 3

Valve No.	Valve Name	Position	Initial
3CA-58	½" Tell Tale between 3CA-39 & 3CA-62	Closed	
3CA-39	Caustic to Unit #3 LP Block	Open	
3CA-62	Caustic to Unit #3 LP Block	Open	
3LP-51	Caustic Addition	Open	
3CA-103	Caustic Recirc Block	Closed	
3CA-97	Caustic Recirc Block	Closed	
3CA-96	Caustic Recirc Block	Closed	

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DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/0/B/2003/02
Change(s) NA to
NA Incorporated

(2) STATION: Oconee Nuclear Station

(3) PROCEDURE TITLE: Estimate of Failed Fuel Based on I-131 Concentration

(4) PREPARED BY: Pat Hall DATE: 8/2/82

(5) REVIEWED BY: D P Roberts DATE: 8/2/82

Cross-Disciplinary Review By: Thomas Porter 8/3/82 N/R: DM

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ____________________ (SRO) Date: ____________________

By: ____________________ Date: ____________________

(7) APPROVED BY: Tony B. Owen Date: 8/3/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ____________________ Date: ____________________

Reviewed/Approved By: ____________________ Date: ____________________

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

ESTIMATE OF FAILED FUEL BASED ON I-131 CONCENTRATION

1.0 Purpose

This procedure describes the method for calculating the number of failed fuel pins and the percent failed fuel for four fuel conditions using the I-131 concentration (in μCi/ml) in the Reactor Coolant System (RCS).

2.0 Limits and Precautions

2.1 The numbers obtained by using this procedure are at best, estimates only.

2.2 All formulas quoted are based upon equilibrium full power core iodine. If fuel damage is suspected to have occurred during times of reduced power or near the time of significant power change, the core I-131 inventory must be adjusted by using Enclosure 10.2. This is the correction factor Y.

2.3 All values given are normalized to volumes of coolant at normal reactor coolant system pressure and temperature. To correct for other RCS system temperatures or RCS sample temperatures, use Enclosure 10.1. This is the correction factor X.

2.4 The decay of Te-131 to I-131 has been neglected as insignificant in this analysis.

2.5 Iodine spiking may occur after a shutdown or significant power change. Data from other nuclear power plants have shown that the iodine spiking process has been observed to occur during a period of 1 to 3 days after the change or shutdown. However, the spike seems to peak during the period from 4 to 8 hours after the change. I-131 concentrations can increase by a factor of 2 to 25 above the equilibrium levels during these times, although an increase over a factor of 10 is unusual and would only be seen at a shutdown. Increases by a factor of 2 to 3 are typical for a significant power decrease (i.e., 100% to 50% power). Do not misinterpret this temporary change for fuel failure if there is no other evidence of fuel damage. Other evidence of fuel damage can be constituted by any indication of inadequate core cooling, loose parts indication, high incore thermocouple indication, etc.

2.6 If estimates for fuel failure are needed for fuel conditions other than those covered by the four cases described below, or if more accurate fuel failure data is needed, see Section 7.0 of this procedure.

2.7 The following four cases cover a very board range of core conditions. Choose the one that best suits the existing conditions.

2.8. Follow up as necessary with Babcock and Wilcox site managers depending on the plant situation.

3.0 Case I - Normal Operation

3.1 Initial Conditions

3.1.1 The conditions which pertain to Case I - Normal operation are as follows:

3.1.1.1 Normal reactor operation at any power or shutdown with no unusual conditions prior to shutdown. Adequate core cooling has been maintained.

3.2 Procedure

3.2.1 If 3.1.1 describes the core conditions, use the following formulas to calculate the range of failed fuel values. Evaluate correction factors X and Y by using Enclosures 10.1 and 10.2.

3.2.1.1
$$\frac{(\text{Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{3.5 \times 10^{-3}\ \mu Ci/ml} =$$

= Number of failed pins (Max. expected and best estimate)

3.2.1.2
$$\frac{(\text{Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{4.9 \times 10^{-3}\ \mu Ci/ml} =$$

= Number of failed pins (Min. expected)

3.2.1.3
$$\frac{(\text{Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{1.8\ \mu Ci/ml} =$$

= Percent failed fuel (Max. expected and best estimate)

3.2.1.4
$$\frac{(\text{Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{2.5\ \mu Ci/ml} =$$

= Percent failed fuel (Min. expected)

NOTE: Values for I-131 concentration in μCi/ml for Oconee at normal operating conditions are between 1.0×10^{-3} and 5.0×10^{-1} μCi/ml.

4.0 Case II - Macroscopic Clad Damage

4.1 Initial Conditions

4.1.1 The conditions which pertain to Case II - Macroscopic clad damage are as follows:

4.1.1.1 Normal reactor operation at any power, or shutdown where some mechanical clad failure (i.e., a loose part monitor indication) or a flow induced failure is suspected. The core has adequate cooling and no significant fuel overtemperature is observed.

4.2 Procedure

4.2.1 If 4.1.1 best describes the core conditions, use the following formulas to calculate the range of failed fuel values. Evaluate correction factors X and Y by using Enclosure 10.1 and 10.2.

4.2.1.1 $\dfrac{\text{(Measured I-131 concentration μCi/ml)(X)(Y)}}{5.5 \times 10^{-2} \text{ μCi/ml}}$ = Number of failed pins (Max. expected)

4.2.1.2 $\dfrac{\text{(Measured I-131 concentration μCi/ml)(X)(Y)}}{16.5 \times 10^{-2} \text{ μCi/ml}}$ = Number of failed pins (Best estimate)

4.2.1.3 $\dfrac{\text{(Measured I-131 concentration μCi/ml)(X)(Y)}}{27.4 \times 10^{-2} \text{ μCi/ml}}$ = Number of failed pins (Min. expected)

4.2.1.4 $\dfrac{\text{(Measured I-131 concentration μCi/ml)(X)(Y)}}{27.9 \text{ μCi/ml}}$ = Percent failed fuel (Max. expected)

4.2.1.5 $\frac{\text{(Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{83.7\ \mu Ci/ml}$ =

= Percent failed fuel (Best estimate)

4.2.1.6 $\frac{\text{(Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{139.5\ \mu Ci/ml}$ =

= Percent failed fuel (Min. expected)

5.0 Case III - Severe Fuel Overtemperature

5.1 Initial Conditions

5.1.1 The conditions which pertain to Case III - Severe Fuel Overtemperature are as follows:

5.1.1.1 TMI type accident where there has been an abnormal shutdown and it is suspected that the fuel has been at least partially uncovered for a period of time greater than a few minutes. Voiding in the core is detected by high incore thermocouple readings and loss of margin to saturation. Fuel clad oxidation is detected by excess hydrogen in the containment or in the reactor coolant sample; however, no fuel melting is suspected.

5.2 Procedure

5.2.1 If 5.1.1 best describes the core conditions, use the following formulas to calculate the range of failed fuel values. Evaluate correction factors X and Y by using Enclosures 10.1 and 10.2.

5.2.1.1 $\frac{\text{(Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{2.4\ \mu Ci/ml}$ =

= Number of failed pins (Max. expected)

5.2.1.2 $\frac{\text{(Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{2.9\ \mu Ci/ml}$ =

= Number of failed pins (Best estimate)

5.2.1.3 $\frac{\text{(Measured I-131 concentration } \mu Ci/ml)(X)(Y)}{3.2\ \mu Ci/ml}$ =

= Number of failed pins (Min. expected)

5.2.1.4 (Measured I-131 concentration μCi/ml)(X)(Y) / 1255 μCi/ml = Percent failed fuel (Max. expected)

5.2.1.5 (Measured I-131 concentration μCi/ml)(X)(Y) / 1535 μCi/ml = Percent failed fuel (Best estimate)

5.2.1.6 (Measured I-131 concentration μCi/ml)(X)(Y) / 1675 μCi/ml = Percent failed fuel (Min. expected)

6.0 Case IV - Fuel Melting

6.1 Initial Conditions

6.1.1 The conditions which pertain to Case IV - Fuel Melting, are as follows:

6.1.1.1 Severe accident where there has been an abnormal shutdown and the core is uncovered for a long period of time. Incore thermocouple temperature readings are above 2300°F for a long period of time. Fuel melting is suspected (i.e., fuel temperature exceeds 5000°F) and is verified by the inability to operate the incore instrumentation system properly.

6.2 Procedure

6.2.1 If 6.1.1 best describes the core conditions, use the following formulas to caluclate the failed fuel values. Evaluate correction factors X and Y by using Enclosures 10.1. and 10.2.

6.2.1.1 (Measured I-131 concentration μCi/ml)(X)(Y) / 5.5 μCi/ml = Number of failed pins (Best estimate)

6.2.1.2 (Measured I-131 concentration μCi/ml)(X)(Y) / 2790 μCi/ml = Percent of failed fuel (Best estimate)

7.0 Case V - Other Fuel Conditions

7.1 If fuel conditions other than those described above exist, or if a more detailed failed fuel estimation is desired for either emergency or normal operation, contact the appropriate B&W Site Managers or the Crisis Management Center for assistance.

8.0 Data Disposition

8.1 When plant conditions dictate that the Technical Support Center (TSC) is not necessary to the Safe Operation of ONS:

8.1.1 Deliver Enclosures 10.4 - 10.7 to the Station Chemist in the Technical Services Building. Deliver a copy to the Primary Chemistry Supervisor.

8.2 When plant conditions, addressed in the Emergency Plan, dictate that the TSC be manned:

8.2.1 Deliver Enclosures 10.4 - 10.7 to the Station Chemist in the TSC. Deliver a copy of Enclosures 10.4 - 10.7 to the Power Chemistry Supervisor in the Operational Support Center (OSC).

9.0 References

9.1 Letter of 4/14/82 from R. Michael Glover to C. C. Jennings, Subject: "Failed Fuel Estimating"

9.2 ONS Emergency Plan, Section II.D

9.3 MNS Administrative Procedure AP/0/A/5500/33

9.4 ONS FSAR

10.0 Enclosures

10.1 Density Correction Factor, (X)

10.2 Core I-131 Inventory Correction Factor, (Y)

10.3 Examples

10.4 Failed Fuel Calculations - Case I

10.5 Failed Fuel Calculations - Case II

10.6 Failed Fuel Calculations - Case III

10.7 Failed Fuel Calculations - Case IV

ENCLOSURE 10.1

DENSITY CORRECTION FACTOR

(X)

Find the appropriate RC System temperature at the time of accident. Find the approximate temperature at which the RC samples are taken. The intersection of both numbers is the density correction factor, X.

NOTE: Normal RC System sample temperature is approximately 90°F. Use this temperature if no other information is available.

RCS Sample Temperature °F

RCS Temperature °F		80	90	100
	100	.996	.998	1
	150	.983	.985	.987
	200	.966	.968	.970
	250	.945	.947	.949
	300	.921	.923	.924
	350	.894	.895	.897
	400	.862	.864	.865
	450	.827	.828	.830
	500	.787	.788	.790
	550	.739	.740	.741
	560	.728	.729	.731
	570	.717	.718	.719
	580	.706	.708	.708
	590	.693	.694	.695
	600	.680	.681	.683

ENCLOSURE 10.2

CORE I-131 INVENTORY CORRECTION FACTOR

(Y)

1C 2.1 Situation 1:

Use the following equation to calculate (Y) at power operation (except 0%) where the power level has not changed more than ± 10% within the last 22 days.

Eq. 10.2.1.1 $Y = \frac{100}{PL}$

Where: Y = the Core I-131 inventory correction factor.

PL = the power level, in %, at the suspected time of fuel failure.

10.2.2 Situation 2:

Use the following equation to calculate (Y) at times other than covered by Situation 1 above.

Eq. 10.2.2.1 $Y = \frac{100}{(PL_i)(e^{-\lambda t}) + (PL_f)(1-e^{-\lambda t})}$

Where: Y = the core I-131 inventory correction factor.

PL_i = the initial power level before the power change.

PL_f = the final power level before/at the suspected time of fuel failure

λ = the decay constant for I-131, 0.084 day^{-1}

$t = t_1 + t_2$

t_1 = the median time, in days, to make the power change from PL_i to PL_f.

t_2 = the time, in days, after the final power level (PL_f) is reached that the fuel failure is suspected to have occurred.

ENCLOSURE 10.3
EXAMPLES

Problem 1

a. Power level has been decreased from 85% to 50%.

b. This power change took four hours and occurred between 1200 and 1600. T_{AVG} at 50% is 570°F.

c. At 1800 a loose part monitor alarm goes off indicating a loose object in the core. The reactor is not tripped.

d. A Chemistry team is immediately dispatched to take a sample RC System as failed fuel is suspected.

e. Chemistry sample indicates I-131 concentration is 10.0 µCi/ml.

Part 1. Determine the best estimate of the number of failed pins.

Part 2. Determine the best estimate of percent failed fuel.

Solution

This is Case II, Section 4.0

Use equation 4.2.1.2 for Part 1

Use equation 4.2.1.5 for Part 2

Part 1.

$$\frac{\text{Measured I-131 concentration } \mu\text{Ci/ml}}{16.5 \times 10^{-2}\ \mu\text{Ci/ml}} (X)(Y) = \text{Number of failed pins}$$

Determine X: Enclosure 10.1

T_{AVG} is 570°F at 50%.
Assume RCS Sample Temperature is 90°F
Therefore, X = .718

Determine Y: Enclosure 10.2

$\lambda_I = .0864\ \text{day}^{-1}$

$t = \frac{(4)}{2} + (2) = 4$ hours

Remember, t is the median time to make a power change plus the difference between the time when the damage is suspected and the time the new power level is reached.

Convert t to days $t = 4\ \text{hours} \times \frac{1\ \text{day}}{24\ \text{hrs.}} = .167$ days

ENCLOSURE 10.3
EXAMPLES

$$Y = \frac{100}{(85)e^{-(.0864\ day^{-1})(.167\ day)} + (50)\ 1-e^{-(.0864\ day^{-1})(.167\ day)}}$$

$$Y = \frac{100}{(85)(.9857) + (50)(.0143)} = 1.183$$

Part 1. $\frac{10\ \mu Ci/ml}{16.5 \times 10^{-2}\ \mu Ci/ml}$ (.718) (1.183) = 51.5 ≅ 52 failed pins <u>Answer</u>

Part 2. $\frac{\text{Measured I-131 Concentration}\ \mu Ci/ml}{83.7\ \mu Ci/ml}$ (X)(Y) = % failed fuel

$\frac{10\ \mu Ci/ml}{83.7\ \mu Ci/ml}$ (.718) (1.183) = 0.1% failed fuel <u>Answer</u>

ENCLOSURE 10.3
EXAMPLES

Problem 2

a. The reactor has just tripped instantly from 100% power due to a malfunctioning instrument. There were no unusual conditions prior to the trip.

b. T_{AVG} is now 557°F at 0% power.

c. The operator, while having no reason to suspect failed fuel, is curious about the amount of failed fuel present now following the trip.

d. A Chemistry team is sent to take an RC sample 12 hours after the trip.

e. The Chemistry sample gives an I-131 concentration of 2.0×10^{-2} μCi/ml. (A typical value for a normally operating plant. See Note under Case I, Section 3.0)

f. Chemistry personnel also indicate that RC sample temperature is 100°F.

Part 1. Determine the maximum expected number of failed fuel pins.

Part 2. Determine the maximum expected percent failed fuel in the core.

Solution

This is Case I, Section 3.0

Use equation 3.2.1.1 for Part 1

Use equation 3.2.1.3 for Part 2

Part 1. $$\frac{\text{Measured I-131 concentration } \mu\text{Ci/ml}}{3.5 \times 10^{-3}\ \mu\text{Ci/ml}} (X)(Y) = \text{Number of failed pins}$$

Determine X: Enclosure 10.1 — RC Temperature is 557°F at 0%
RC sample temperature is 100°F
Therefore, X ≅ .732

ENCLOSURE 10.3
EXAMPLES

Determine Y: Enclosure 10.2

Situation 2: $t = 12 \text{ hours} \times \frac{1 \text{ day}}{24 \text{ hrs.}} = .5 \text{ days}$

$$Y = \frac{100}{(100)\, e^{-(.0864)\,(.5)} + (0)\; 1\text{-}e^{-(.0864)\,(.5)}}$$

$Y = 1.044$

NOTE: If $t = 0$ or a sample was taken immediately, $Y = 1.0$.

Part 1. $\frac{2.0 \times 10^{-2}\ \mu Ci/ml}{3.5 \times 10^{-3}\ \mu Ci/ml}\,(.732)(1.044) = 4.4$

or ≅ 4 to 5 failed pins Answer

Part 2. $\frac{\text{Measured I-131 Concentration } \mu Ci/ml}{1.8\ \mu Ci/ml}\,(X)(Y) = \%$ failed fuel

$\frac{2.0 \times 10^{-2}\ \mu Ci/ml}{1.8\ \mu Ci/ml}\,(.732)\,(1.044) = .0085$ % failed fuel

The above numbers are indicative of normal operation.

Answer

NOTE: I-131 spiking may be a problem here. See Section 2.5.

ENCLOSURE 10.3
EXAMPLES

Problem 3

a. Power level has been between 50% and 65% for the last 30 days and is presently at 60% at 1800.

b. T_{AVG} is ≅ 575°F at 60% power.

c. It is desired to see if any significant failed fuel exists in the core even though no abnormal occurrences have taken place.

d. At 2200 the same day, a Chemistry sample is taken of the RC system.

e. The Chemistry sample indicates I-131 concentration is 3.9×10^{-2} μCi/ml.

Part 1. Determine the best estimate of the number of failed pins.

Part 2. Determine the best estimate of the % failed fuel.

Solution

This is Case I, Section 3.0

Use equation 3.2.1.1 for Part 1

Use equation 3.2.1.3 for Part 2

Part 1. $$\frac{\text{Measured I-131 concentration } \mu\text{Ci/ml}}{3.5 \times 10^{-3}\ \mu\text{Ci/ml}}\ (X)(Y) = \text{Number of failed pins}$$

Determine X: Enclosure 10.1

T_{AVG} is 575°F at 60% power
Assure RCS sample temp. of 90°F
Therefore, X ≅ .713

Determine Y: Enclosure 10.2

Situation I

$$Y = \frac{100}{60} = 1.67$$

ENCLOSURE 10.3
EXAMPLES

Part 1. $\frac{3.9 \times 10^{-2}\ \mu Ci/ml}{3.5 \times 10^{-3}\ \mu Ci/ml}$ (.713)(1.67) = 13.27

≅ 14 failed pins <u>Answer</u>

Part 2. $\frac{\text{Measured I-131 Concentration } \mu Ci/ml}{1.8\ \mu Ci/ml}$ (X)(Y) = % failed fuel

$\frac{3.9 \times 10^{-2}\ \mu Ci/ml}{1.8\ \mu Ci/ml}$ (.713)(1.67) = .026% failed fuel <u>Answer</u>

The above numbers are acceptable for a normally operating plant.

ENCLOSURE 10.3
EXAMPLES

Problem 4

a. The unit has been at 97% power for a month when a depressurization of the RC system occurs.

b. The reactor trips.

c. Heavy vibration is observed in the RC pumps.

d. Thermocouple temperatures over 1000°F are indicated in the core.

e. RIA-36 has alarmed.

f. High Pressure Injection was delayed and it is suspected the core was uncovered between 30 and 60 minutes before sufficient reactor vessel water level was regained.

g. The incore instrumentation system is still operable.

h. The RC sample indicates an I-131 concentration of 3800 μCi/ml.

i. A Chemistry sample is taken immediately (within the hour) after the trip.

Part 1. Determine the maximum expected number of failed pins.

Part 2. Determine the maximum expected % of failed fuel.

Solution

This is Case III, Section 5.0

Use equation 5.2.1.1 for Part 1

Use equation 5.2.1.4 for Part 2

Determine X: Enclosure 10.1

RC Temp. T_{AVG} at 0% power is 557°F
Assume sample temperature of 90°F
Therefore, $X \cong .730$

Determine Y: Enclosure 10.2

$$Y = \frac{100}{97} = 1.03$$

ENCLOSURE 10.3
EXAMPLES

Part 1. $\frac{3800\ \mu Ci/ml}{2.4\ \mu Ci/ml}$ (.730)(1.03) = 1190.5

≅ 1191 number failed pins, max. expected <u>Answer</u>

Part 2. $\frac{3800\ \mu Ci/ml}{1255\ \mu Ci/ml}$ (.730)(1.03) = 2.28% failed fuel, max. expected <u>Answer</u>

ENCLOSURE 10.4

FAILED FUEL CALCULATIONS

CASE I

UNIT ________ DATE/TIME__________ BY________________

X = __________ Y = __________ I-131 _____________µCi/ml

Maximum Number of Failed Fuel Pins (Best Estimate):

$\frac{\quad}{3.5\ E-3}$ ( ) ( ) =

Minimum Number of Failed Fuel Pins:

$\frac{\quad}{4.9\ E-3}$ ( ) ( ) =

Maximum % Failed Fuel (Best Estimate):

$\frac{\quad}{1.8}$ ( ) ( ) = %

Minimum % Failed Fuel:

$\frac{\quad}{2.5}$ ( ) ( ) = %

COMMENTS:

Reviewed By______________

ENCLOSURE 10.5

FAILED FUEL CALCULATIONS

CASE II

UNIT__________ DATE/TIME__________ BY________________

X = __________ Y = __________ I-131 __________ __μCi/ml

Maximum Number of Failed Fuel Pins:

$\frac{\_\_\_\_\_\_}{5.5\ E\text{-}2}$ ( ) ( ) =

Best Estimate of Failed Fuel Pins:

$\frac{\_\_\_\_\_\_}{1.65\ E\text{-}1}$ ( ) ( ) =

Minimum Number of Failed Fuel Pins:

$\frac{\_\_\_\_\_\_}{2.74\ E\text{-}1}$ ( ) ( ) =

Maximum % Failed Fuel:

$\frac{\_\_\_\_\_\_}{27.9}$ ( ) ( ) = %

Best Estimate Failed Fuel:

$\frac{\_\_\_\_\_\_}{83.7}$ ( ) ( ) = %

Minimum % Failed Fuel:

$\frac{\_\_\_\_\_\_}{139.5}$ ( ) ( ) = %

COMMENTS:

Reviewed By ____________

ENCLOSURE 10.6

FAILED FUEL CALCULATIONS

CASE III

UNIT__________ DATE/TIME__________ BY________________

X = __________ Y = __________ I-131 ____________µCi/ml

Maximum Number of Failed Fuel Pins:

$\frac{\quad}{2.4}$ ( ) ( ) =

Best Estimate of Failed Fuel Pins:

$\frac{\quad}{2.9}$ ( ) ( ) =

Minimum Number of Failed Fuel Pins:

$\frac{\quad}{3.2}$ ( ) ( ) =

Maximum % Failed Fuel:

$\frac{\quad}{1255}$ ( ) ( ) = %

Best Estimate Failed Fuel:

$\frac{\quad}{1535}$ ( ) ( ) = %

Minimum % Failed Fuel:

$\frac{\quad}{1675}$ ( ) ( ) = %

COMMENTS:

Reviewed By______________

ENCLOSURE 10.7

FAILED FUEL CALCULATIONS

CASE IV

UNIT__________ DATE/TIME__________ BY________________

X = __________ Y = __________ I-131 ____________μCi/ml

Best Estimate of Failed Fuel Pins:

$\frac{\quad}{5.5}$ ( ) ( ) =

Best Estimate of % Failed Fuel:

$\frac{\quad}{2790}$ ( ) ( ) = %

COMMENTS:

Reviewed By__________

Form SPD-1002-1 ~~CONTROL COPY~~ INFORMATION ONLY

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/0/B/4003/02
Change(s) n/a to
____ Incorporated

(2) STATION: Oconee

(3) PROCEDURE TITLE: The Determination of Plume Direction and Sector(s) to be Monitored Following a Large Unplanned Release of Gaseous Radioactivity

(4) PREPARED BY: Milo R. Killough DATE: 04-29-82

(5) REVIEWED BY: Jimmy J. Sevic DATE: 4/29/82

Cross-Disciplinary Review By: ____ N/R: JS.

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ____ (SRO) Date: ____

By: ____ Date: ____

(7) APPROVED BY: Tony B. Owen Date: 5/3/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ____ Date: ____

Reviewed/Approved By: ____ Date: ____

REVIEWED TO ASSURE ADEQUACY
BY MRK DATE 5-13-82

This working copy has been compared with the control copy and is appropriate by MRK Date 8-18-82

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

THE DETERMINATION OF PLUME DIRECTION AND SECTOR(S)

TO BE MONITORED FOLLOWING A LARGE UNPLANNED RELEASE

OF GASEOUS RADIOACTIVITY

1.0 Discussion

1.1 Scope - This procedure covers the methodologies and techniques used in determining the direction of a plume and the sector(s) to be monitored by the Field Monitoring Teams in the event of an accidental release of radioactive gases from ONS.

1.2 Principle - The determination of plume direction and, therefore, the sector(s) to be monitored shall be based on site specific meteorological conditions. The Unit 1 Control Room operator(s) shall provide meteorlogical data (wind speed and direction, temperatures and vertical temperature gradient obtained from the primary meteorological tower (46 m) and wind direction from the river tower located near the S.C. Highway 183 bridge). Plume evaluation nomographs have been prepared using the various combinations in which these meteorological variables might occur. The applicable nomograph(s) shall be selected and placed on the 10 mile radius map. The area bounded by the overlay then becomes the sector(s) to be monitored in accordance with Procedure No. CP/0/B/4003/01.

1.3 Limits and Precautions

1.3.1. The Control Room shall provide meteorological condition updates every 15 minutes once the Technical Support Center has been activated.

1.3.2 In the event site meteorological data is not available, the following meteorological data shall be obtained from the National Weather Service at the Greenville-Spartanburg Airport:

1.3.2.1 Wind speed in mph (mph = knots x 1.15)

1.3.2.2 Direction from which wind is blowing in degrees.

1.3.3 The plume evaluation nomographs (overlays) shall be kept in the Field Monitoring Coordinators emergency kit situated in the Environmental Lab, Administration Building Annex.

2.0 Procedure

2.1 Obtain and record on Enclosure 4.1 the following meteorological data from the Unit 1 Control Room (vertical board panel displaying weather information located at the northeast corner of the Control Room):

2.1.1 Δt in ^{o}F (difference in temperature between the top of the tower and the bottom).

NOTE: The Δt can be positive or negative.

2.1.2 Wind speed in mph (Primary Tower)

2.1.3 Direction from which the wind is blowing in degrees, 0 to 360° (Primary Tower)

2.1.4 Direction from which the wind is blowing in degrees, 0 to 360° (River Tower)

2.2 Select the correct plume evaluation nomograph using the above meteorological data and the following guidelines:

2.2.1 If the time of day is between 1600 and 1000 and the primary tower wind speed is less than 15 mph and the primary tower Δt is positive, select nomograph "A".

2.2.2 For all other meteorological conditions select one of five other nomographs using the following combinations of parameters:

For a Δt Of	And Wind Speed Of	Select Nomograph
-25.0 to -1.3°F	0 to 50 mph	"B"
-1.2° to -1.0°F	0 to 50 mph	"C"
-0.9° to -0.4°F	0 to 50 mph	"D"
-0.3° to +10.0°F	0 to 6 mph	"E"
-0.3° to +10.0°F	7 to 50 mph	"F"

2.2.3 If National Weather Service meteorological data is used select one of three nomographs based on the following:

For Time of Day	And Wind Speed of	Select Nomograph
1000 to 1600	0 to 50 mph	"D"
1600 to 1000	> 15 mph	"F"
1600 to 1000	≤ 15 mph	"A"

2.2.4 Record the nomograph selected on Enclosure 4.1.

2.3 Determine the direction of the plume in the following manner:

2.3.1 If plume evaluation nomograph "B", "C", "D", "E" or "F" was selected in Section 2.2, place the nomograph on the 10 mile radius map with the end of the arrow on the station (center of map) and the top pointing in the opposite direction from which the primary tower wind is blowing.

2.3.2 If plume evaluation nomograph "A" was selected in Section 2.2, the "A" nomograph should be placed on the 10 mile radius map as follows:

NOTE: If National Weather Service meteorological data is used and nomograph "A" was selected, use the same assumption as in Step 2.3.2.3.

2.3.2.1 If the river wind direction from Step 2.1.4 is between 100° and 190° and the river wind direction differs from the primary tower wind direction by more than 45°, place nomograph "A" on the map with the arrow pointing in the direction of 350° and then place a second nomograph "A" on the map with the arrow pointing opposite the primary tower wind direction.

2.3.2.2 If the river wind direction from Step 2.1.4 is between 100° and 190° and the primary tower wind direction is not different from the river wind direction by more than 45°, place one nomograph "A" on the map with the arrow pointing in the direction of 180° and then place a second nomograph "A" on the map with the arrow pointing opposite the primary tower wind direction.

2.3.2.3 If the river wind direction is not between 100° and 190° but the primary tower wind direction differs from the river wind direction by more than 45°, the plume direction can not be determined and all directions are considered to be affected. Place the "A" nomograph on the map with the arrow pointing in the 0° direction but assume that all directions are affected and dispatch Field Monitoring Teams to monitor in all directions.

2.3.2.4 If the river wind direction is not between 100° and 190° and the primary tower wind direction does not differ from the river wind direction by more than 45°, place nomograph "A" on the map with the arrow pointing opposite the primary tower wind direction.

2.4 Determine the sector(s) and predesignated sampling locations to be monitored.

2.4.1 Once the appropriate nomograph has been placed over the 10 mile radius map, dispatch Field Monitoring Teams to locate and monitor the plume within the bounds of the nomograph and in accordance with Procedure No. CP/0/B/4003/01.

2.4.2 The dashed lines on the plume evaluation nomographs show the appropriate plume width. The solid lines encompass the area likely to bracket the plume centerline. The areas possibly affected by the plume include the area inside the solid lines ± 1/2 of the plume width (as indicated by the dashed lines).

NOTE: If nomograph "A" is selected, assume the affected area or the area to be monitored is ± 90° from the nomograph centerline or ± 4 sectors.

2.5 Reassess nomograph selection every hour and/or whenever there is a 22.5° shift in wind direction.

3.0 References

3.1 Procedure for Environmental Surveillance Following a Large Unplanned Release of Gaseous Radioactivity (CP/0/B/4003/01)

4.0 Enclosures

4.1 Meteorological Data

ENCLOSURE 4.1

METEOROLOGICAL DATA

Primary Tower (46m)

1. Time of Day _____
2. Δt _____ ^{o}F (temp. gradient between top of tower and bottom)
3. Tower Wind Speed _____ mph
4. Direction From Which Wind is Blowing _____ Degrees

River Tower

1. Time of Day _____
2. Direction From Which Wind is Blowing _____ Degrees

National Weather Service*

1. Time of Day _____
2. Direction From Which Wind is Blowing _____ Degrees

*National Weather Service/Greenville/Spartanburg Airport

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Form 34731 (10-81)
(Formerly SPD-1002-1)

INFORMATION ONLY

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: HP/0/B/1009/12
Change(s) 2 to
N/A Incorporated

(2) STATION: Oconee

(3) PROCEDURE TITLE: Distribution of Potassium Iodide Tablets in the Event of a Radioiodine Release

(4) PREPARED BY: E. D. Hzight DATE: 8/11/82

(5) REVIEWED BY: Charlie Yongue DATE: 8-12-82

Cross-Disciplinary Review By: N/R: cy

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: Tony B. Owen Date: 8/13/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

DISTRIBUTION OF POTASSIUM IODIDE TABLETS

IN THE EVENT OF A RADIOIODINE RELEASE

1.0 Purpose

This procedure provides information necessary to distribute Active Potassium Iodide (KI) tablets to inplant personnel in the event of a release of radioiodine. Also, it outlines storage and supply information to assure sufficient quality and quantity of thyroid blocking material.

2.0 References

2.1 NCRP Report No. 55; Protection of the Thyroid Gland in the Event of Releases of Radioiodine 1977

2.2 NCRP Report No. 65; Management of Persons Accidentally Contaminated with Radioiodine 1980

2.3 Body Burden Analysis procedure

2.4 System Health Physics Manual

2.5 NUREG 0654

3.0 Limits and Precautions

3.1 Persons who are allergic to KI must not receive these tablets.

3.2 Nursing mothers who receive KI tablets must be advised to use nutrient substitutes (ex: milk or a formula) for children for the duration of the ten-day tablet use period.

3.3 Personnel must be advised not to deviate from prescribed dosages and dosage rates.

3.4 Best results will be achieved when KI tablets are administered immediately (within 2 hours) after an exposure, although administration as late as 24 hours after an emergency will be of (limited) value.

3.5 Do not distribute discolored, disfigured tablets, or tablets that have reached their expiration date. Such tablets shall be discarded.

3.6 Hands of personnel must be free from contamination prior to taking KI tablets.

4.0 Procedure

4.1 Responsibilities for Distribution

4.1.1 Persons suspected of having been in the affected area prior to detection and during the release, persons present in the affected area, and persons who will enter the area while a significant amount of radioiodine is present will be instructed by the Station Health Physicist to immediately register in the KI distribution center (for example, the Technical Support Center (TSC) for each unit).

NOTE: A significant amount of radioiodine in this case is that amount taken into the body that would result in a quarterly permissible occupational dose, or more. For example, exposure to 4.6 x 10^{-6} mCi/ml airborne iodine for one hour would result in such an exposure. This corresponds to 520 MPC-hrs which is the quarterly limit.

4.2 Registration of persons exposed to a significant amount of radioiodine

4.2.1 When persons notified by Health Physics arrive at the distribution area, record appropriate data per Enclosure 5.1.

4.2.2 The Station Health Physicist or his designee should give one (1) tablet to each affected person and instructions concerning the use of the tablet. Then issue to each affected person one bottle containing nine (9) KI tablets, and the package insert for the use of the tablets (refer to Enclosure 5.2 for an example of the package insert).

4.2.2.1 Tablets are to be taken only as directed. One (1) tablet per day for ten (10) days is the recommended dosage.

4.2.2.2 After the initial dose of KI, subsequent doses will be taken on a daily basis. Tablets should be taken as near a 24-hour schedule as possible.

NOTE: For best results, emphasis must be placed upon the proper use of these tablets.

4.2.3 Tablets removed from full bottles of KI should be stored in 10 ml plastic vials. The expiration date on the bottle from which the tablets were taken or from the expiration date extension letter and the name of the Health Physics

representative must be recorded on the 10 ml vials. Tablets stored in 10 ml plastic vials should then be used for the single tablet initial issuance of KI to affected persons.

4.3 Thyroid Burden Analysis Following Radioiodine Exposure

4.3.1 All personnel receiving KI tablets should receive a thyroid scan. If the number of people render this step impractical, the Count Room Supervisor should draw a representative sample of persons listed on Enclosure 5.1 who received KI tablets.

NOTE: Subsequent action involving thyroid burden analysis should follow guidelines established in the System Health Physics Manual.

4.3.2 Records of thyroid scan should be maintained per procedure.

NOTE: Thyroid scans immediately after an accident could lengthen KI distribution time and cause confusion among personnel. Distribute KI before analyzing thyroid concentration.

4.4 Storage Requirements

4.4.1 There are three major storage requirements to be observed:

4.4.1.1 Store in a temperature range of 59 to 86 degrees F.

4.4.1.2 Store in a low humidity area (avoid direct exposure to liquids).

4.4.1.3 Store in an area protected from exposure to light.

NOTE: Supplies of KI tablets are maintained in the TSC emergency cabinet and the emergency kits for field monitoring teams. The supplies are inventoried as per PT/0/B/2000/04 and CP/0/B/4003/06.

4.4.2 Upon receiving a shipment of KI, boxes should be opened as soon as possible and bottles examined to ensure that an airtight seal has been maintained. Bottles must be returned to boxes, and boxes must be sealed shut, so as to avoid exposure to light.

4.4.3 To ensure a sufficient supply of tablets, a minimum of 50 bottles with 14 tablets per bottle should be maintained on-site.

4.5 Shelf Life and Changeout of KI Tablets

4.5.1 Thryo Block™ tablet bottles are labelled with an expiration date from the factory. As tablets reach the expiration dates, the tablets must be discarded.

NOTE: The expiration date listed on the bottle may have been extended. Documentation of an extension should be placed with the supply of KI tablets.

4.5.2 Order replacement tablets at least three (3) months prior to the date of expiration listed on the bottles of KI.

4.5.3 Upon receiving a shipment of KI tablets, supplies should be shifted so as to use older tablets before new tablets.

4.5.4 After the radioiodine emergency, tablets in the 10 ml plastic vials must be discarded.

5.0 Enclosures

5.1 Potassium Iodide Tablet Distribution Data Sheet

5.2 Package Insert for Thyro-Block™ Tablets and Solution

ENCLOSURE 5.1

POTASSIUM IODIDE TABLET DISTRIBUTION DATA SHEET

HP BADGE NUMBER	NAME	DEPARTMENT	DATE & TIME OF SUSPECTED EXPOSURE	DATE & TIME OF INITIAL ISSUANCE

Package Insert for Thyro-Block™ Tablets and Solution

Patient Package Insert For

THYRO-BLOCK™

(POTASSIUM IODIDE)
(pronounced poe-TASS-e-um EYE-oh-dyed)
(abbreviated KI)
TABLETS and SOLUTION U.S.P.

IF YOU ARE TOLD TO TAKE THIS MEDICINE, TAKE IT ONE TIME EVERY 24 HOURS. DO NOT TAKE IT MORE OFTEN. MORE WILL NOT HELP YOU AND MAY INCREASE THE RISK OF SIDE EFFECTS. *DO NOT TAKE THIS DRUG IF YOU KNOW YOU ARE ALLERGIC TO IODIDE.* (SEE SIDE EFFECTS BELOW.)

INDICATIONS

THYROID BLOCKING IN A RADIATION EMERGENCY ONLY.

DIRECTIONS FOR USE

Use only as directed by State or local public health authorities in the event of a radiation emergency.

DOSE

Tablets: ADULTS AND CHILDREN 1 YEAR OF AGE OR OLDER: One (1) tablet once a day. Crush for small children.
BABIES UNDER 1 YEAR OF AGE: One-half (1/2) tablet once a day. Crush first.

Solution: ADULTS AND CHILDREN 1 YEAR OF AGE OR OLDER: Add 6 drops to one-half glass of liquid and drink each day.
BABIES UNDER 1 YEAR OF AGE: Add 3 drops to a small amount of liquid once a day.

For all dosage forms: Take for 10 days unless directed otherwise by State or local public health authorities.

Store at controlled room temperature between 15° and 30°C (59° to 86°F). Keep container tightly closed and protect from light. Do not use the solution if it appears brownish in the nozzle of the bottle.

WARNING

Potassium iodide should not be used by people allergic to iodide. Keep out of the reach of children. In case of overdose or allergic reaction, contact a physician or the public health authority.

DESCRIPTION

Each THYRO-BLOCK™ TABLET contains 130 mg of potassium iodide.

Each drop of THYRO-BLOCK™ SOLUTION contains 21 mg of potassium iodide.

HOW POTASSIUM IODIDE WORKS

Certain forms of iodine help your thyroid gland work right. Most people get the iodine they need from foods, like iodized salt or fish. The thyroid can "store" or hold only a certain amount of iodine.

In a radiation emergency, radioactive iodine may be released in the air. This material may be breathed or swallowed. It may enter the thyroid gland and damage it. The damage would probably not show itself for years. Children are most likely to have thyroid damage.

If you take potassium iodide, it will fill-up your thyroid gland. This reduces the chance that harmful radioactive iodine will enter the thyroid gland.

WHO SHOULD NOT TAKE POTASSIUM IODIDE

The only people who should not take potassium iodide are people who know they are allergic to iodide. You may take potassium iodide even if you are taking medicines for a thyroid problem (for example, a thyroid hormone or antithyroid drug). Pregnant and nursing women and babies and children may also take this drug.

HOW AND WHEN TO TAKE POTASSIUM IODIDE

Potassium Iodide should be taken as soon as possible after public health officials tell you. You should take one dose every 24 hours. More will not help you because the thyroid can "hold" only limited amounts of iodine. Larger doses will increase the risk of side effects. You will probably be told not to take the drug for more than 10 days.

SIDE EFFECTS

Usually, side effects of potassium iodide happen when people take higher doses for a long time. You should be careful not to take more than the recommended dose or take it for longer than you are told. Side effects are unlikely because of the low dose and the short time you will be taking the drug.

Possible side effects include skin rashes, swelling of the salivary glands, and "iodism" (metallic taste, burning mouth and throat, sore teeth and gums, symptoms of a head cold, and sometimes stomach upset and diarrhea).

A few people have an allergic reaction with more serious symptoms. These could be fever and joint pains, or swelling of parts of the face and body and at times severe shortness of breath requiring immediate medical attention.

Taking iodide may rarely cause overactivity of the thyroid gland, underactivity of the thyroid gland, or enlargement of the thyroid gland (goiter).

WHAT TO DO IF SIDE EFFECTS OCCUR

If the side effects are severe or if you have an allergic reaction, stop taking potassium iodide. Then, if possible, call a doctor or public health authority for instructions.

HOW SUPPLIED

THYRO-BLOCK™ TABLETS (Potassium Iodide, U.S.P.) bottles of 14 tablets (NDC 0037-0472-20.) Each white, round, scored tablet contains 130 mg potassium iodide.

THYRO-BLOCK™ SOLUTION (Potassium Iodide Solution, U.S.P.) 30 ml (1 fl. oz.) light-resistant, measured-drop dispensing units (NDC 0037-4287-25). Each drop contains 21 mg potassium iodide.

WALLACE LABORATORIES
Division of
CARTER-WALLACE, INC.
Cranbury, New Jersey 08512

CW—107915—10/79 Issue 10/79

INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

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

(2) STATION: Oconee

(3) PROCEDURE TITLE: Environmental Equipment Checks

(4) PREPARED BY: Gene Pittman DATE: 8-26-82

(5) REVIEWED BY: D. Taylor DATE: 8-27-82

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

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: [illegible] Date: 8/27/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

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.

4.4 This procedure must be retyped within 30 days of any approved change.

4.5 A copy of the control copy must be sent to emergency preparedness coordinator any time a change is made.

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-[illegible]3-276
8.6	One Leeds and Northrup 3-Lead Resistance Temperature Detector (RTD) Air Temperature System	
8.7	One Belfort Instrument Company Hygro-thermograph Recorder	
8.8	One Belfort Instrument Company weighing Rain Gauge Recorder	

9.0 Equipment Specifications

Wind Speed	0-30 mph (60 and 90 mph selectable ranges)
Wind Direction	0-540 degrees
Ambient Air Temperature	-15 to 105°F
Temperature Differential	-30 to 30°F
Rainfall Gauge	0-12 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 and wind speed 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 Air Temperature Recorder

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 Hygro-Thermograph Recorder

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 Rain Gauge Recorder

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 aligning 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

Date Begun__________

Date Completed________

WR#________________

______ 4.1

______ 4.2

______ 4.3

______ 4.4

______ 4.5

STRING CHECKS AND DATA SECTIONS

______ 10.0	______ 10.3	______ 10.6	______ 11.4.a.	______ 11.5.a.
______ 10.1	______ 10.4	______ 10.7	______ 11.3.b.	______ 11.5.b.
______ 10.2	______ 10.5			

______ 10.2.3 Wires removed and jumpers installed.

______ 10.2.4 Jumpers removed and wires replaced.

Performed by ____________________ ____________________

____________________ ____________________

__________ Notified Instrument Supervisor that a tolerance of 2% was exceeded
(Tech) on following compoents:
Init. and date

__________ An evaluation was made on the above problem(s) and the following
Inst. Supvr. corrective action taken:
Init. and Date

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

Equipment Removed From Service _____,_____

Equipment Returned To Service _____,_____

ENCLOSURE 11.5.b

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

Equipment Removed From Service _____,_____

Equipment Returned To Service _____,_____