Duke Energy

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U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
Emergency Plan Implementing Procedures Manual
Volume B, Revision 2000-01

Please find attached for your use and review copies of the revision to the Oconee Nuclear Station Emergency Plan:

Volume B Revision 2000-01 January 11, 2000

This revision is being submitted in accordance with 10 CFR 50-54(q) and does not decrease the effectiveness of the Emergency Plan or the Emergency Plan Implementing Procedures.

Any questions or concerns pertaining to this revision please call Mike Thorne, Emergency Planning Manger
at 864-885-3210.

By copy of this letter, two copies of this revision are being provided to the NRC, Region II, Atlanta, Georgia.

Very truly yours,

W. R. McCollum, Jr.
VP, Oconee Nuclear Site

xc: (w/2 copies of attachments)
Mr. Luis Reyes,
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A045

PDR ADOCK 05000269

January 11, 2000

OCONEE NUCLEAR SITE

SUBJECT: Emergency Plan Implementing Procedures
Volume B, Revision 2000-01

Please make the following changes to the Emergency Plan, Volume B by following these instructions.

REMOVE	ADD
Cover Sheet Rev. 99-10	Cover Sheet Rev. 2000-01
Table of Contents page 1 & 2	Table of Contents page 1 & 2
CP/1/A/2002/004C - 09/17/99	CP/1/A/2002/004C - 12/16/99
CP/2/A/2002/004C - 09/17/99	CP/2/A/2002/004C - 12/16/99
CP/3/A/2002/004C - 10/13/99	CP/3/A/2002/004C - 12/16/99
CP/3/A/2002/005 - 03/17/99	CP/3/A/2002/005 - 12/29/99
CP/1&2/A/2002/005 - 08/04/99	CP/1&2/A/2002/005 - 12/29/99
CP/3/A/2002/005 - 03/17/99	CP/3/A/2002/005 - 12/29/99
Chemistry Manual 5.2 - 03/16/99	Chemistry Manual 5.2 - 12/28/99

If you have any questions regarding this revision please contact Mike Thorne at ext. 885-3210.

DUKE POWER

EMERGENCY PLAN
IMPLEMENTING PROCEDURES
VOLUME B

APPROVED:

W. W. Foster

W. W. Foster, Manager
Safety Assurance

01/11/2000
Date Approved

01/11/2000
Effective Date

VOLUME B
REVISION 2000-01
JANUARY 2000

VOLUME B
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(R06-1)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. CP/1/A/2002/004 C
Revision No 19
Continuous Use

INFORMATION ONLY

PREPARATION

(2) Station Oconee Nuclear Station

(3) Procedure Title Operating Procedure for the Post Accident Liquid Sampling System (PALSS)

(4) Prepared By M.R. Gwin Date 12/13/99

(5) Requires 10CFR50.59 evaluation?
- ☑ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By Dean Cantrell (QR) Date 12/14/99
Cross-Disciplinary Review By _____ (QR)NA HQC Date _____
Reactivity Mgmt. Review By _____ (QR)NA HQC Date _____

(7) Additional Reviews
QA Review By _____ Date _____
Reviewed By _____ Date _____
Reviewed By _____ Date _____

(8) Temporary Approval *(if necessary)*
By _____ (SRO/QR) Date _____
By _____ (QR) Date _____

(9) Approved By Bryan L. Mas Date 12/16/99

PERFORMANCE ***(Compare with control copy every 14 calendar days while work is being performed.)***

(10) Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____
Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification
- ☐ Yes ☐ NA Check lists and/or blanks initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ NA Listed enclosures attached?
- ☐ Yes ☐ NA Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ NA Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ NA Procedure requirements met?

Verified By _____ Date _____

(13) Procedure Completion Approved _____ Date _____

(14) Remarks *(Attach additional pages, if necessary)*

Operating Procedure for the Post Accident Liquid Sampling System (PALSS)

1. Purpose

NOTE:	Seven Control copies and one Information Only copy of this procedure shall be routed to the Emergency Preparedness Team within three working days after any approved changes.

The post accident liquid sampling system (PALSS) provides the capability to obtain a primary coolant sample via the HPI Letdown, LPI Pump Discharge or the RCS "J" leg during a nuclear reactor accident condition(s) as described in the FSAR and in accordance with NUREG-0737.

2. Limits and Precautions

2.1 This procedure should be used to operate PALSS to sample the Reactor Coolant System under the following conditions:

2.1.1 Post Accident.

2.1.2 Inaccessibility of (routine) Primary Sampling Area **AND/OR** HPI Letdown Sampling not possible.

2.1.3 Request from the Chemistry Manager or his designee.

2.2 Under accident conditions, valve alignments shall **NOT** be made and samples shall **NOT** be taken without prior authorization from the Emergency Coordinator **OR** the TSC/OSC! (Containment isolation valves may be closed upon ES actuation, see Enclosure 7.6.)

2.3 Under accident conditions, do **NOT** attempt any phase of sampling **OR** analysis without Radiation Protection job coverage!

2.4 Consider portable shielding, remote handling equipment, video equipment, etc., where practical or available during sampling, sample preparation, and sample analysis.

2.5 Chemistry personnel shall operate only those valves operated by the Control Panel **OR** via the sample panel unless clearly specified otherwise in this procedure.

2.6 **IF** power is **NOT** available at the PALSS Control Panel, return to a low dose area and contact Chemistry management.

2.6.1 Refer to Enclosure 7.5 and troubleshoot as required to determine source of problem.

2.6.2 Notify the OSC/TSC.

2.6.3 **IF** necessary, request the OSC have Operations ensure the following breakers are closed (to ensure power availability).

- 1L2 Bkr. #39 Sampling/Control Panels Power Supply (located next to U2 sampling panel)
- MCC1XL Bkr. for 1DW-278 (DW Flush Supply to Post Accident Sample) (PALSS Control Panel)

2.7 **IF** reviewed and approved by a supervisor and one other individual who is familiar with this procedure, steps may be performed out of sequence.

2.8 Steps preceded by "____" in the left margin are sign off steps. These steps must be signed off before continuing. Steps preceded with " ☐ " (immediately to the left of the step) are check off steps and should be checked off as completed.

2.9 Independent Verification (designated by two sign-off steps) is a documented check by a second individual which helps to ensure the correct condition or position of plant components. Separate Verification (designated by SV) ensures individuals act separately and independently. Double Verification (designated by DV) ensures the "doer" and "verifier" independently decide that an action is correct prior to the "doer" performing the action. The "verifier" shall use a "hands-on" approach to verify the action of the "doer".

CAUTION: Chemical hazards shall be known prior to use. For additional information and first aid requirements, refer to the MSDS sheet.

2.10 Personal protective requirements for chemicals used in this procedure are pH buffers 4.0, 7.0, and 10.0:

- lab coat
- gloves (rubber/vinyl)
- chemical splash goggles

2.11 **WHEN** flushing the desired sample to the waste tanks, request Operations add a second compressor on the GWD header because fresh fission gasses may cause a serious problem in the Aux. Building.

- **IF** possible, this increased vacuum should be maintained until sampling is complete.

2.12 All sample vials should be cleaned and rinsed to protect against chloride contamination.

- Do **NOT** place bare finger tips on the surface of the septum.

3. Apparatus

3.1 A minimum of 4 Lockable Glass (Gas) Syringes (1 to 2 ml size only)

3.2 Liquid Sample Carrier (Bucket, Etc.), Gas Syringe Carrier

3.3 Watch or Lab Timer

3.4 Plastic Bags

3.5 15 - 40cc Evacuated Sample Vial(s) for Liquid Sample

3.6 Nitrogen Supply Bottle with > 600 psi available. (with Two Stage Regulator; 0 to 200 psig on Delivery Stage) replace as required

4. Reagents

4.1 Buffer Solutions - Use purchased 4.00, 7.00 and/or 10.00 buffers or equivalent

5. Procedure

5.1 Prerequisites and Panel Preparation (preliminary)

5.1.1 Initiate Enclosure 7.7.

5.1.2 **IF** routing waste to the RBES or sampling from the RCS "J" Leg:

- Take Enclosure 7.6 to the responsible individual in Operations (designated by the OSC) for completion.
- Request Operations complete the appropriate step(s) of Enclosure 7.6.

5.1.3 Label glass vial(s) for collecting the liquid sample.

5.2 Panel Preparation (prior to sampling)

NOTE: **IF** any item on the control or sample panel is not clearly identified, refer to Enclosure 7.1 and 7.2.

☐ 5.2.1 Inform the U-1 Control Room that sampling of the RCS will be done via the PALSS panel.

- Identify the flowpath J-Leg, LPI **OR** Letdown.
- Recommend an extra waste gas compressor be placed into service.

Operator Notified: _____

5.2.2 At the Control Panel, ensure that SW 1 (valve power switch), is in the "OFF" position.

- Ensure PALSS safety switch is "ON".

CAUTION: Make the mating of connector cable 1 to connector 1 on the Junction Box the LAST cable connection made. **IF** this is not done last, the exposed pins of the other cables may become energized and become an electrical hazard.

☐ 5.2.3 Position the Control Panel using RP as a guideline, in the lowest dose area possible.

☐ 5.2.4 **IF** necessary, route and connect the six required cables (CON 6 - CON 1) from the Control Panel to the Junction Box, starting with connector 6 and ending with connector 1.

☐ 5.2.4.1 Connect CON-6 cable at both ends.

☐ 5.2.4.2 Connect CON-5 cable at both ends.

☐ 5.2.4.3 Connect CON-4 cable at both ends.

☐ 5.2.4.4 Connect CON-3 cable at both ends.

☐ 5.2.4.5 Connect CON-2 cable at both ends.

☐ 5.2.4.6 Connect CON-1 cable at the PALSS control panel end.

☐ 5.2.4.7 Connect CON-1 cable to the junction box last.

☐ 5.2.5 Ensure off all control and solenoid valves (no lights).

5.2.6 Position the following valves: (outside of Sample Panel)

CAUTION: Nitrogen cylinder must be replaced if pressure is < 600 psig in order to prevent backflow of fission gas into the cylinder.

☐ Open valve(s) on Nitrogen Supply Bottle (> 600 psi tank pressure required & ~100 psi delivery pressure)

☐ **IF** necessary, replace cylinder.

☐ Open 1IA-2423 (Instrument Air Supply).

NOTE: The following switches are found on the PALSS Control Panel.

☐ 5.2.7 Turn system power on by inserting Control Panel Key into (KS 1) Key Lock Switch and turning the key.

NOTE: The lights in the middle of each switch which controls a valve should be "OFF". The green lights should be "LIT" on the push-button switches, (PB 1) through (PB 8).

☐ 5.2.8 Ensure all lamps on the Control Panel are functioning by turning ON SW 2 (lamp test switch).

☐ 5.2.9 Make note of **OR** repair any not functioning properly. (The lamp test switch does not light).

☐ 5.2.9.1 Turn SW 2 (lamp test switch) to "OFF".

☐ 5.2.10 Turn SW 1 (valve power switch) to the "ON" Position.

NOTE: In an accident situation, waste will be routed to the RBES unless otherwise directed by supervision. The alternate route is the HAWT via PB1 (1LP-130).

_____ 5.2.11 **IF** routing waste to the RBES, open PB2 (1LP-65, 1B Emergency Sump Line Drain Block).

_____ 5.2.12 **IF** routing waste to the HAWT, open PB1 (1LP-130, Sample Return to High Activity Waste Tank).

5.3 Panel Preparation (pH Meter Standardization) (PALSS Control Panel)

5.3.1 Purge the pH housing with Nitrogen as follows:

NOTE: All other control valves must be closed.

☐ 5.3.1.1 Open 204

☐ 5.3.1.2 Open 206

☐ 5.3.1.3 Open 103

☐ 5.3.1.4 Open 102

☐ 5.3.1.5 Open 105

☐ 5.3.1.6 Open 202

☐ 5.3.1.7 Wait at least 2 minutes, close 105.

5.3.2 Pressurize Buffer Tank A as follows:

NOTE: SV 209 controls both buffer tanks (A and B).

☐ 5.3.2.1 Place 209 in the 'A' position.

☐ 5.3.2.2 Wait at least 30 seconds., then place 209 in the "OFF" position.

☐ 5.3.2.3 Close 202

5.3.3 Evacuate pH housing as follows:

☐ 5.3.3.1 Open 208

☐ 5.3.3.2 Open 201

☐ 5.3.3.3 **WHEN** the pressure on PG 4 stabilizes (normally < 2.0 PSIA),

☐ A. Close 201

☐ B. Record the pH Housing pressure from PG 4 **OR** PG 5.

pH Housing Pressure for A Buffer = _____ PSIA

☐ 5.3.3.4 Close 102

☐ 5.3.3.5 Close 103

☐ 5.3.3.6 Close 206

☐ 5.3.3.7 Close 204

☐ 5.3.3.8 Close 208

5.3.4 Transfer A Buffer into the pH housing as follows:

☐ 5.3.4.1 Place 209 in the 'A' position.

☐ 5.3.4.2 Wait at least 1 minute, then place 209 in the "OFF" position.

5.3.5 Standardize the pH meter as follows:

NOTE: The following keys are located on the pH meter in the face of the PALSS control panel.

5.3.5.1 Use the "menu" key to move to the main menu. The display will show: ("Configuration, Calibration, Maintenance, I/O Setup").

5.3.5.2 Using the "arrow up or down" keys, move to and highlight "Calibration".

5.3.5.3 Press "enter".

5.3.5.4 Using the "arrow up or down" keys, move to and highlight "Calibration / Buffer Calibration pH".

5.3.5.5 Press the "Hold" key.

5.3.5.6 Press the "next" key to move to the next screen.

NOTE:
- A flashing value indicates the probe may be broken.
- A value that **CANNOT** be adjusted to within ± .5 pH offset will make the unit return to the calibration screen, indicating that the pH electrode may need to be replaced.

5.3.5.7 The display will show the pH of the 'A' buffer solution.

5.3.5.8 Wait for a stable reading, then using the "function keys, side to side" select the desired digit space and change the value on the display using the "arrow up and down" keys to match the actual 'A' buffer pH.

5.3.5.9 **WHEN** the unit display indicates the buffer pH, press the "ENTER" key.

5.3.5.10 Record the pH meter value set for the 'A' buffer pH.

'A' Buffer Solution pH _____

5.3.5.11 **WHEN** the unit successfully meets the preset specifications and the entered buffer value is displayed, press "next" until the screen with the following is visible:

SLOPE

Note: Buffer must be > 2 pH units away from the STD buffer.

NOTE: The unit should still be in the "hold" mode.

5.3.5.12 Press "next". The following screen should be visible:

SLOPE

Place electrode in Buffer Attention.
Wait for Stable Reading!

5.3.6 Flush the pH housing with DW as follows:

☐ 5.3.6.1 Open 101

☐ 5.3.6.2 Open 102

☐ 5.3.6.3 Open 105

☐ 5.3.6.4 Open PB-6 (1DW-278, DW Flush Supply to Post Accident Sample).

☐ 5.3.6.5 Wait at least 5 minutes, close 101.

☐ 5.3.6.6 Close PB-6 (1DW-278, DW Flush Supply to Post Accident Sample).

5.3.7 Purge the demineralized water out of the pH housing with nitrogen as follows:

- ☐ 5.3.7.1 Open 202
- ☐ 5.3.7.2 Open 204
- ☐ 5.3.7.3 Open 206
- ☐ 5.3.7.4 Open 103
- ☐ 5.3.7.5 Place 209 in the 'A' position.
- ☐ 5.3.7.6 Place 209 in the "OFF" position.
- ☐ 5.3.7.7 After at least 2 minutes, close 105.

5.3.8 Pressurize Buffer Tank B as follows:

- ☐ 5.3.8.1 Place 209 in the 'B' position.
- ☐ 5.3.8.2 Wait at least 30 seconds, place 209 in the "OFF" position.
- ☐ 5.3.8.3 Close 202

5.3.9 Evacuate pH housing as follows:

- ☐ 5.3.9.1 Open 208
- ☐ 5.3.9.2 Open 201
- ☐ 5.3.9.3 **WHEN** the pressure on PG 4 stabilizes (normally < 2.0 PSIA), close 201.
- ☐ 5.3.9.4 Record pH Housing pressure from PG 4.

  pH Housing Pressure for B Buffer = _____ PSIA
- ☐ 5.3.9.5 Close 102
- ☐ 5.3.9.6 Close 103
- ☐ 5.3.9.7 Close 206
- ☐ 5.3.9.8 Close 204
- ☐ 5.3.9.9 Close 208

5.3.10 Transfer B Buffer into the pH housing as follows:

☐ 5.3.10.1 Place 209 in the 'B' position.

☐ 5.3.10.2 Wait at least 1 minute, place 209 in the "OFF" position.

5.3.11 Calibrate the pH meter as follows: (pH meter on the face of the PALSS Control Panel)

NOTE: The unit should still be in the "HOLD" mode. This key causes the pH meter to maintain a constant output and alarm condition. This allows the electrode to be removed (optional) for calibration in a buffer without process upset. The temperature compensation feature is also disabled in the "HOLD" mode (this allows calibration of the meter to the particular temperature of the buffer used).

5.3.11.1 Press "next". The display will show the pH of the 'B' buffer as measured by the electrode.

5.3.11.2 Wait for a stable reading, then select the desired digit space using the "function keys side to side".

5.3.11.3 Adjust the value on the display using the "arrow up and down" keys, until the display matches the actual pH of the buffer solution.

5.3.11.4 Press "enter". This will set the instrument slope.

5.3.11.5 Record the pH meter value set for the 'B' buffer pH.

'B' Buffer Solution pH _____

5.3.11.6 **IF** the slope adjustment was successful, the Completed screen will be displayed:

SLOPE
Slope Completed
Slope Buffer Value Saved

5.3.11.7 Using the "hold" key, take the unit out of the hold mode.

NOTE: **IF** the calibration was not successful, the menu will return to the original Calibration Menu by itself and display an error code.

5.3.11.8 Use the "next" key to rotate back to the original Calibration menu screen.

5.3.11.9 Press the "Display" key. The pH meter is now in the sample measurement mode.

5.3.12 Flush the pH housing with DW as follows:

- ☐ 5.3.12.1 Open 101
- ☐ 5.3.12.2 Open 102
- ☐ 5.3.12.3 Open 105
- ☐ 5.3.12.4 Open PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)
- ☐ 5.3.12.5 Ensure the pH meter reads demin water header pH (~ 5 to 7) for an adequate flush.
- ☐ 5.3.12.6 Wait ≥ 3 minutes, close 101.
- ☐ 5.3.12.7 Close PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)

5.3.13 Purge the demineralized water out of the pH housing with nitrogen as follows:

- ☐ 5.3.13.1 Open 202
- ☐ 5.3.13.2 Open 204
- ☐ 5.3.13.3 Open 206
- ☐ 5.3.13.4 Open 103
- ☐ 5.3.13.5 Wait ≥ 2 minutes **OR** until pressure on PG 3 drops rapidly (below 50 psi), then close 105.
- ☐ 5.3.13.6 Place the 209 in the 'B' position.
- ☐ 5.3.13.7 Place the 209 in the "OFF" position.
- ☐ 5.3.13.8 Close 202
- ☐ 5.3.13.9 Close 204
- ☐ 5.3.13.10 Close 206
- ☐ 5.3.13.11 Close 103

☐ 5.3.13.12 Close 102

☐ 5.3.13.13 Close 105

5.4 Panel Preparation (pH Housing and Gas Tank(s) Evacuation) (PALSS Control Panel)

5.4.1 Evacuate pH housing and gas tanks as follows:

☐ 5.4.1.1 Open 208

☐ 5.4.1.2 Open 201

☐ 5.4.1.3 Open 203

☐ 5.4.1.4 Open 204

☐ 5.4.1.5 Open 205

☐ 5.4.1.6 Open 206

☐ 5.4.1.7 Open 207

☐ 5.4.1.8 Open 103

☐ 5.4.1.9 Open 102

☐ 5.4.1.10 Monitor the pressure in the pH housing and gas tanks on PG 5 **OR** PG 4.

- **WHEN** the pressure stabilizes (normally < 2.0 PSIA), close 201.

☐ 5.4.1.11 Close 208

5.4.2 pH Housing Pressure

☐ 5.4.2.1 Record pH Housing pressure from PG 5 (alternate PG 4).

pH Housing Pressure _____ PSIA

☐ 5.4.2.2 Close 102

☐ 5.4.2.3 Close 103

☐ 5.4.2.4 Close 206

☐ 5.4.2.5 Close 207

5.4.3 30 ml and 500 ml Gas Tanks Pressure

☐ 5.4.3.1 Record gas tank pressures from PG 5 (alternate PG 4).

Gas tanks (30ml and 500ml) pressure _____ PSIA

☐ 5.4.3.2 Close 205

☐ 5.4.3.3 Close 204

☐ 5.4.3.4 Close 203

5.5 Panel Operation (Reactor Coolant Sample Flush/Acquisition) (PALSS Control Panel)

NOTE: The sample will be taken via the LPI pump discharge, HPI Letdown, or the RCS "J-Leg" sample point.

CAUTION: 1. PB 6 (1DW-278) must be closed to prevent flow of RCS into the demineralized water header.

2. CV-102 and CV-105 must be closed to prevent overpressurization and failure of the pH housing.

_____ 5.5.1 Ensure closed the following valves:

5.5.1.1 Close PB-6 (1DW-278, DW Flush Supply to Post Accident Sample).

5.5.1.2 Close 102

5.5.1.3 Close 105

☐ 5.5.2 Ensure SS 3 (selector switch) is in the "PT 1" position.

_____ 5.5.3 **IF** sampling the RCS "J-Leg", then open PB 4 (1RC-179, Post Accident Sample Block).

_____ 5.5.4 **IF** sampling the LPI pump Discharge, then open PB 3 (1LP-126, Isolation for LP Sample).

_____ 5.5.5 **IF** sampling the HPI Letdown, then open PB 5 (1LP-124, Isolation for HP Sample Letdown).

☐ 5.5.6 Open 101

☐ 5.5.7 Open 104

CAUTION: Monitor PG 3 to ensure that the outlet pressure does **NOT** exceed 600 PSIG. Adjust slowly.

☐ 5.5.8 Open 401 to establish the maximum flow without exceeding 600 PSIG on PG 3.

☐ 5.5.9 Record the flowrate from FG1 _____ gpm.

☐ 5.5.10 Record the pressure from PG 3 _____ psig.

5.5.11 **IF** LT 3 (clogged filter light switch) comes on and remains on, but flow on FG-1 is > 1.5 gpm, continue with procedure.

- **IF** flow is < 1.5 gpm, contact Chemistry Staff for further instructions.
- **IF** directed by management, proceed to Enclosure 7.3.

☐ 5.5.12 Select the desired thermocouple to monitor the inlet **OR** outlet of the sample **OR** the cooling water using SS 1:

TE 1 - Measures sample inlet to heat exchanges.

TE 2 - Measures sample return from heat exchanger.

TE 3 - Measures cooling water inlet to heat exchanger.

TE 4 - Measures cooling water return from heat exchanger.

☐ 5.5.12.1 Switch SS 1 to "TE 1"

☐ 5.5.12.2 Record sample inlet temperature on TG 1.

INLET TEMPERATURE _____°F

☐ 5.5.12.3 Switch SS 1 to "TE 2".

☐ 5.5.12.4 Record sample outlet temperature on TG 2.

OUTLET TEMPERATURE _____°

5.5.13 After > 15 gallons have flowed through the system (calculate time based on FG-1 reading):

☐ 5.5.13.1 Slowly throttle 401 until fully closed.

☐ 5.5.13.2 Immediately close 104

☐ 5.5.13.3 Immediately close 101

☐ 5.5.13.4 Record 500 ml liquid tank pressure from PG 1.

Pressure = _____ PSIG

☐ 5.5.14 Move selector switch SS 3 to the "PT 2" position to measure discharge pressure of the injection valves.

NOTE: There are two continuous flow paths through the sample valve(s). When the valve(s) is opened, the sample loop is moved to the sample flow path. When the valve(s) is closed, the sample loop is moved to the sample injection (collection) flow path.

5.5.15 Ensure open the desired sample injection valve(s) of the 0.1 ml, 1 ml and/or 5 ml loop, respectively (normally the 5 ml and 1 ml loop are used):

☐ 503 (0.1 ml Loop)

☐ 502 (1 ml Loop)

☐ 501 (5 ml Loop)

☐ 5.5.16 Open 107

☐ 5.5.17 Slowly open 402 keeping flowrate on FG 2 < 300 ml/min.

NOTE: Greater than 40 PSIG sample pressure must be supplied to the injection valves.

5.5.18 After ≥ 5 minutes, close the sample injection valve(s) opened in Step 5.5.15.

☐ 503 (0.1 ml Loop)

☐ 502 (1 ml Loop)

☐ 501 (5 ml Loop)

5.5.19 Record sample time: _____

_____ 5.5.20 Close the sample valve selected in Step 5.5.3 or 5.5.4 or 5.5.5

- PB 4 (1RC-179, Post Accident Sample Block)
- PB 3 (1LP-126, Isolation for LP Sample)
- PB 5 (1LP-124, Isolation for HP Sample Letdown)

☐ 5.5.21 After 1 minute, close 402.

CAUTION: **IF** the pressure on PG-1 is > 100 psi or is increasing with time, contact Chemistry Staff and notify that RCS is leaking by sample valve.

☐ 5.5.22 After 1 minute, record the pressure on PG-1: _____psi

☐ 5.5.23 Close 107

5.6 Depressurization (PALSS Control Panel)

☐ 5.6.1 Ensure SS 3 (selector switch) is in the "PT 1" position.

☐ 5.6.2 Ensure closed 206

☐ 5.6.3 Ensure closed 207

☐ 5.6.4 Open 103

☐ 5.6.5 Wait ≥ 2 minutes.

NOTE: Pressure on PG 1 should be < 50 PSIG.

☐ 5.6.6 Record the pressure from PG 1 _____ PSIG.

5.7 Gas Collection (PALSS Control Panel)

5.7.1 Verify pressure in the 30 ml and 500 ml gas tank is ≤ 2.0 PSIA.

For 500 ml Gas Tank:

☐ 5.7.1.1 Open 205

☐ 5.7.1.2 Open 203

☐ 5.7.1.3 Record PG 5 (alternate gauge PG 4).

500 ml Gas Tank Pressure _____

☐ 5.7.1.4 Close 205

☐ 5.7.1.5 Close 203

For 30 ml Gas Tank:

☐ 5.7.1.6 Open 204

☐ 5.7.1.7 Open 203

☐ 5.7.1.8 Record PG 5 (alternate gauge PG 4).

30 ml Gas Tank Pressure _____

☐ 5.7.1.9 Close 204

☐ 5.7.1.10 Close 203

5.7.2 **IF** the pressure in the 30 ml and 500 ml Gas Tank is ≤ 2.0 PSIA, proceed to Step 5.7.5 **IF** the Nitrogen stripping method is to be used for gas collection and analysis.

5.7.3 **IF** the alternate method (Total Gas Method) is to be used, proceed to Step 5.7.6.

☐ 5.7.4 **IF** the pressure in the 30 ml **OR** 500 ml Gas Tank is > 2.0 PSIA, then evacuation of the tanks must be repeated as follows:

☐ 5.7.4.1 Close 103

☐ 5.7.4.2 Open 204

☐ 5.7.4.3 Open 205

☐ 5.7.4.4 Open 201

☐ 5.7.4.5 Open 208

☐ 5.7.4.6 Open 203

5.7.4.7 **WHEN** the reading from PG 5 (alternate gauge PG 4) is ≤ 2.0 PSIA, close

☐ A. 204

☐ B. 205

☐ C. 201

☐ D. 208

☐ E. 203

☐ 5.7.4.8 Open 103

5.7.4.9 **IF** the Nitrogen stripping method is to be used for gas collection and analysis, continue with Step 5.7.5.

5.7.4.10 **IF** the alternate method (Total Gas Method) is to be used, proceed to Step 5.7.6.

NOTE: Nitrogen Stripping Method is the typical method.

5.7.5 Nitrogen Stripping Method (Gas Analysis)

☐ 5.7.5.1 Ensure closed 205

☐ 5.7.5.2 Open 207

☐ 5.7.5.3 Open 106

NOTE: The pressure on PG-1 should be monitored for an increase of approximately 15 psi. Because PT-1 is a high range pressure transmitter the indicated reading on PG-1 will vary from calibration to calibration and may indicate anywhere from -15 to 15 psi initially.

☐ 5.7.5.4 For a 10 minute interval, periodically turn on 109 to vibrate 500 ml liquid tank, monitor the pressure on PG 1 (switch SS 3 to "PT 1").

☐ 5.7.5.5 Close 106

☐ 5.7.5.6 Open 205

☐ 5.7.5.7 Open 204

5.7.5.8 After ≥ 5 minutes when PG 4 (alternate PG 1) stabilizes, close:

☐ A. 204

☐ B. 205

☐ C. 207

☐ D. 103

5.7.5.9 Proceed to Section 5.8.

NOTE: Calculated method should be used only as an alternate.

5.7.6 Total Gas Method (Calculated)

☐ 5.7.6.1 Monitor PG 4.

☐ 5.7.6.2 **WHEN** the pressure shown on PG 4 is < 30 PSIA, the low range pressure transmitter, PT 5, can be used to obtain a more accurate pressure measurement.

- PT 5 can be used by opening 203.

☐ 5.7.6.3 Ensure SS 2 switch is in the "RD 2" position.

☐ 5.7.6.4 Record the initial temperature reading from TG 2 and pressure reading from PG 5.

TG 2 Init. Temp. Reading _____ °F

PG 5 Init. Press. Reading _____ PSIA

☐ 5.7.6.5 Open 206

☐ 5.7.6.6 Open 204

☐ 5.7.6.7 Turn on the vibrator using 109 and monitor PG 5.

☐ 5.7.6.8 **WHEN** the pressure of the 30 ml gas tank stabilizes, record the final pressure and temperature.

TG 2 Final Temp. Reading _____ °F

PG 5 Final Press. Reading _____ PSIA

☐ 5.7.6.9 Close 203

☐ 5.7.6.10 Close 204

☐ 5.7.6.11 Close 206

☐ 5.7.6.12 Ensure 109 is off.

☐ 5.7.6.13 Close 103

☐ 5.7.6.14 Calculate the total amount of H_2 in the sample using Enclosure 7.4.

☐ 5.7.6.15 Report results on Enclosure 7.7.

5.8 Sample pH Measurement (PALSS Control Panel)

☐ 5.8.1 Ensure closed 206

☐ 5.8.2 Ensure closed 204

☐ 5.8.3 Ensure SS 3 switch is set on PT 1.

5.8.4 Pressurize liquid tank to at least 60 PSIG as monitored on PG 1 (alternate PG 4), as follows:

☐ 5.8.4.1 Open 202

☐ 5.8.4.2 Open 205

☐ 5.8.4.3 Open 207

☐ 5.8.4.4 Open 103

☐ 5.8.4.5 After 30 seconds, close 103.

☐ 5.8.4.6 Close 207

☐ 5.8.4.7 Close 205

☐ 5.8.4.8 Close 202

☐ 5.8.5 Open 102

5.8.6 Record pH on Enclosure 7.7.

☐ 5.8.7 Close 102

5.8.8 Notify OSC that RCS sampling via the PALSS is completed and that sample retrieval will begin following system flush.

OSC Person Notified: _____

5.9 System Flush (PALSS Control Panel)

NOTE: Directions regarding sample panel flushing will be determined by management.

5.9.1 Ensure 204 and 206 remain closed and the sample injection valve(s) selected (501, 502 and/or 503) is turned off.

5.9.2 **IF** either LT 1 **OR** LT 2 indicator is illuminated:

☐ 5.9.2.1 Open 108

☐ 5.9.2.2 Turn on 110 (sump pump).

☐ 5.9.2.3 **WHEN** both LT1 and LT2 are out, close 108.

☐ 5.9.2.4 Turn off 110 (sump pump).

5.9.3 **IF** given the direction to flush the panel, flush the 500 ml liquid tank, pH housing, and sample injection valves as follows:

500 ml Liquid Tank

☐ 5.9.3.1 Open 101

☐ 5.9.3.2 Open 104

☐ 5.9.3.3 Open 401

☐ 5.9.3.4 Open PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)

pH Housing

☐ 5.9.3.5 Open 102

☐ 5.9.3.6 Open 105

Sample Injection Valves

☐ 5.9.3.7 Open 107

☐ 5.9.3.8 Open 402

☐ 5.9.3.9 Flush the sample panel until the general area dose rate on the exterior of the panel is ≤ 2 mR/hr **OR** a satisfactory level is achieved per RP.

☐ 5.9.3.10 Close 402

☐ 5.9.3.11 Close 107

☐ 5.9.3.12 Close 105

☐ 5.9.3.13 Close 102

☐ 5.9.3.14 Close 101

☐ 5.9.3.15 Close 104

☐ 5.9.3.16 Close 401

☐ 5.9.3.17 Close PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)

5.10 Liquid & Gas Sample Retrieval (PALSS Control Panel)

Liquid Sample Retrieval

☐ 5.10.1 Ensure open the waste route selected in Step 5.2.11 or 5.2.12:

- PB 1 (1LP-130, Sample Return to High Activity Waste Tank)

OR • PB 2 (1LP-65, 1B Emergency Sump Line Drain Block).

☐ 5.10.2 Ensure closed all other PB valves (motor operated).

☐ 5.10.3 **IF** LT 1 **OR** LT 2 is illuminated, perform Step 5.9.1.

☐ 5.10.4 Select the flow path for sample collection by turning CV 612 to the desired injection valve (0.1 ml, 1 ml, or 5 ml loop).

Sample Loop(s) Selected _____

☐ 5.10.5 Slowly turn CV 613 to the "N_2" position.

☐ 5.10.6 After collecting approximately 15 mls of liquid sample, turn CV 613 to the "VENT" position.

☐ 5.10.7 Wait ≥ 10 seconds for sample line depressurization.

☐ 5.10.8 Turn CV 612 to the "OFF" position.

☐ 5.10.9 As necessary for additional sample(s), repeat Steps 5.10.3 through 5.10.7.

Gas Sample Retrieval

☐ 5.10.10 **WHEN** possible, use the gas-tight syringe(s) to retrieve the gas sample(s) from the 30 ml gas tank keeping syringe vertical (needle down).

☐ 5.10.11 **IF** possible, place syringes in the gas locked position and store vertically (needle down).

5.11 30 ml Gas Tank and 500 ml Gas Tank Purge (PALSS Control Panel)

☐ 5.11.1 Verify Nitrogen supply still has ≥ 100 psig delivery pressure.

5.11.2 Allow all of the following valves to stay open ≥ 2 minutes except alternate the valve pairs 204/206 and 205/207 open and close within the 2 minute period:

☐ 5.11.2.1 Open 202

☐ 5.11.2.2 Open 204

☐ 5.11.2.3 Open 205

☐ 5.11.2.4 Open 206

☐ 5.11.2.5 Open 207

☐ 5.11.2.6 Open 103

☐ 5.11.2.7 Open 104

☐ 5.11.2.8 Open 401

☐ 5.11.2.9 After flushing for several seconds, close the following:

A. 204

B. 206

☐ 5.11.2.10 After additional flush for several seconds, open the following:

A. 204

B. 206

☐ 5.11.2.11 Close 205

☐ 5.11.2.12 Close 207

☐ 5.11.2.13 After several seconds, open the following:

A. 205

B. 207

☐ 5.11.2.14 **IF** the valves need further cycling (it has not been ≥ 2 minutes) return to Step 5.11.2.10.

☐ 5.11.2.15 **IF** the timer is ≥ 2 minutes, proceed to Step 5.11.3.

☐ 5.11.3 Close 202

☐ 5.11.4 Close 401

☐ 5.11.5 Close 104

☐ 5.11.6 Close 103

☐ 5.11.7 Open 201

☐ 5.11.8 Open 208

5.11.9 After ≥ 10 seconds, close the following:

☐ 5.11.9.1 206

☐ 5.11.9.2 207

☐ 5.11.9.3 204

☐ 5.11.9.4 205

☐ 5.11.9.5 201

☐ 5.11.9.6 208

☐ 5.11.10 Repeat Step 5.11.2 through 5.11.9 until dose rates of 30 ml and 500 ml tank are ≤ 10 mR/hr (at contact) **OR** a satisfactory level is achieved per RP.

5.12 System Shutdown

_____ 5.12.1 Ensure closed the following motor operated valves: (PALSS Control Panel)

☐ PB 1 (1LP-130, Sample Return to High Activity Waste Tank)

☐ PB 2 (1LP-65, 1B Emergency Sump Line Drain Block)

☐ PB 3 (1LP-126, Isolation for LP Sample)

☐ PB 4 (1RC-179, Post Accident Sample Block)

☐ PB 5 (1LP-124, Isolation for HP Sample Letdown)

☐ PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)

☐ PB 8 (1LP-129, Sample Drain to the High Activity Waste Tank)

_____ 5.12.2 Ensure closed the following solenoid valves: (PALSS Control Panel)

☐ 201

☐ 202

☐ 203

☐ 204

☐ 205

☐ 206

☐ 207

☐ 208

☐ 209

_____ 5.12.3 Ensure closed the following control valves: (PALSS Control Panel)

☐ 101

☐ 102

☐ 103

☐ 104

☐ 105

☐ 106

☐ 107

☐ 108

_____ 5.12.4 Return the valve power switch, SW 1, to the "OFF" position.

_____ 5.12.5 Return the key switch, KS 1, to the "OFF" position.

_____ 5.12.6 Close 1IA-2423 (Instrument Air Supply) (Outside the PALSS Sample Panel)

_____ 5.12.7 Ensure N_2 cylinder discharge pressure > 600 psi.

- **IF** necessary, replace cylinder.

_____ 5.12.8 Close N_2 Supply Bottle valves (Outside the PALSS Sample Panel)

NOTE: The following cable connections are located between the PALSS Control Panel and the cable junction box.

CAUTION: Make the disconnection of connector cable 1 from the Junction Box the FIRST cable disconnection. **IF** this is not done first, the exposed pins of the other cables may become energized and become an electrical hazard.

☐ 5.12.9 **IF** directed by Chemistry Staff, disconnect the following cables in order:

Staff notified _____ Check below as directed by Staff.

☐ Leave the power cables connected.

☐ Disconnect the power cables connected.

☐ 5.12.9.1 CON-1 from the junction box (this is the first cable disconnect made), then from the PALSS Control Panel.

☐ 5.12.9.2 CON-2 cable at both ends.

☐ 5.12.9.3 CON-3 cable at both ends.

☐ 5.12.9.4 CON-4 cable at both ends.

☐ 5.12.9.5 CON-5 cable at both ends.

☐ 5.12.9.6 CON-6 cable at both ends.

☐ 5.12.10 Store the control panel in the AB 1st floor hallway/corridor within ten (10) feet from the Unit 1 electrical junction box.

☐ 5.12.11 Ensure the control panel wheels are locked to prevent panel movement.

☐ 5.12.12 Ensure CV 609 is in the "AIR" position.

☐ 5.12.13 Ensure CV 610 is in the "NITROGEN" position.

☐ 5.12.14 Inform the OSC that flushing of the PALSS Panel has been completed.

OSC Person Notified: _____

5.13 Sample Analysis

NOTE: Steps 5.13.1 - 5.13.3 can be performed in any order. Substeps must be performed in the order written.

5.13.1 Gas (Nitrogen Stripping Method)

5.13.1.1 Analyze up to four syringes of stripped gas using LM-O-P008 (The Determination of Hydrogen in Gas Samples using the Carle Gas Chromatograph and the Spectra Physics Integrator).

5.13.1.2 Use the following formula to calculate results:

$$\%\ H_2 \frac{615.72\ cc}{0.50\ Kg} \times \frac{1}{100} = cc/Kg\ H_2$$

Where: % H_2 is determined from LM-O-P008

615.72 cc = 30 ml gas bomb + 500 ml gas bomb + tubing volume (volume occupied by sample gas).

0.50 Kg = collected sample size

$\frac{1}{100}$ = conversion of percent to decimal

5.13.1.3 Record results in cc/kg H_2 on Enclosure 7.7.

5.13.1.4 **IF** needed, reserve other stripped gas syringes for use as backups **OR** to perform a gas sample gamma spectra.

5.13.2 Liquid

5.13.2.1 Submit sample to count room for gamma spectra analysis. The sample may be counted in the rheodyne sample vial using the loop volume (preferred) or in a 50 ml bottle. **IF** a 50 ml bottle is used, refer to the following table for preparation guidelines:

PALSS Loop Size	Gamma Spectra Volume Ratio	Dilute sample from PALSS with demin. to: (mls)	mls of diluted sample to dilute to 50 mls for gamma spectra analysis
5.24	5/45	50	(50/5.24)*5 or ~ 48
5.24	1/49	100	(100/5.24)*1 or ~19
1.04	1/49	50	(50/1.04)*1 or ~48
1.04	.5/49.5	100	(100/1.04)*0.5 or ~48
0.10058	.1/49.9	50	(50/0.10058)*0.1 or ~50

5.13.2.2 Record results in mCi/ml on Enclosure 7.7 and attach GeLi Spectra.

5.13.2.3 Analyze PALSS sample for boron.

- To obtain a boron concentration that will correlate directly with the normal RCS, the dilution factor must be multiplied by the analyzed sample concentration (obtained from the Boron Titration).

$$\text{ppm B} = \text{measured ppm B} \times \frac{\text{Total dilution volume (sample loop + dilution water), mls}}{\text{sample loop volume, mls}}$$

5.13.2.4 Record results of boron sample analysis on Enclosure 7.7.

5.13.2.5 Perform a chloride analysis of the sample.

- To obtain a Cl concentration that will correlate directly with the normal RCS, the dilution factor must be multiplied by the analyzed sample concentration.

$$\text{ppb Cl} = \text{measured ppb Cl} \times \frac{\text{Total dilution volume (sample loop + dilution water), mls}}{\text{sample loop volume, mls}}$$

NOTE: **IF** the Cl results are below the Limit of detection (LOD) for the Cl analysis, multiply the LOQ by the dilution factor for reporting purposes (record as "< LOQ * dilution factor" instead of "T0").

5.13.2.6 Record results on Enclosure 7.7.

5.13.2.7 **IF** needed, reserve any remaining liquid sample for use as a backup.

5.13.3 **IF** approved by OSC & RP, prepare Panel for next use by performing the following: (PALSS Sample Panel)

- Fill buffer tanks(s) with ~ 600 mls of buffer solution for calibrating the pH meter.
  - This solution will be pressurized with nitrogen gas to at least 60 psig using the nitrogen purge system inside the PALSS sample panel.
  - Connect tank(s) to quick connect fittings inside sample panel.

NOTE:
1. Always fill Buffer Tank A with a pH 7 buffer. Buffer Tank B should be filled with a pH 4 buffer if expected pH < 7.0 **OR** a pH 10 buffer if expected pH > 7.0.
2. Buffer tanks may be pre-prepared and stored inside of PALSS sample panel. Verify that buffer expiration dates have not been exceeded.

- Fill the 50 ml sample flush cylinder with demineralized water for flushing the liquid sample from the Rheodyne sample injection valves.
  - While holding in a vertical position, attach the matching quick disconnects and fill the cylinder from the bottom to the top using demineralized water.
  - Connect to sample shelf inside sample panel.

- Replace Gas Bomb Septa.

5.13.4 Ensure all data is recorded and Enclosure 7.7 is complete.

5.13.5 Route this procedure along with the gamma spectra(s) to the OSC.

6. References

6.1 NUREG-0737, Section II.B.3

6.2 DPC System Radiation Protection Manual

6.3 Post Accident Liquid Sampling System Manual, Production Support Department, OM-311C-0331

6.4 ASTM Volume 11.01, D-1293-84 (1990)

6.5 DPC LM-O-P008

6.6 DPC LM-O-P004

6.7 ITS 5.5.4

7. Enclosures

7.1 Valve Arrangement Diagram (Control Panel)

7.2 Valve Arrangement Diagram (General - One Line)

7.3 PALSS Inlet Filter/Strainer Back Flush Procedure

7.4 Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

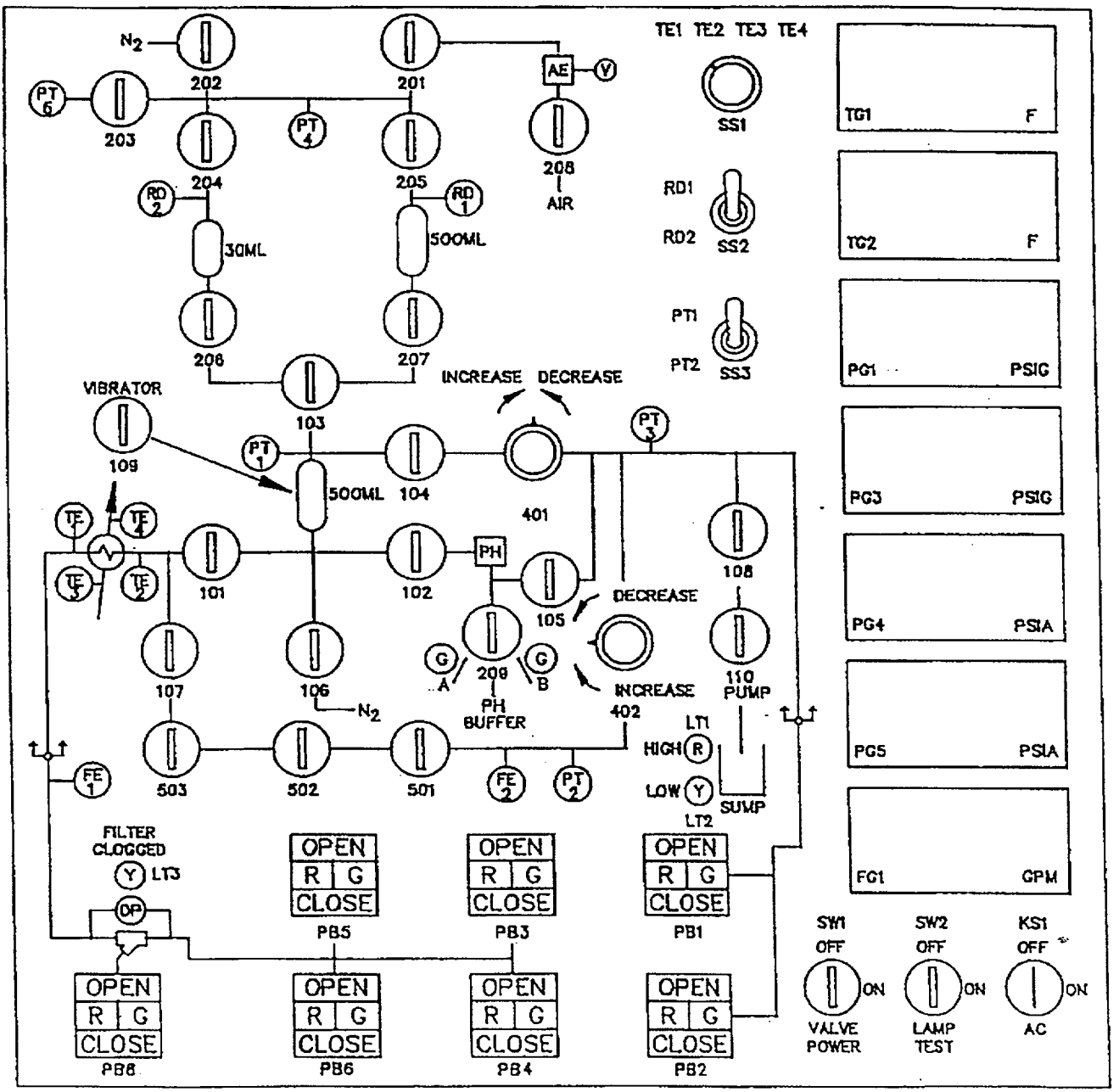
7.5 Unit 1 PALSS Power Supply

7.6 Operations Checklist for Unit 1 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

7.7 PALSS Authorization for Operation and Data Transmittal Form

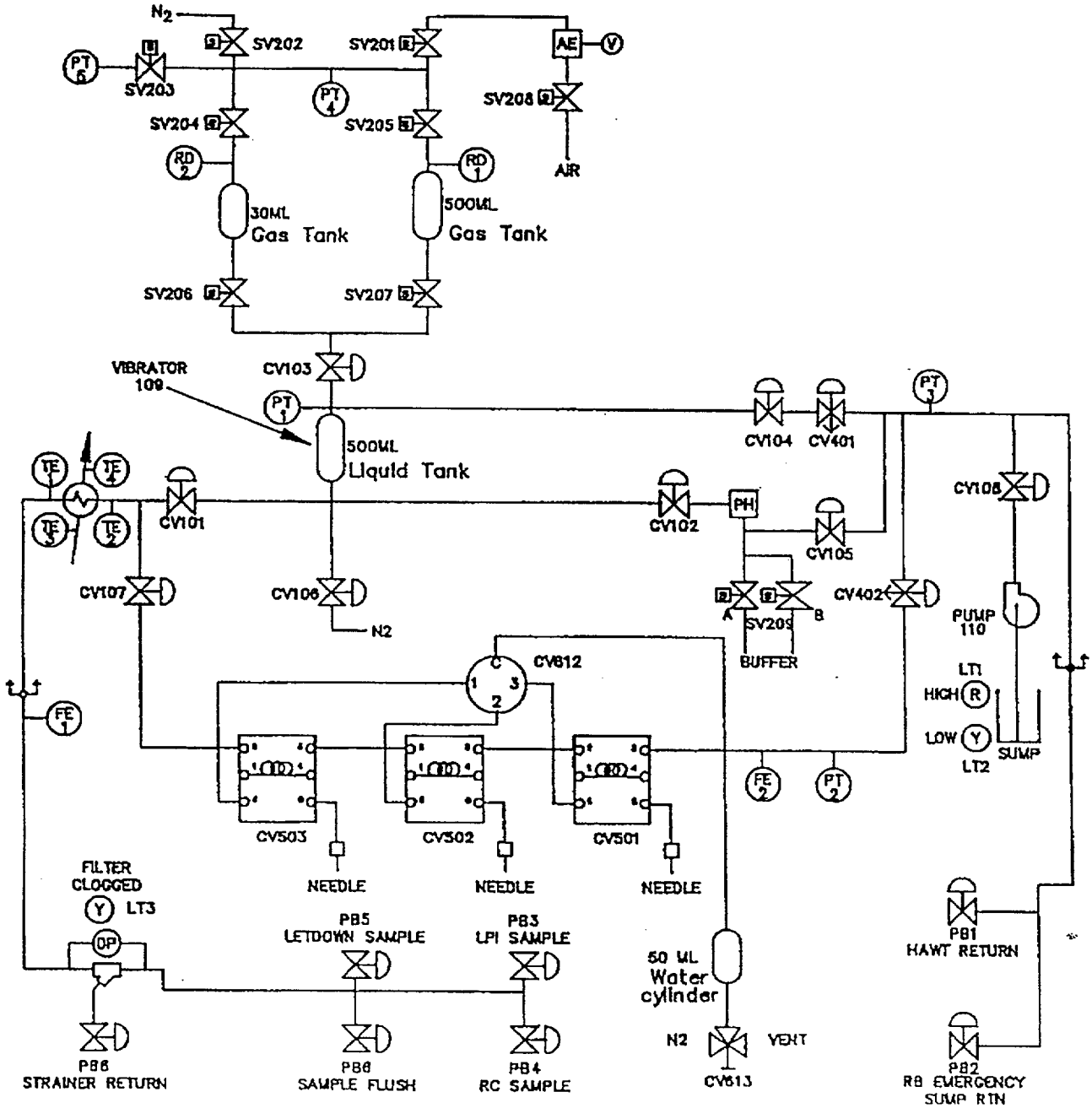
Enclosure 7.1

Valve Arrangement Diagram
(Control Panel)



Enclosure 7.2

Valve Arrangement Diagram
(General - One Line)



PALSS Inlet Filter/Strainer
Back Flush Procedure

1. Purpose

This enclosure gives instructions for back flushing the PALSS inlet filter/strainer.

2. Limits and Precautions

The following RCS sample valves must be closed to prevent contamination of the demineralized water header with reactor coolant: (PALSS Control Panel)

- PB 5 (1LP-124, Isolation for HP Sample Letdown)
- PB 3 (1LP-126, Isolation for LP Sample)
- PB4 (1RC-179, Post Accident Sample Block)

3. Procedure (PALSS Control Panel)

☐ 3.1 Ensure closed PB 5 (1LP-124, Isolation for HP Sample Letdown).

☐ 3.2 Ensure closed PB 3 (1LP-126, Isolation for LP Sample).

☐ 3.3 Ensure closed PB 4 (1RC-179, Post Accident Sample Block).

☐ 3.4 After ≥ 30 seconds, close 104.

☐ 3.5 Ensure SS 3 (selector switch) is in the "PT-1" position.

☐ 3.6 Monitor pressure on PG-1 for one minute.

☐ 3.6.1 **IF** the pressure on PG-1 > 60 psi **OR** is increasing with time, immediately contact Chemistry Staff and notify the RCS may be leaking by PB 5 (1LP-124, Isolation for HP Sample Letdown), PB 3 (1LP-126, Isolation for LP Sample) **OR** PB 4 (1RC-179, Post Accident Sample Block).

- Do **NOT** proceed without Staff approval.

☐ 3.7 Close 101

☐ 3.8 Open PB 8 (1LP-129, Sample Drain to the High Activity Waste Tank)

☐ 3.9 Open PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)

☐ 3.10 Backflush ≥ 5 minutes, then close:

☐ 3.10.1 PB 6 (1DW-278, DW Flush Supply to Post Accident Sample)

☐ 3.10.2 PB 8 (1LP-129, Sample Drain to the High Activity Waste Tank)

3.11 **IF** the purpose is to resume sampling, open:

- PB 5 (1LP-124, Isolation for HP Sample Letdown)

OR • PB 3 (1LP-126, Isolation for LP Sample)

OR • PB 4 (1RC-179, Post Accident Sample Block)

☐ 3.11.1 Open 104

☐ 3.11.2 Open 101

☐ 3.11.3 Return to procedural step allowing completion of the sampling process.

3.12 **IF** the clogged filter light is still "ON" and no flow is shown on FG 1, stop sampling.

3.13 Notify Chemistry Staff.

Staff Notified: _____

Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

1. Purpose

This enclosure provides guidance on calculations for hydrogen using Ideal Gas Laws.

2. Limits and Precautions

N/A

3. Procedure

3.1 Record the initial and final temperature and pressure readings from Steps 5.7.6.4 and 5.7.6.8.

Initial Temperature Reading _____ °F

Final Temperature Reading _____ °F

Initial Pressure Reading _____ PSIA

Final Pressure Reading _____ PSIA

3.2 Calculate the average gas temperature reading using the following equation:

$$T_{avg} = (T_{final} + T_{init})/2$$

where, T_{avg} = Average Gas Temperature, °C

T_{final} = Final Gas Temperature Reading, °C

T_{init} = Initial Gas Temperature Reading, °C

3.3 Calculate the differential gas pressure using the following equation:

$$P_{diff} = P_{final} - P_{init}$$

where, P_{diff} = Differential Gas Pressure, PSI

P_{final} = Final Gas Pressure Reading, PSIA

P_{init} = Initial Gas Pressure Reading, PSIA

Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

3.4 Calculate the hydrogen concentration of the trapped PALSS gas sample using the following equation:

$$H_2 = \frac{(3{,}719.83)(P_{diff})}{(T_{avg} + 273)} + \frac{(P_{final} - 0.69)}{0.769}$$

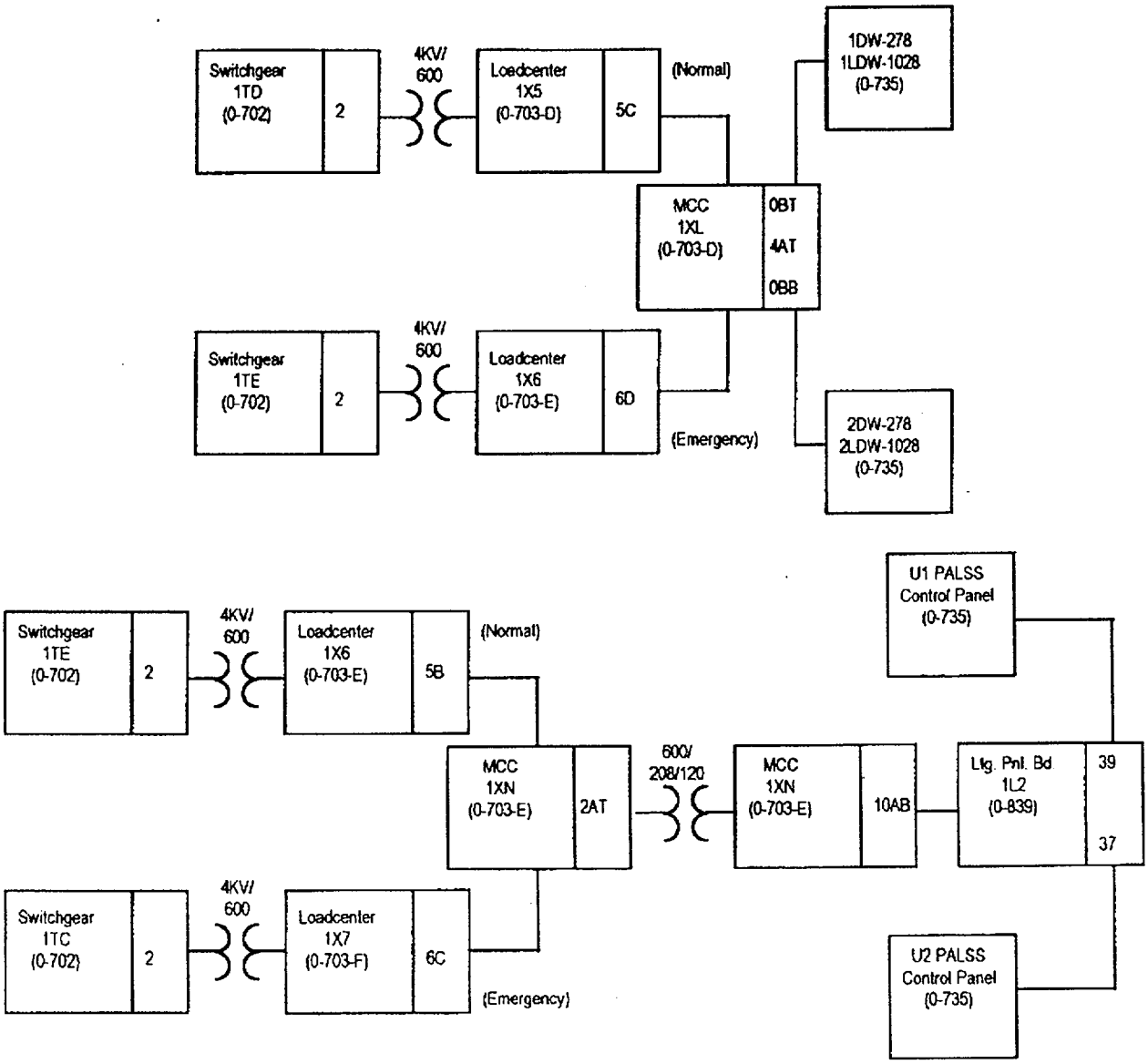
(H_2 in Gas Sample) (H_2 remaining in Liquid Sample)

where, H_2 = PALSS gas sample Hydrogen Concentration, cc/Kg

3.5 Record hydrogen concentration result from Step 3.4 above on Enclosure 7.7.

Enclosure 7.5

Unit 1 PALSS Power Supply



Operations Checklist for Unit 1 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

1. Purpose

This enclosure gives the valve lineups needed for routing reactor coolant from the RCS "J" Leg through the PALSS to the RBES.

2. Limits and Precautions

2.1 Demineralized water header should be in service and have at least 60 psi pressure. RCW (sample cooling supply) should also be in service.

3. Procedure

3.1 Establish communications with Chemistry personnel assigned to the task.

Chemistry personnel assigned: _____

CAUTION: **IF** containment integrity is required or is to be considered, station personnel in constant communication with the Control Room in the vicinity of 1LP-65 ('1B' Emer Sump Line Drain Block) to immediately close 1LP-65 **IF** ES actuation occurs.

DV _____ 3.2 Open 1LP-65 ('1B' Emer Sump Line Drain Block) (Unit 1 LPI Room) manual valve to be operated by reach rod from LPI Hatch Room 119 (on west wall ~ 9 ft. to the right of 1LP-22).

_____ 3.3 Record that the valve is open in OP/0/A/1102/020 (Shift Turnover).

3.4 Establish flow to the PALSS panel via the RCS "J" Leg as follows:

3.4.1 Remove tag from breaker #14 on 1KVIB for:

_____ • 1RC-162 (RC Sample Valve) (inside RB, operated from Control Room)

_____ • 1RC-164 (RC Sample Isolation Valve) (Unit 1LPI Room, operated from Control Room)

_____ 3.4.2 Close breaker #14.

_____ 3.4.3 Remove tag from breaker #4 on 1KVIA for 1RC-165, (RC Sample Isolation Valve (Solenoid Valve)). (Unit 1LPI Room, operated from Control Room)

_____ 3.4.4 Close breaker #4.

Operations Checklist for Unit 1 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

CAUTION: **IF** containment integrity is required or is being considered, assign an Operator to close 1RC-162, 1RC-163, 1RC-164, and 1RC-165 in case of an ES Actuation.

_____ _____ 3.4.5 Open 1RC-162 (RC Sample Valve). (inside RB, operated from Control Room)
DV

_____ _____ 3.4.6 Open 1RC-163 (RC Sample Isolation Valve (Solenoid Valve). (inside RB, operated from Control Room)
DV

_____ _____ 3.4.7 Open 1RC-164 (RC Sample Isolation Valve). (Unit 1 LPI Room, operated from Control Room)
DV

_____ _____ 3.4.8 Open 1RC-165 (RC Sample Isolation Valve (Solenoid Valve). (Unit 1 LPI Room, operated from Control Room)
DV

_____ 3.4.9 Record that 1RC-164 (RC Sample Isolation Valve) and 1RC-165 (RC Sample Isolation Valve (Solenoid Valve)) are open in OP/0/A/1102/020 (Shift Turnover).

3.5 Chemistry will notify Operations **WHEN** the RCS sample has been obtained

Operations notified: _____

3.6 Chemistry will ask Operations to close the following valves. (operated from Control Room)

_____ _____ 3.6.1 1RC-165 (RC Sample Isolation Valve (Solenoid Valve)). (Unit 1 LPI Room)
DV

_____ _____ 3.6.2 1RC-164 (RC Sample Isolation Valve). (Unit 1LPI Room)
DV

_____ 3.6.3 Record that containment isolation valves 1RC-164 (RC Sample Isolation Valve) and 1RC-165 (RC Sample Isolation Valve (Solenoid Valve)) are closed in OP/0/A/1102/020 (Shift Turnover).

_____ _____ 3.6.4 1RC-163 (RC Sample Valve (Solenoid Valve)). (Reactor Building)
DV

_____ _____ 3.6.5 1RC-162 (RC Sample Valve). (Reactor Building)
DV

Operations Checklist for Unit 1 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

3.7 **WHEN** RCS sampling is complete, ensure open the following breakers:

_____ 3.7.1 Tag open breaker #14 on 1KVIB for OP/1/A/1102/001 (Unit Startup).

NOTE:	Both 1RC-162 (RC Sample Valve) and 1RC-164 (RC Sample Isolation Valve) are powered from this breaker.

_____ 3.7.2 Tag open breaker #4 on 1KVIA for 1RC-165 (RC Sample Isolation Valve (Solenoid Valve)) for OP/1/A/1102/001 (Unit Startup).

3.8 Close 1LP-65 ('1B' Emer Sump Line Drain Block). (operated by reach rod from LPI Hatch Rm. 119, on west wall ≈ 9 ft. to the right of 1LP-22)

3.9 Record that 1LP-65 ('1B' Emer Sump Line Drain Block) is closed in OP/0/A/1102/020 (Shift Turnover).

_____ 3.10 Ensure completed enclosure is maintained by Chemistry.

PALSS Authorization for Operation and Data Transmittal Form

Date _____

____ **1. Verbal/written direction for sampling the Reactor Coolant via the PALSS has been received from the TSC/OSC.**

Sample Point: RCS "J-Leg" _____ Waste Route: RBES _____

LPI Pump Discharge_____ HAWT _____

HPI Letdown _____

Person Authorizing Sampling _____

____ **2. The specific post-accident analysis requested by TSC/OSC:**

____ Boron = _____ppm

____ Hydrogen = _____cc/kg

____ Chloride = _____ppm

____ pH = _____

____ Gas Gamma (attach)

____ Liquid Gamma (attach)

____ Other (specify) _____

3. Have RP determine general area dose rate at the PALS valve panel and record below.

Dose rate (general area) = _____ r/hr

____ **4. Determine by detailed planning meeting the exact course of action and data required.**

____ **5. Evaluate the use of portable shielding, remove handling equipment, video equipment, etc., to minimize the exposure to personnel while sampling.**

____ **6. Have RP determine 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.**

____ **7. Determine how long to flush the PALSS sample panel, based on general area dose readings.**

____ **8. Request RP to designate a route from PALSS to the Lab.**

Sample route designated:_____

_____

9. Evaluate the use of portable shielding, remove handling equipment, video equipment, etc., to minimize the exposure to personnel in the Lab for the required analyses.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. CP/2/A/2002/004 C
Revision No 19
Continuous Use

INFORMATION ONLY

PREPARATION

(2) Station Oconee Nuclear Station

(3) Procedure Title Operating Procedure for the Post Accident Liquid Sampling System (PALSS)

(4) Prepared By _____ Date 12/13/99

(5) Requires 10CFR50.59 evaluation?
- ☑ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By _____ (QR) Date 12-14-99
Cross-Disciplinary Review By _____ (QR)NA N/A Date _____
Reactivity Mgmt. Review By _____ (QR)NA N/A Date _____

(7) Additional Reviews
QA Review By _____ Date _____
Reviewed By _____ Date _____
Reviewed By _____ Date _____

(8) Temporary Approval *(if necessary)*
By _____ (SRO/QR) Date _____
By _____ (QR) Date _____

(9) Approved By _____ Date 12/16/99

PERFORMANCE ***(Compare with control copy every 14 calendar days while work is being performed.)***

(10) Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____
Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification
- ☐ Yes ☐ NA Check lists and/or blanks initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ NA Listed enclosures attached?
- ☐ Yes ☐ NA Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ NA Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ NA Procedure requirements met?

Verified By _____ Date _____

(13) Procedure Completion Approved _____ Date _____

(14) Remarks *(Attach additional pages, if necessary)*

Operating Procedure for the Post Accident Liquid Sampling System (PALSS)

1. Purpose

NOTE:	Seven Control copies and one Information Only copy of this procedure shall be routed to the Emergency Preparedness Team within three working days after any approved changes.

The post accident liquid sampling system (PALSS) provides the capability to obtain a primary coolant sample via the HPI Letdown, LPI Pump Discharge or the RCS "J" leg during a nuclear reactor accident condition(s) as described in the FSAR and in accordance with NUREG-0737.

2. Limits and Precautions

2.1 This procedure should be used to operate PALSS to sample the Reactor Coolant System under the following conditions:

2.1.1 Post Accident.

2.1.2 Inaccessibility of (routine) Primary Sampling Area **AND/OR** HPI Letdown Sampling not possible.

2.1.3 Request from the Chemistry Manager or his designee.

2.2 Under accident conditions, valve alignments shall **NOT** be made and samples shall **NOT** be taken without prior authorization from the Emergency Coordinator **OR** the TSC/OSC! (Containment isolation valves may be closed upon ES actuation, see Enclosure 7.6.)

2.3 Under accident conditions, do **NOT** attempt any phase of sampling **OR** analysis without Radiation Protection job coverage!

2.4 Consider portable shielding, remote handling equipment, video equipment, etc., where practical or available during sampling, sample preparation, and sample analysis.

2.5 Chemistry personnel shall operate only those valves operated by the Control Panel **OR** via the sample panel unless clearly specified otherwise in this procedure.

2.6 **IF** power is **NOT** available at the PALSS Control Panel, return to a low dose area and contact Chemistry management.

2.6.1 Refer to Enclosure 7.5 and troubleshoot as required to determine source of problem.

2.6.2 Notify the OSC/TSC.

2.6.3 **IF** necessary, request the OSC have Operations ensure the following breakers are closed (to ensure power availability).

- 1L2 Bkr. #39 Sampling/Control Panels Power Supply (located next to U2 sampling panel)
- MCC1XL Bkr. for 1DW-278 (DW Flush Supply to Post Accident Sample) (PALSS Control Panel)

2.7 **IF** reviewed and approved by a supervisor and one other individual who is familiar with this procedure, steps may be performed out of sequence.

2.8 Steps preceded by "____" in the left margin are sign off steps. These steps must be signed off before continuing. Steps preceded with " ☐ " (immediately to the left of the step) are check off steps and should be checked off as completed.

2.9 Independent Verification (designated by two sign-off steps) is a documented check by a second individual which helps to ensure the correct condition or position of plant components. Separate Verification (designated by SV) ensures individuals act separately and independently. Double Verification (designated by DV) ensures the "doer" and "verifier" independently decide that an action is correct prior to the "doer" performing the action. The "verifier" shall use a "hands on" approach to verify the action of the "doer".

CAUTION: Chemical hazards shall be known prior to use. For additional information and first aid requirements, refer to the MSDS sheet.

2.10 Personal protective requirements for chemicals used in this procedure are pH buffers 4.0, 7.0, and 10.0:

- lab coat
- gloves (rubber/vinyl)
- chemical splash goggles

2.11 **WHEN** flushing the desired sample to the waste tanks, request Operations add a second compressor on the GWD header because fresh fission gasses may cause a serious problem in the Aux. Building.

- **IF** possible, this increased vacuum should be maintained until sampling is complete.

2.12 All sample vials should be cleaned and rinsed to protect against chloride contamination.

- Do **NOT** place bare finger tips on the surface of the septum.

3. Apparatus

3.1 A minimum of 4 Lockable Glass (Gas) Syringes (1 to 2 ml size only)

3.2 Liquid Sample Carrier (Bucket, Etc.), Gas Syringe Carrier

3.3 Watch or Lab Timer

3.4 Plastic Bags

3.5 15 - 40cc Evacuated Sample Vial(s) for Liquid Sample

3.6 Nitrogen Supply Bottle with > 600 psi available. (with Two Stage Regulator; 0 to 200 psig on Delivery Stage) replace as required

4. Reagents

4.1 Buffer Solutions - Use purchased 4.00, 7.00 and/or 10.00 buffers or equivalent

5. Procedure

5.1 Prerequisites and Panel Preparation (preliminary)

5.1.1 Initiate Enclosure 7.7.

5.1.2 **IF** routing waste to the RBES or sampling from the RCS "J" Leg:

- Take Enclosure 7.6 to the responsible individual in Operations (designated by the OSC) for completion.
- Request Operations complete the appropriate step(s) of Enclosure 7.6.

5.1.3 Label glass vial(s) for collecting the liquid sample.

5.2 Panel Preparation (prior to sampling)

NOTE: **IF** any item on the control or sample panel is not clearly identified, refer to Enclosure 7.1 and 7.2.

☐ 5.2.1 Inform the U-1 Control Room that sampling of the RCS will be done via the PALSS panel.

- Identify the flowpath J-Leg, LPI **OR** Letdown.
- Recommend an extra waste gas compressor be placed into service.

Operator Notified: _____

5.2.2 At the Control Panel, ensure that SW 1 (valve power switch), is in the "OFF" position.

- Ensure PALSS safety switch is "ON".

CAUTION: Make the mating of connector cable 1 to connector 1 on the Junction Box the LAST cable connection made. **IF** this is not done last, the exposed pins of the other cables may become energized and become an electrical hazard.

☐ 5.2.3 Position the Control Panel using RP as a guideline, in the lowest dose area possible.

☐ 5.2.4 **IF** necessary, route and connect the six required cables (CON 6 - CON 1) from the Control Panel to the Junction Box, starting with connector 6 and ending with connector 1.

☐ 5.2.4.1 Connect CON-6 cable at both ends.

☐ 5.2.4.2 Connect CON-5 cable at both ends.

☐ 5.2.4.3 Connect CON-4 cable at both ends.

☐ 5.2.4.4 Connect CON-3 cable at both ends.

☐ 5.2.4.5 Connect CON-2 cable at both ends.

☐ 5.2.4.6 Connect CON-1 cable at the PALSS control panel end.

☐ 5.2.4.7 Connect CON-1 cable to the junction box last.

☐ 5.2.5 Ensure off all control and solenoid valves (no lights).

5.2.6 Position the following valves: (outside of Sample Panel)

CAUTION: Nitrogen cylinder must be replaced if pressure is < 600 psig in order to prevent backflow of fission gas into the cylinder.

☐ Open valve(s) on Nitrogen Supply Bottle (> 600 psi tank pressure required & ~100 psi delivery pressure)

☐ **IF** necessary, replace cylinder.

☐ Open 2IA-2423 (Instrument Air Supply).

NOTE: The following switches are found on the PALSS Control Panel.

☐ 5.2.7 Turn system power on by inserting Control Panel Key into (KS 1) Key Lock Switch and turning the key.

NOTE: The lights in the middle of each switch which controls a valve should be "OFF". The green lights should be "LIT" on the push-button switches, (PB 1) through (PB 8).

☐ 5.2.8 Ensure all lamps on the Control Panel are functioning by turning ON SW 2 (lamp test switch).

☐ 5.2.9 Make note of **OR** repair any not functioning properly. (The lamp test switch does not light).

☐ 5.2.9.1 Turn SW 2 (lamp test switch) to "OFF".

☐ 5.2.10 Turn SW 1 (valve power switch) to the "ON" Position.

NOTE: In an accident situation, waste will be routed to the RBES unless otherwise directed by supervision. The alternate route is the HAWT via PB1 (2LP-130).

_____ 5.2.11 **IF** routing waste to the RBES, open PB2 (2LP-65, 2B Emergency Sump Line Drain Block).

_____ 5.2.12 **IF** routing waste to the HAWT, open PB1 (2LP-130, Sample Return to High Activity Waste Tank).

5.3 Panel Preparation (pH Meter Standardization) (PALSS Control Panel)

5.3.1 Purge the pH housing with Nitrogen as follows:

NOTE: All other control valves must be closed.

- ☐ 5.3.1.1 Open 204
- ☐ 5.3.1.2 Open 206
- ☐ 5.3.1.3 Open 103
- ☐ 5.3.1.4 Open 102
- ☐ 5.3.1.5 Open 105
- ☐ 5.3.1.6 Open 202
- ☐ 5.3.1.7 Wait at least 2 minutes, close 105.

5.3.2 Pressurize Buffer Tank A as follows:

NOTE: SV 209 controls both buffer tanks (A and B).

- ☐ 5.3.2.1 Place 209 in the 'A' position.
- ☐ 5.3.2.2 Wait at least 30 seconds, then place 209 in the "OFF" position.
- ☐ 5.3.2.3 Close 202

5.3.3 Evacuate pH housing as follows:

- ☐ 5.3.3.1 Open 208
- ☐ 5.3.3.2 Open 201
- ☐ 5.3.3.3 **WHEN** the pressure on PG 4 stabilizes (normally < 2.0 PSIA),
  - ☐ A. Close 201
  - ☐ B. Record the pH Housing pressure from PG 4 **OR** PG 5.

    pH Housing Pressure for A Buffer = _____ PSIA
- ☐ 5.3.3.4 Close 102

☐ 5.3.3.5 Close 103

☐ 5.3.3.6 Close 206

☐ 5.3.3.7 Close 204

☐ 5.3.3.8 Close 208

5.3.4 Transfer A Buffer into the pH housing as follows:

☐ 5.3.4.1 Place 209 in the 'A' position.

☐ 5.3.4.2 Wait at least 1 minute, then place 209 in the "OFF" position.

5.3.5 Standardize the pH meter as follows:

NOTE: The following keys are located on the pH meter in the face of the PALSS control panel.

5.3.5.1 Use the "menu" key to move to the main menu. The display will show: ("Configuration, Calibration, Maintenance, I/O Setup").

5.3.5.2 Using the "arrow up or down" keys, move to and highlight "Calibration".

5.3.5.3 Press "enter".

5.3.5.4 Using the "arrow up or down" keys, move to and highlight "Calibration / Buffer Calibration pH".

5.3.5.5 Press the "Hold" key.

5.3.5.6 Press the "next" key to move to the next screen.

NOTE:
- A flashing value indicates the probe may be broken.
- A value that **CANNOT** be adjusted to within ± .5 pH offset will make the unit return to the calibration screen, indicating that the pH electrode may need to be replaced.

5.3.5.7 The display will show the pH of the 'A' buffer solution.

5.3.5.8 Wait for a stable reading, then using the "function keys, side to side" select the desired digit space and change the value on the display using the "arrow up and down" keys to match the actual 'A' buffer pH.

5.3.5.9 **WHEN** the unit display indicates the buffer pH, press the "ENTER" key.

5.3.5.10 Record the pH meter value set for the 'A' buffer pH.

'A' Buffer Solution pH _____

5.3.5.11 **WHEN** the unit successfully meets the preset specifications and the entered buffer value is displayed, press "next" until the screen with the following is visible:

SLOPE

Note: Buffer must be > 2 pH units away from the STD buffer.

NOTE: The unit should still be in the "hold" mode.

5.3.5.12 Press "next". The following screen should be visible:

SLOPE

Place electrode in Buffer Attention.
Wait for Stable Reading!

5.3.6 Flush the pH housing with DW as follows:

☐ 5.3.6.1 Open 101

☐ 5.3.6.2 Open 102

☐ 5.3.6.3 Open 105

☐ 5.3.6.4 Open PB-6 (2DW-278, DW Flush Supply to Post Accident Sample).

☐ 5.3.6.5 Wait at least 5 minutes, close 101.

☐ 5.3.6.6 Close PB-6 (2DW-278, DW Flush Supply to Post Accident Sample).

5.3.7 Purge the demineralized water out of the pH housing with nitrogen as follows:

- ☐ 5.3.7.1 Open 202
- ☐ 5.3.7.2 Open 204
- ☐ 5.3.7.3 Open 206
- ☐ 5.3.7.4 Open 103
- ☐ 5.3.7.5 Place 209 in the 'A' position.
- ☐ 5.3.7.6 Place 209 in the "OFF" position.
- ☐ 5.3.7.7 After at least 2 minutes, close 105.

5.3.8 Pressurize Buffer Tank B as follows:

- ☐ 5.3.8.1 Place 209 in the 'B' position.
- ☐ 5.3.8.2 Wait at least 30 seconds, place 209 in the "OFF" position.
- ☐ 5.3.8.3 Close 202

5.3.9 Evacuate pH housing as follows:

- ☐ 5.3.9.1 Open 208
- ☐ 5.3.9.2 Open 201
- ☐ 5.3.9.3 **WHEN** the pressure on PG 4 stabilizes (normally < 2.0 PSIA), close 201.
- ☐ 5.3.9.4 Record pH Housing pressure from PG 4.

  pH Housing Pressure for B Buffer = _____ PSIA
- ☐ 5.3.9.5 Close 102
- ☐ 5.3.9.6 Close 103
- ☐ 5.3.9.7 Close 206
- ☐ 5.3.9.8 Close 204
- ☐ 5.3.9.9 Close 208

5.3.10 Transfer B Buffer into the pH housing as follows:

☐ 5.3.10.1 Place 209 in the 'B' position.

☐ 5.3.10.2 Wait at least 1 minute, place 209 in the "OFF" position.

5.3.11 Calibrate the pH meter as follows: (pH meter on the face of the PALSS Control Panel)

NOTE: The unit should still be in the "HOLD" mode. This key causes the pH meter to maintain a constant output and alarm condition. This allows the electrode to be removed (optional) for calibration in a buffer without process upset. The temperature compensation feature is also disabled in the "HOLD" mode (this allows calibration of the meter to the particular temperature of the buffer used).

5.3.11.1 Press "next". The display will show the pH of the 'B' buffer as measured by the electrode.

5.3.11.2 Wait for a stable reading, then select the desired digit space using the "function keys side to side".

5.3.11.3 Adjust the value on the display using the "arrow up and down" keys, until the display matches the actual pH of the buffer solution.

5.3.11.4 Press "enter". This will set the instrument slope.

5.3.11.5 Record the pH meter value set for the 'B' buffer pH.

'B' Buffer Solution pH _____

5.3.11.6 **IF** the slope adjustment was successful, the Completed screen will be displayed:

SLOPE
Slope Completed
Slope Buffer Value Saved

5.3.11.7 Using the "hold" key, take the unit out of the hold mode.

NOTE: **IF** the calibration was not successful, the menu will return to the original Calibration Menu by itself and display an error code.

5.3.11.8 Use the "next" key to rotate back to the original Calibration menu screen.

5.3.11.9 Press the "Display" key. The pH meter is now in the sample measurement mode.

5.3.12 Flush the pH housing with DW as follows:

☐ 5.3.12.1 Open 101

☐ 5.3.12.2 Open 102

☐ 5.3.12.3 Open 105

☐ 5.3.12.4 Open PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

☐ 5.3.12.5 Ensure the pH meter reads demin water header pH (~ 5 to 7) for an adequate flush.

☐ 5.3.12.6 Wait ≥ 3 minutes, close 101.

☐ 5.3.12.7 Close PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

5.3.13 Purge the demineralized water out of the pH housing with nitrogen as follows:

☐ 5.3.13.1 Open 202

☐ 5.3.13.2 Open 204

☐ 5.3.13.3 Open 206

☐ 5.3.13.4 Open 103

☐ 5.3.13.5 Wait ≥ 2 minutes **OR** until pressure on PG 3 drops rapidly (below 50 psi), then close 105.

☐ 5.3.13.6 Place the 209 in the 'B' position.

☐ 5.3.13.7 Place the 209 in the "OFF" position.

☐ 5.3.13.8 Close 202

☐ 5.3.13.9 Close 204

☐ 5.3.13.10 Close 206

☐ 5.3.13.11 Close 103

☐ 5.3.13.12 Close 102

☐ 5.3.13.13 Close 105

5.4 Panel Preparation (pH Housing and Gas Tank(s) Evacuation) (PALSS Control Panel)

5.4.1 Evacuate pH housing and gas tanks as follows:

☐ 5.4.1.1 Open 208

☐ 5.4.1.2 Open 201

☐ 5.4.1.3 Open 203

☐ 5.4.1.4 Open 204

☐ 5.4.1.5 Open 205

☐ 5.4.1.6 Open 206

☐ 5.4.1.7 Open 207

☐ 5.4.1.8 Open 103

☐ 5.4.1.9 Open 102

☐ 5.4.1.10 Monitor the pressure in the pH housing and gas tanks on PG 5 **OR** PG 4.

- **WHEN** the pressure stabilizes (normally < 2.0 PSIA), close 201.

☐ 5.4.1.11 Close 208

5.4.2 pH Housing Pressure

☐ 5.4.2.1 Record pH Housing pressure from PG 5 (alternate PG 4).

pH Housing Pressure _____ PSIA

☐ 5.4.2.2 Close 102

☐ 5.4.2.3 Close 103

☐ 5.4.2.4 Close 206

☐ 5.4.2.5 Close 207

5.4.3 30 ml and 500 ml Gas Tanks Pressure

☐ 5.4.3.1 Record gas tank pressures from PG 5 (alternate PG 4).

Gas tanks (30ml and 500ml) pressure _____ PSIA

☐ 5.4.3.2 Close 205

☐ 5.4.3.3 Close 204

☐ 5.4.3.4 Close 203

5.5 Panel Operation (Reactor Coolant Sample Flush/Acquisition) (PALSS Control Panel)

NOTE: The sample will be taken via the LPI pump discharge, HPI Letdown, or the RCS "J-Leg" sample point.

CAUTION: 1. PB 6 (2DW-278) must be closed to prevent flow of RCS into the demineralized water header.

2. CV-102 and CV-105 must be closed to prevent overpressurization and failure of the pH housing.

_____ 5.5.1 Ensure closed the following valves:

5.5.1.1 Close PB-6 (2DW-278, DW Flush Supply to Post Accident Sample).

5.5.1.2 Close 102

5.5.1.3 Close 105

☐ 5.5.2 Ensure SS 3 (selector switch) is in the "PT 1" position.

_____ 5.5.3 **IF** sampling the RCS "J-Leg", then open PB 4 (2RC-179, Post Accident Sample Block).

_____ 5.5.4 **IF** sampling the LPI pump Discharge, then open PB 3 (2LP-126, Isolation for LP Sample).

_____ 5.5.5 **IF** sampling the HPI Letdown, then open PB 5 (2LP-124, Isolation for HP Sample Letdown).

☐ 5.5.6 Open 101

☐ 5.5.7 Open 104

CAUTION: Monitor PG 3 to ensure that the outlet pressure does **NOT** exceed 600 PSIG. Adjust slowly.

☐ 5.5.8 Open 401 to establish the maximum flow without exceeding 600 PSIG on PG 3.

☐ 5.5.9 Record the flowrate from FG1 _____ gpm.

☐ 5.5.10 Record the pressure from PG 3 _____ psig.

5.5.11 **IF** LT 3 (clogged filter light switch) comes on and remains on, but flow on FG-1 is > 1.5 gpm, continue with procedure.

- **IF** flow is < 1.5 gpm, contact Chemistry Staff for further instructions.
- **IF** directed by management, proceed to Enclosure 7.3.

☐ 5.5.12 Select the desired thermocouple to monitor the inlet **OR** outlet of the sample, **OR** the cooling water using SS 1:

TE 1 - Measures sample inlet to heat exchanges.

TE 2 - Measures sample return from heat exchanger.

TE 3 - Measures cooling water inlet to heat exchanger.

TE 4 - Measures cooling water return from heat exchanger.

☐ 5.5.12.1 Switch SS 1 to "TE 1"

☐ 5.5.12.2 Record sample inlet temperature on TG 1.

INLET TEMPERATURE _____°F

☐ 5.5.12.3 Switch SS 1 to "TE 2".

☐ 5.5.12.4 Record sample outlet temperature on TG 2.

OUTLET TEMPERATURE _____°

5.5.13 After > 15 gallons have flowed through the system (calculate time based on FG-1 reading):

☐ 5.5.13.1 Slowly throttle 401 until fully closed.

☐ 5.5.13.2 Immediately close 104

☐ 5.5.13.3 Immediately close 101

☐ 5.5.13.4 Record 500 ml liquid tank pressure from PG 1.

Pressure = _____ PSIG

☐ 5.5.14 Move selector switch SS 3 to the "PT 2" position to measure discharge pressure of the injection valves.

NOTE: There are two continuous flow paths through the sample valve(s). When the valve(s) is opened, the sample loop is moved to the sample flow path. When the valve(s) is closed, the sample loop is moved to the sample injection (collection) flow path.

5.5.15 Ensure open the desired sample injection valve(s) of the 0.1 ml, 1 ml and/or 5 ml loop, respectively (normally the 5 ml and 1 ml loop are used):

☐ 503 (0.1 ml Loop)

☐ 502 (1 ml Loop)

☐ 501 (5 ml Loop)

☐ 5.5.16 Open 107

☐ 5.5.17 Slowly open 402 keeping flowrate on FG 2 < 300 ml/min.

NOTE: Greater than 40 PSIG sample pressure must be supplied to the injection valves.

5.5.18 After ≥ 5 minutes, close the sample injection valve(s) opened in Step 5.5.15.

☐ 503 (0.1 ml Loop)

☐ 502 (1 ml Loop)

☐ 501 (5 ml Loop)

5.5.19 Record sample time: _____

_____ 5.5.20 Close the sample valve selected in Step 5.5.3 or 5.5.4 or 5.5.5

- PB 4 (2RC-179, Post Accident Sample Block)
- PB 3 (2LP-126, Isolation for LP Sample)
- PB 5 (2LP-124, Isolation for HP Sample Letdown)

☐ 5.5.21 After 1 minute, close 402.

CAUTION: **IF** the pressure on PG-1 is > 100 psi or is increasing with time, contact Chemistry Staff and notify that RCS is leaking by sample valve.

☐ 5.5.22 After 1 minute, record the pressure on PG-1: _____psi

☐ 5.5.23 Close 107

5.6 Depressurization (PALSS Control Panel)

☐ 5.6.1 Ensure SS 3 (selector switch) is in the "PT 1" position.

☐ 5.6.2 Ensure closed 206

☐ 5.6.3 Ensure closed 207

☐ 5.6.4 Open 103

☐ 5.6.5 Wait ≥ 2 minutes.

NOTE: Pressure on PG 1 should be < 50 PSIG.

☐ 5.6.6 Record the pressure from PG 1 _____ PSIG.

5.7 Gas Collection (PALSS Control Panel)

5.7.1 Verify pressure in the 30 ml and 500 ml gas tank is ≤ 2.0 PSIA.

For 500 ml Gas Tank:

☐ 5.7.1.1 Open 205

☐ 5.7.1.2 Open 203

☐ 5.7.1.3 Record PG 5 (alternate gauge PG 4).

500 ml Gas Tank Pressure _____

☐ 5.7.1.4 Close 205

☐ 5.7.1.5 Close 203

For 30 ml Gas Tank:

☐ 5.7.1.6 Open 204

☐ 5.7.1.7 Open 203

☐ 5.7.1.8 Record PG 5 (alternate gauge PG 4).

30 ml Gas Tank Pressure _____

☐ 5.7.1.9 Close 204

☐ 5.7.1.10 Close 203

5.7.2 **IF** the pressure in the 30 ml and 500 ml Gas Tank is ≤ 2.0 PSIA, proceed to Step 5.7.5 **IF** the Nitrogen stripping method is to be used for gas collection and analysis.

5.7.3 **IF** the alternate method (Total Gas Method) is to be used, proceed to Step 5.7.6.

☐ 5.7.4 **IF** the pressure in the 30 ml **OR** 500 ml Gas Tank is > 2.0 PSIA, evacuation of the tanks must be repeated as follows:

☐ 5.7.4.1 Close 103

☐ 5.7.4.2 Open 204

☐ 5.7.4.3 Open 205

☐ 5.7.4.4 Open 201

☐ 5.7.4.5 Open 208

☐ 5.7.4.6 Open 203

5.7.4.7 **WHEN** the reading from PG 5 (alternate gauge PG 4) is ≤ 2.0 PSIA, close

☐ A. 204

☐ B. 205

☐ C. 201

☐ D. 208

☐ E. 203

☐ 5.7.4.8 Open 103

5.7.4.9 **IF** the Nitrogen stripping method is to be used for gas collection and analysis, continue with Step 5.7.5.

5.7.4.10 **IF** the alternate method (Total Gas Method) is to be used, proceed to Step 5.7.6.

NOTE: Nitrogen Stripping Method is the typical method.

5.7.5 Nitrogen Stripping Method (Gas Analysis)

☐ 5.7.5.1 Ensure closed 205

☐ 5.7.5.2 Open 207

☐ 5.7.5.3 Open 106

NOTE: The pressure on PG-1 should be monitored for an increase of approximately 15 psi. Because PT-1 is a high range pressure transmitter the indicated reading on PG-1 will vary from calibration to calibration and may indicate anywhere from -15 to 15 psi initially.

☐ 5.7.5.4 For a 10 minute interval, periodically turn on 109 to vibrate 500 ml liquid tank, monitor the pressure on PG 1 (switch SS 3 to "PT 1").

☐ 5.7.5.5 Close 106

☐ 5.7.5.6 Open 205

☐ 5.7.5.7 Open 204

5.7.5.8 After ≥ 5 minutes when PG 4 (alternate PG 1) stabilizes, close:

☐ A. 204

☐ B. 205

☐ C. 207

☐ D. 103

5.7.5.9 Proceed to Section 5.8.

NOTE: Calculated method should be used only as an alternate.

5.7.6 Total Gas Method (Calculated)

☐ 5.7.6.1 Monitor PG 4.

☐ 5.7.6.2 **WHEN** the pressure shown on PG 4 is < 30 PSIA, the low range pressure transmitter, PT 5, can be used to obtain a more accurate pressure measurement.

- PT 5 can be used by opening 203.

☐ 5.7.6.3 Ensure SS 2 switch is in the "RD 2" position.

☐ 5.7.6.4 Record the initial temperature reading from TG 2 and pressure reading from PG 5.

TG 2 Init. Temp. Reading _____ °F

PG 5 Init. Press. Reading _____ PSIA

☐ 5.7.6.5 Open 206

☐ 5.7.6.6 Open 204

☐ 5.7.6.7 Turn on the vibrator using 109 and monitor PG 5.

☐ 5.7.6.8 **WHEN** the pressure of the 30 ml gas tank stabilizes, record the final pressure and temperature.

TG 2 Final Temp. Reading _____ °F

PG 5 Final Press. Reading _____ PSIA

☐ 5.7.6.9 Close 203

☐ 5.7.6.10 Close 204

☐ 5.7.6.11 Close 206

☐ 5.7.6.12 Ensure 109 is off.

☐ 5.7.6.13 Close 103

☐ 5.7.6.14 Calculate the total amount of H_2 in the sample using Enclosure 7.4.

☐ 5.7.6.15 Report results on Enclosure 7.7.

5.8 Sample pH Measurement (PALSS Control Panel)

☐ 5.8.1 Ensure closed 206

☐ 5.8.2 Ensure closed 204

☐ 5.8.3 Ensure SS 3 switch is set on PT 1.

5.8.4 Pressurize liquid tank to at least 60 PSIG as monitored on PG 1 (alternate PG 4), as follows:

☐ 5.8.4.1 Open 202

☐ 5.8.4.2 Open 205

☐ 5.8.4.3 Open 207

☐ 5.8.4.4 Open 103

☐ 5.8.4.5 After 30 seconds, close 103.

☐ 5.8.4.6 Close 207

☐ 5.8.4.7 Close 205

☐ 5.8.4.8 Close 202

☐ 5.8.5 Open 102

5.8.6 Record pH on Enclosure 7.7.

☐ 5.8.7 Close 102

5.8.8 Notify OSC that RCS sampling via the PALSS is completed and that sample retrieval will begin following system flush.

OSC Person Notified: _____

5.9 System Flush (PALSS Control Panel)

NOTE: Directions regarding sample panel flushing will be determined by management.

5.9.1 Ensure 204 and 206 remain closed and the sample injection valve(s) selected (501, 502 and/or 503) is turned off.

5.9.2 **IF** either LT 1 **OR** LT 2 indicator is illuminated:

☐ 5.9.2.1 Open 108

☐ 5.9.2.2 Turn on 110 (sump pump).

☐ 5.9.2.3 **WHEN** both LT1 and LT2 are out, close 108.

☐ 5.9.2.4 Turn off 110 (sump pump).

5.9.3 **IF** given the direction to flush the panel, flush the 500 ml liquid tank, pH housing, and sample injection valves as follows:

500 ml Liquid Tank

☐ 5.9.3.1 Open 101

☐ 5.9.3.2 Open 104

☐ 5.9.3.3 Open 401

☐ 5.9.3.4 Open PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

pH Housing

☐ 5.9.3.5 Open 102

☐ 5.9.3.6 Open 105

Sample Injection Valves

☐ 5.9.3.7 Open 107

☐ 5.9.3.8 Open 402

☐ 5.9.3.9 Flush the sample panel until the general area dose rate on the exterior of the panel is ≤ 2 mR/hr **OR** a satisfactory level is achieved per RP.

☐ 5.9.3.10 Close 402

☐ 5.9.3.11 Close 107

☐ 5.9.3.12 Close 105

☐ 5.9.3.13 Close 102

☐ 5.9.3.14 Close 101

☐ 5.9.3.15 Close 104

☐ 5.9.3.16 Close 401

☐ 5.9.3.17 Close PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

5.10 Liquid & Gas Sample Retrieval (PALSS Control Panel)

Liquid Sample Retrieval

☐ 5.10.1 Ensure open the waste route selected in Step 5.2.11 or 5.2.12:

- PB 1 (2LP-130, Sample Return to High Activity Waste Tank)

OR • PB 2 (2LP-65, 2B Emergency Sump Line Drain Block).

☐ 5.10.2 Ensure closed all other PB valves (motor operated).

☐ 5.10.3 **IF** LT 1 **OR** LT 2 is illuminated, perform Step 5.9.1.

☐ 5.10.4 Select the flow path for sample collection by turning CV 612 to the desired injection valve (0.1 ml, 1 ml, or 5 ml loop).

Sample Loop(s) Selected _____

☐ 5.10.5 Slowly turn CV 613 to the "N_2" position.

☐ 5.10.6 After collecting approximately 15 mls of liquid sample, turn CV 613 to the "VENT" position.

☐ 5.10.7 Wait ≥ 10 seconds for sample line depressurization.

☐ 5.10.8 Turn CV 612 to the "OFF" position.

☐ 5.10.9 As necessary for additional sample(s), repeat Steps 5.10.3 through 5.10.7.

Gas Sample Retrieval

☐ 5.10.10 **WHEN** possible, use the gas-tight syringe(s) to retrieve the gas sample(s) from the 30 ml gas tank keeping syringe vertical (needle down).

☐ 5.10.11 **IF** possible, place syringes in the gas locked position and store vertically (needle down).

5.11 30 ml Gas Tank and 500 ml Gas Tank Purge (PALSS Control Panel)

☐ 5.11.1 Verify Nitrogen supply still has ≥ 100 psig delivery pressure.

5.11.2 Allow all of the following valves to stay open ≥ 2 minutes except alternate the valve pairs 204/206 and 205/207 open and close within the 2 minute period:

☐ 5.11.2.1 Open 202

☐ 5.11.2.2 Open 204

☐ 5.11.2.3 Open 205

☐ 5.11.2.4 Open 206

☐ 5.11.2.5 Open 207

☐ 5.11.2.6 Open 103

☐ 5.11.2.7 Open 104

☐ 5.11.2.8 Open 401

☐ 5.11.2.9 After flushing for several seconds, close the following:

A. 204

B. 206

☐ 5.11.2.10 After additional flush for several seconds, open the following:

A. 204

B. 206

☐ 5.11.2.11 Close 205

☐ 5.11.2.12 Close 207

☐ 5.11.2.13 After several seconds, open the following:

A. 205

B. 207

☐ 5.11.2.14 **IF** the valves need further cycling (it has not been ≥ 2 minutes) return to Step 5.11.2.10.

☐ 5.11.2.15 **IF** the timer is ≥ 2 minutes, proceed to Step 5.11.3.

☐ 5.11.3 Close 202

☐ 5.11.4 Close 401

☐ 5.11.5 Close 104

☐ 5.11.6 Close 103

☐ 5.11.7 Open 201

☐ 5.11.8 Open 208

5.11.9 After ≥ 10 seconds, close the following:

☐ 5.11.9.1 206

☐ 5.11.9.2 207

☐ 5.11.9.3 204

☐ 5.11.9.4 205

☐ 5.11.9.5 201

☐ 5.11.9.6 208

☐ 5.11.10 Repeat Step 5.11.2 through 5.11.9 until dose rates of 30 ml and 500 ml tank are ≤ 10 mR/hr (at contact) **OR** a satisfactory level is achieved per RP.

5.12 System Shutdown

_____ 5.12.1 Ensure closed the following motor operated valves: (PALSS Control Panel)

☐ PB 1 (2LP-130, Sample Return to High Activity Waste Tank)

☐ PB 2 (2LP-65, 2B Emergency Sump Line Drain Block)

☐ PB 3 (2LP-126, Isolation for LP Sample)

☐ PB 4 (2RC-179, Post Accident Sample Block)

☐ PB 5 (2LP-124, Isolation for HP Sample Letdown)

☐ PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

☐ PB 8 (2LP-129, Sample Drain to the High Activity Waste Tank)

_____ 5.12.2 Ensure closed the following solenoid valves: (PALSS Control Panel)

☐ 201

☐ 202

☐ 203

☐ 204

☐ 205

☐ 206

☐ 207

☐ 208

☐ 209

_____ 5.12.3 Ensure closed the following control valves: (PALSS Control Panel)

☐ 101

☐ 102

☐ 103

☐ 104

☐ 105

☐ 106

☐ 107

☐ 108

_____ 5.12.4 Return the valve power switch, SW 1, to the "OFF" position.

_____ 5.12.5 Return the key switch, KS 1, to the "OFF" position.

_____ 5.12.6 Close 2IA-2423 (Instrument Air Supply) (Outside the PALSS Sample Panel)

_____ 5.12.7 Ensure N_2 cylinder discharge pressure > 600 psi.

- **IF** necessary, replace cylinder.

_____ 5.12.8 Close N_2 Supply Bottle valves (Outside the PALSS Sample Panel)

NOTE: The following cable connections are located between the PALSS Control Panel and the cable junction box.

CAUTION: Make the disconnection of connector cable 1 from the Junction Box the FIRST cable disconnection. **IF** this is not done first, the exposed pins of the other cables may become energized and become an electrical hazard.

☐ 5.12.9 **IF** directed by Chemistry Staff, disconnect the following cables in order:

Staff notified _____ Check below as directed by Staff.

☐ Leave the power cables connected.

☐ Disconnect the power cables connected.

☐ 5.12.9.1 CON-1 from the junction box (this is the first cable disconnect made), then from the PALSS Control Panel.

☐ 5.12.9.2 CON-2 cable at both ends.

☐ 5.12.9.3 CON-3 cable at both ends.

☐ 5.12.9.4 CON-4 cable at both ends.

☐ 5.12.9.5 CON-5 cable at both ends.

☐ 5.12.9.6 CON-6 cable at both ends.

☐ 5.12.10 Store the control panel in the AB 1st floor hallway/corridor within ten (10) feet from the Unit 1 electrical junction box.

☐ 5.12.11 Ensure the control panel wheels are locked to prevent panel movement.

☐ 5.12.12 Ensure CV 609 is in the "AIR" position.

☐ 5.12.13 Ensure CV 610 is in the "NITROGEN" position.

☐ 5.12.14 Inform the OSC that flushing of the PALSS Panel has been completed.

OSC Person Notified: _____

5.13 Sample Analysis

NOTE:	Steps 5.13.1 - 5.13.3 can be performed in any order. Substeps must be performed in the order written.

5.13.1 Gas (Nitrogen Stripping Method)

5.13.1.1 Analyze up to four syringes of stripped gas using LM-O-P008 (The Determination of Hydrogen in Gas Samples using the Carle Gas Chromatograph and the Spectra Physics Integrator).

5.13.1.2 Use the following formula to calculate results:

$$\%\ H_2 \frac{615.72\ cc}{0.50\ Kg} \times \frac{1}{100} = cc/Kg\ H_2$$

Where: % H_2 is determined from LM-O-P008

615.72 cc = 30 ml gas bomb + 500 ml gas bomb + tubing volume (volume occupied by sample gas).

0.50 Kg = collected sample size

$\frac{1}{100}$ = conversion of percent to decimal

5.13.1.3 Record results in cc/kg H_2 on Enclosure 7.7.

5.13.1.4 **IF** needed, reserve other stripped gas syringes for use as backups **OR** to perform a gas sample gamma spectra.

5.13.2 Liquid

5.13.2.1 Submit sample to count room for gamma spectra analysis. The sample may be counted in the rheodyne sample vial using the loop volume (preferred) or in a 50 ml bottle. **IF** a 50 ml bottle is used, refer to the following table for preparation guidelines:

PALSS Loop Size	Gamma Spectra Volume Ratio	Dilute sample from PALSS with demin. to: (mls)	mls of diluted sample to dilute to 50 mls for gamma spectra analysis
5.24	5/45	50	(50/5.24)*5 or ~ 48
5.24	1/49	100	(100/5.24)*1 or ~19
1.04	1/49	50	(50/1.04)*1 or ~48
1.04	.5/49.5	100	(100/1.04)*0.5 or ~48
0.10058	.1/49.9	50	(50/0.10058)*0.1 or ~50

5.13.2.2 Record results in mCi/ml on Enclosure 7.7 and attach GeLi Spectra.

5.13.2.3 Analyze PALSS sample for boron.

- To obtain a boron concentration that will correlate directly with the normal RCS, the dilution factor must be multiplied by the analyzed sample concentration (obtained from the Boron Titration).

$$\text{ppm B} = \text{measured ppm B} \times \frac{\text{Total dilution volume (sample loop + dilution water), mls}}{\text{sample loop volume, mls}}$$

5.13.2.4 Record results of boron sample analysis on Enclosure 7.7.

5.13.2.5 Perform a chloride analysis of the sample.

- To obtain a Cl concentration that will correlate directly with the normal RCS, the dilution factor must be multiplied by the analyzed sample concentration.

$$\text{ppb Cl} = \text{measured ppb Cl} \times \frac{\text{Total dilution volume (sample loop + dilution water), mls}}{\text{sample loop volume, mls}}$$

NOTE: **IF** the Cl results are below the Limit of detection (LOD) for the Cl analysis, multiply the LOQ by the dilution factor for reporting purposes (record as "< LOQ * dilution factor" instead of "T0").

5.13.2.6 Record results on Enclosure 7.7.

5.13.2.7 **IF** needed, reserve any remaining liquid sample for use as a backup.

5.13.3 **IF** approved by OSC & RP, prepare Panel for next use by performing the following: (PALSS Sample Panel)

- Fill buffer tanks(s) with ~ 600 mls of buffer solution for calibrating the pH meter.
  - This solution will be pressurized with nitrogen gas to at least 60 psig using the nitrogen purge system inside the PALSS sample panel.
  - Connect tank(s) to quick connect fittings inside sample panel.

NOTE:
1. Always fill Buffer Tank A with a pH 7 buffer. Buffer Tank B should be filled with a pH 4 buffer if expected pH < 7.0 **OR** a pH 10 buffer if expected pH > 7.0.
2. Buffer tanks may be pre-prepared and stored inside of PALSS sample panel. Verify that buffer expiration dates have not been exceeded.

- Fill the 50 ml sample flush cylinder with demineralized water for flushing the liquid sample from the Rheodyne sample injection valves.
  - While holding in a vertical position, attach the matching quick disconnects and fill the cylinder from the bottom to the top using demineralized water.
  - Connect to sample shelf inside sample panel.
- Replace Gas Bomb Septa.

5.13.4 Ensure all data is recorded and Enclosure 7.7 is complete.

5.13.5 Route this procedure along with the gamma spectra(s) to the OSC.

6. References

6.1 NUREG-0737, Section II.B.3

6.2 DPC System Radiation Protection Manual

6.3 Post Accident Liquid Sampling System Manual, Production Support Department, OM-311C-0331

6.4 ASTM Volume 11.01, D-1293-84 (1990)

6.5 DPC LM-O-P008

6.6 DPC LM-O-P004

6.7 ITS 5.5.4

7. Enclosures

7.1 Valve Arrangement Diagram (Control Panel)

7.2 Valve Arrangement Diagram (General - One Line)

7.3 PALSS Inlet Filter/Strainer Back Flush Procedure

7.4 Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

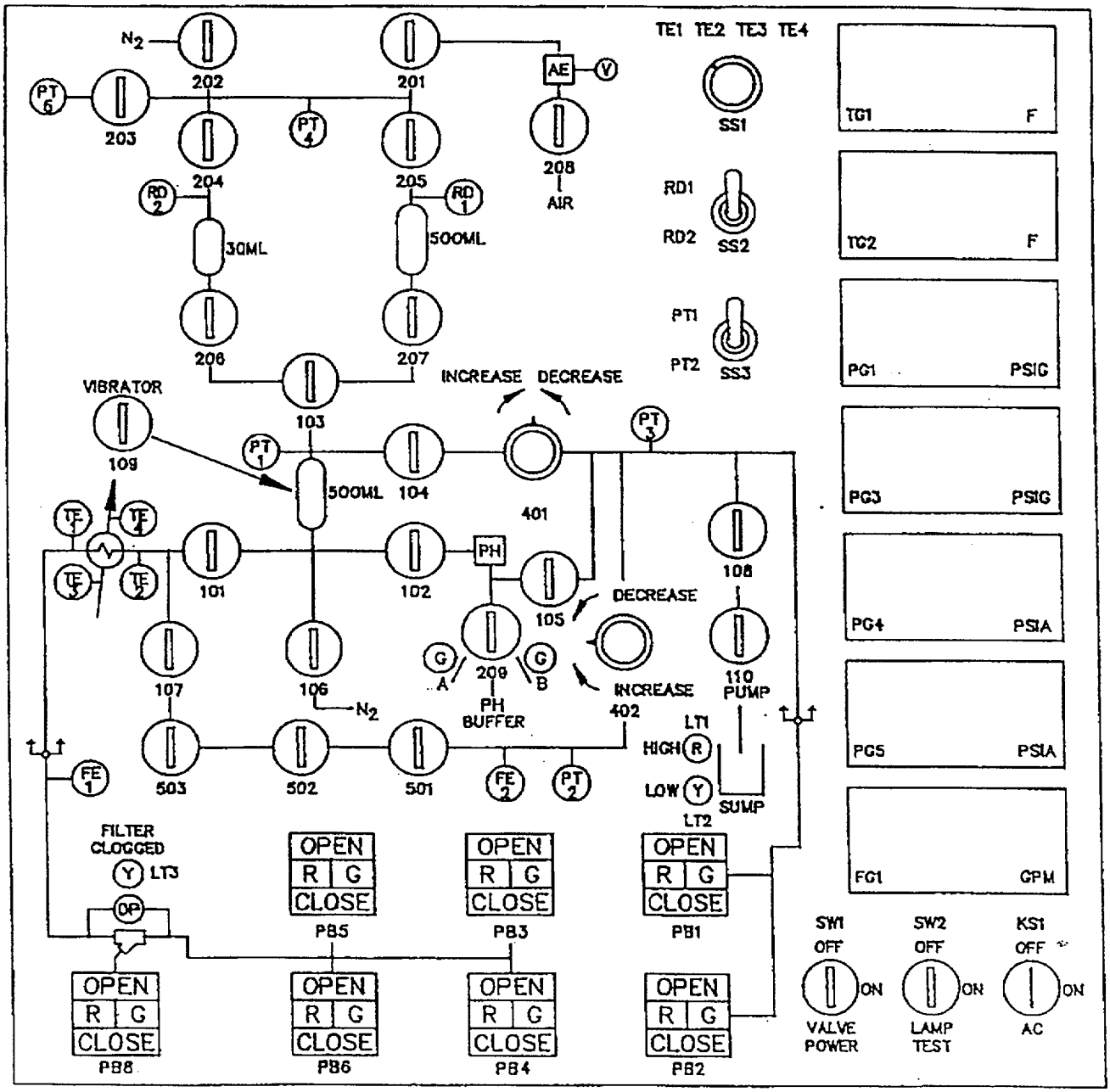
7.5 Unit 2 PALSS Power Supply

7.6 Operations Checklist for Unit 2 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

7.7 PALSS Authorization for Operation and Data Transmittal Form

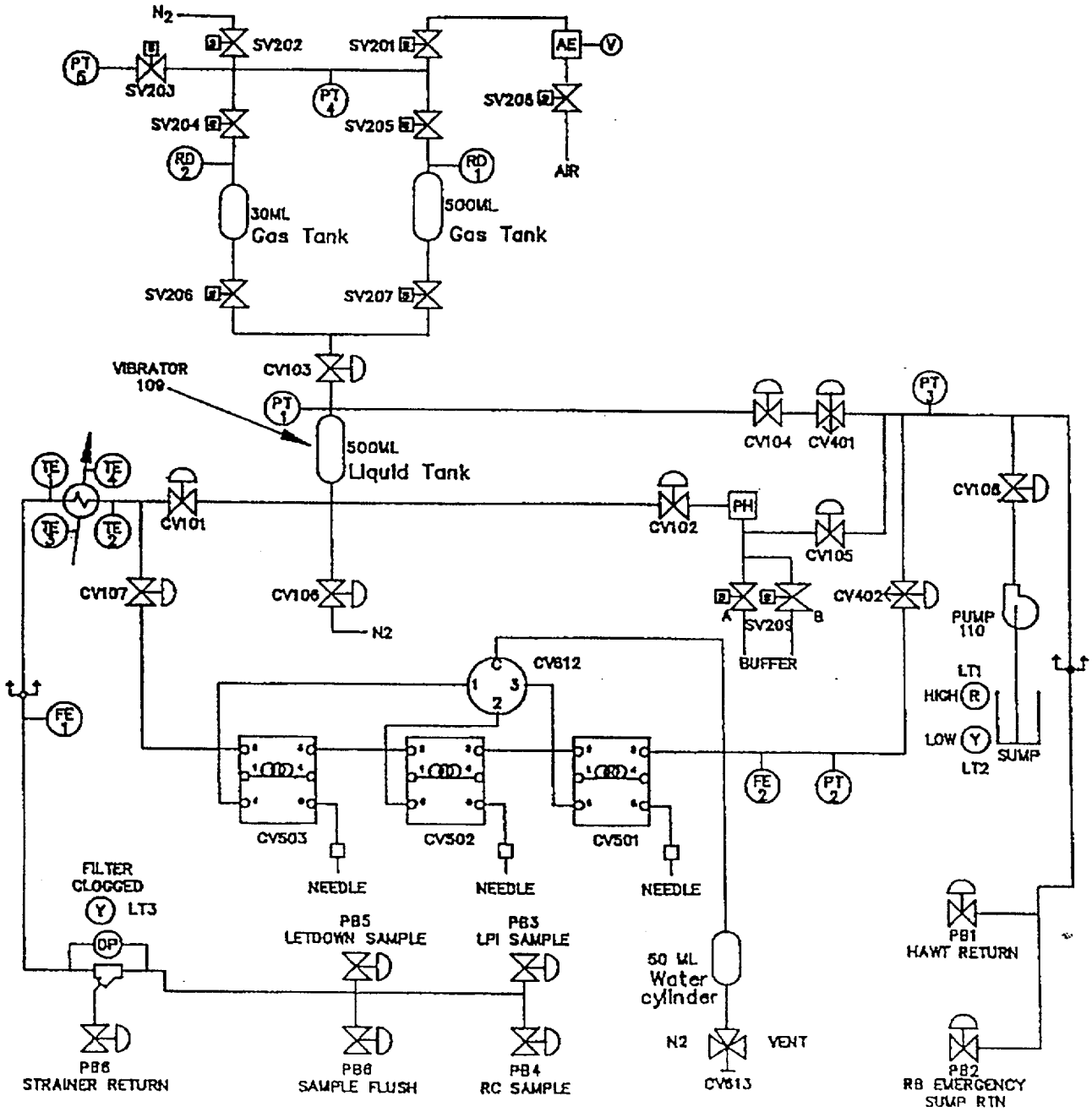
Enclosure 7.1

Valve Arrangement Diagram (Control Panel)



Enclosure 7.2

Valve Arrangement Diagram
(General - One Line)



PALSS Inlet Filter/Strainer Back Flush Procedure

1. Purpose

This enclosure gives instructions for back flushing the PALSS inlet filter/strainer.

2. Limits and Precautions

The following RCS sample valves must be closed to prevent contamination of the demineralized water header with reactor coolant: (PALSS Control Panel)

- PB 5 (2LP-124, Isolation for HP Sample Letdown)
- PB 3 (2LP-126, Isolation for LP Sample)
- PB4 (2RC-179, Post Accident Sample Block)

3. Procedure (PALSS Control Panel)

☐ 3.1 Ensure closed PB 5 (2LP-124, Isolation for HP Sample Letdown).

☐ 3.2 Ensure closed PB 3 (2LP-126, Isolation for LP Sample).

☐ 3.3 Ensure closed PB 4 (2RC-179, Post Accident Sample Block).

☐ 3.4 After ≥ 30 seconds, close 104.

☐ 3.5 Ensure SS 3 (selector switch) is in the "PT-1" position.

☐ 3.6 Monitor pressure on PG-1 for one minute.

☐ 3.6.1 **IF** the pressure on PG-1 > 60 psi **OR** is increasing with time, immediately contact Chemistry Staff and notify the RCS may be leaking by PB 5 (2LP-124, Isolation for HP Sample Letdown), PB 3 (2LP-126, Isolation for LP Sample) **OR** PB 4 (2RC-179, Post Accident Sample Block).

- Do **NOT** proceed without Staff approval.

☐ 3.7 Close 101

☐ 3.8 Open PB 8 (2LP-129, Sample Drain to the High Activity Waste Tank)

☐ 3.9 Open PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

☐ 3.10 Backflush ≥ 5 minutes, then close:

☐ 3.10.1 PB 6 (2DW-278, DW Flush Supply to Post Accident Sample)

☐ 3.10.2 PB 8 (2LP-129, Sample Drain to the High Activity Waste Tank)

3.11 **IF** the purpose is to resume sampling, open:

- PB 5 (2LP-124, Isolation for HP Sample Letdown)

OR • PB 3 (2LP-126, Isolation for LP Sample)

OR • PB 4 (2RC-179, Post Accident Sample Block)

☐ 3.11.1 Open 104

☐ 3.11.2 Open 101

☐ 3.11.3 Return to procedural step allowing completion of the sampling process.

3.12 **IF** the clogged filter light is still "ON" and no flow is shown on FG 1, stop sampling.

3.13 Notify Chemistry Staff.

Staff notified: _____

Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

1. Purpose

This enclosure provides guidance on calculations for hydrogen using Ideal Gas Laws.

2. Limits and Precautions

N/A

3. Procedure

3.1 Record the initial and final temperature and pressure readings from Steps 5.7.6.4 and 5.7.6.8.

Initial Temperature Reading _____ °F

Final Temperature Reading _____ °F

Initial Pressure Reading _____ PSIA

Final Pressure Reading _____ PSIA

3.2 Calculate the average gas temperature reading using the following equation:

$$T_{avg} = (T_{final} + T_{init})/2$$

where, T_{avg} = Average Gas Temperature, °C

T_{final} = Final Gas Temperature Reading, °C

T_{init} = Initial Gas Temperature Reading, °C

3.3 Calculate the differential gas pressure using the following equation:

$$P_{diff} = P_{final} - P_{init}$$

where, P_{diff} = Differential Gas Pressure, PSI

P_{final} = Final Gas Pressure Reading, PSIA

P_{init} = Initial Gas Pressure Reading, PSIA

Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

3.4 Calculate the hydrogen concentration of the trapped PALSS gas sample using the following equation:

$$H_2 = \frac{(3{,}719.83)(P_{diff})}{(T_{avg} + 273)} + \frac{(P_{final} - 0.69)}{0.769}$$

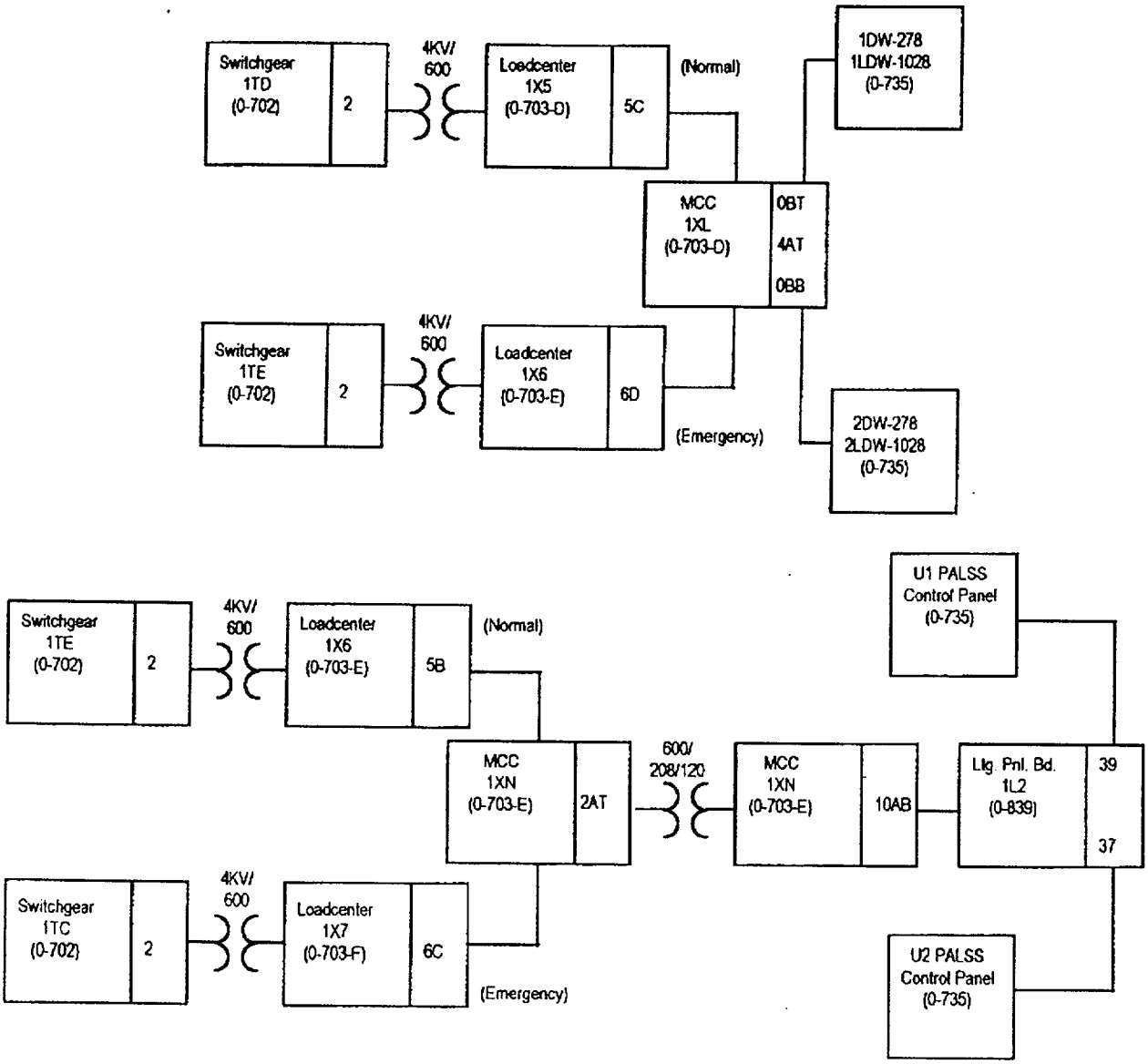
(H_2 in Gas Sample) (H_2 remaining in Liquid Sample)

where, H_2 = PALSS gas sample Hydrogen Concentration, cc/Kg

3.5 Record hydrogen concentration result from Step 3.4 above on Enclosure 7.7.

Enclosure 7.5

Unit 2 PALSS Power Supply



Enclosure 7.6

Operations Checklist for Unit 2 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

1. Purpose

This enclosure gives the valve lineups needed for routing reactor coolant from the RCS "J" Leg through the PALSS to the RBES.

2. Limits and Precautions

2.1 Demineralized water header should be in service and have at least 60 psi pressure. RCW (sample cooling supply) should also be in service.

3. Procedure

3.1 Establish communications with Chemistry personnel assigned to the task.

Chemistry personnel assigned: _____

CAUTION: **IF** containment integrity is required or is to be considered, station personnel in constant communication with the Control Room in the vicinity of 2LP-65 ('2B' Emer Sump Line Drain Block) to immediately close 2LP-65 **IF** ES actuation occurs.

DV _____ 3.2 Open 2LP-65 ('2B' Emer Sump Line Drain Block) (Unit 2 LPI Room) manual valve to be operated by reach rod from LPI Hatch Room 119 (on west wall ~ 9 ft. to the right of 2LP-22).

_____ 3.3 Record that the valve is open in OP/0/A/1102/020 (Shift Turnover).

3.4 Establish flow to the PALSS panel via the RCS "J" Leg as follows:

3.4.1 Remove tag from breaker #14 on 2KVIB for:

_____ • 2RC-162 (RC Sample Isolation Valve) (inside RB, operated from Control Room)

_____ • 2RC-164 (RC Sample Isolation Valve) (Unit 2 LPI Room, operated from Control Room)

_____ 3.4.2 Close breaker #14.

_____ 3.4.3 Remove tag from breaker #4 on 2KVIA for 2RC-165, (RC Sample Isolation Valve (Solenoid Valve)). (Unit 2 LPI Room)

_____ 3.4.4 Close breaker #4.

Operations Checklist for Unit 2 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

CAUTION: **IF** containment integrity is required or is being considered, assign an Operator to close 2RC-162, 2RC-163, 2RC-164, and 2RC-165 in case of an ES Actuation.

_____ _____ 3.4.5 Open 2RC-162 (RC Sample Isolation Valve). (inside RB, operated from Control Room)
DV

_____ _____ 3.4.6 Open 2RC-163 (RC Sample Valve (Solenoid Valve)). (inside RB, operated from Control Room)
DV

_____ _____ 3.4.7 Open 2RC-164 (RC Sample Isolation Valve). (Unit 2 LPI Room, operated from Control Room)
DV

_____ _____ 3.4.8 Open 2RC-165 (RC Sample Isolation Valve (Solenoid Valve)). (Unit 2 LPI Room, operated from Control Room)
DV

_____ 3.4.9 Record that 2RC-164 (RC Sample Isolation Valve) and 2RC-165 (RC Sample Isolation Valve) are open in OP/0/A/1102/020 (Shift Turnover).

3.5 Chemistry will notify Operations when the RCS sample has been obtained

Operations notified: _____

3.6 Chemistry will ask Operations to close the following valves. (operated from Control Room)

_____ _____ 3.6.1 2RC-165 (RC Sample Isolation Valve (Solenoid Valve)). (Unit 2 LPI Room)
DV

_____ _____ 3.6.2 2RC-164 (RC Sample Isolation Valve). (Unit 2 LPI Room)
DV

_____ 3.6.3 Record that containment isolation valves 2RC-164 (RC Sample Isolation Valve) and 2RC-165 (RC Sample Isolation Valve (Solenoid Valve)) are closed in OP/0/A/1102/020 (Shift Turnover).

_____ _____ 3.6.4 2RC-163 (RC Sample Valve (Solenoid Valve)). (Reactor Building)
DV

_____ _____ 3.6.5 2RC-162 (RC Sample Isolation Valve). (Reactor Building)
DV

Operations Checklist for Unit 2 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

3.7 **WHEN** RCS sampling is complete, ensure open the following breakers:

_____ 3.7.1 Tag open breaker #9 on 1KVIB for OP/2/A/1102/001 (Unit Startup).

NOTE:	Both 2RC-162 (RC Sample Isolation Valve) and 2RC-164 (RC Sample Isolation Valve) are powered from this breaker.

_____ 3.7.2 Tag open breaker #4 on 1KVIA for 2RC-165 (RC Sample Isolation Valve (Solenoid Valve)) for OP/2/A/1102/001 (Unit Startup).

3.8 Close 2LP-65 ('2B' Emer Sump Line Drain Block). (operated by reach rod from LPI Hatch Rm. 119, on west wall ≈ 9 ft. to the right of 2LP-22)

3.9 Record that 2LP-65 ('2B' Emer Sump Line Drain Block) is closed in OP/0/A/1102/020 (Shift Turnover).

_____ 3.10 Ensure completed enclosure is maintained by Chemistry.

PALSS Authorization for Operation and Data Transmittal Form

Date _____

_____ **1. Verbal/written direction for sampling the Reactor Coolant via the PALSS has been received from the TSC/OSC.**

Sample Point: RCS "J-Leg" _____ Waste Route: RBES _____

LPI Pump Discharge_____ HAWT _____

HPI Letdown _____

Person Authorizing Sampling _____

_____ **2. The specific post-accident analysis requested by TSC/OSC:**

____ Boron = _____ppm

____ Hydrogen = _____cc/kg

____ Chloride = _____ppm

____ pH = _____

____ Gas Gamma (attach)

____ Liquid Gamma (attach)

____ Other (specify) _____

3. Have RP determine general area dose rate at the PALS valve panel and record below.

Dose rate (general area) = _____ r/hr

_____ **4. Determine by detailed planning meeting the exact course of action and data required.**

_____ **5. Evaluate the use of portable shielding, remove handling equipment, video equipment, etc., to minimize the exposure to personnel while sampling.**

_____ **6. Have RP determine 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.**

_____ **7. Determine how long to flush the PALSS sample panel, based on general area dose readings.**

_____ **8. Request RP to designate a route from PALSS to the Lab.**

Sample route designated:_____

_____

9. Evaluate the use of portable shielding, remove handling equipment, video equipment, etc., to minimize the exposure to personnel in the Lab for the required analyses.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. CP/3/A/2002/004 C
Revision No 17

Continuous Use

INFORMATION ONLY

PREPARATION

(2) Station Oconee Nuclear Station

(3) Procedure Title Operating Procedure for the Post Accident Liquid Sampling System (PALSS)

(4) Prepared By Michael M. Cox Date 12/13/99

(5) Requires 10CFR50.59 evaluation?
- ☑ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By Dean Cantrell (QR) Date 12/14/99
Cross-Disciplinary Review By _____ (QR)NA N/A Date _____
Reactivity Mgmt. Review By _____ (QR)NA N/A Date _____

(7) Additional Reviews
QA Review By _____ Date _____
Reviewed By _____ Date _____
Reviewed By _____ Date _____

) Temporary Approval *(if necessary)*
By _____ (SRO/QR) Date _____
By _____ (QR) Date _____

(9) Approved By Byron L. Nunn Date 12/16/99

PERFORMANCE ***(Compare with control copy every 14 calendar days while work is being performed.)***

(10) Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____
Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification
- ☐ Yes ☐ NA Check lists and/or blanks initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ NA Listed enclosures attached?
- ☐ Yes ☐ NA Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ NA Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ NA Procedure requirements met?

Verified By _____ Date _____

3) Procedure Completion Approved _____ Date _____

(14) Remarks *(Attach additional pages, if necessary)*

Operating Procedure for the Post Accident Liquid Sampling System (PALSS)

1. Purpose

NOTE:	Seven Control copies and one Information Only copy of this procedure shall be routed to the Emergency Preparedness Team within three working days after any approved changes.

The post accident liquid sampling system (PALSS) provides the capability to obtain a primary coolant sample via the HPI Letdown, LPI Pump Discharge or the RCS "J" leg during a nuclear reactor accident condition(s) as described in the FSAR and in accordance with NUREG-0737.

2. Limits and Precautions

2.1 This procedure should be used to operate PALSS to sample the Reactor Coolant System under the following conditions:

2.1.1 Post Accident.

2.1.2 Inaccessibility of (routine) Primary Sampling Area **AND/OR** HPI Letdown Sampling not possible.

2.1.3 Request from the Chemistry Manager or his designee.

2.2 Under accident conditions, valve alignments shall **NOT** be made and samples shall **NOT** be taken without prior authorization from the Emergency Coordinator **OR** the TSC/OSC! (Containment isolation valves may be closed upon ES actuation, see Enclosure 7.6.)

2.3 Under accident conditions, do **NOT** attempt any phase of sampling **OR** analysis without Radiation Protection job coverage!

2.4 Consider portable shielding, remote handling equipment, video equipment, etc., where practical or available during sampling, sample preparation, and sample analysis.

2.5 Chemistry personnel shall operate only those valves operated by the Control Panel **OR** via the sample panel unless clearly specified otherwise in this procedure.

2.6 **IF** power is **NOT** available at the PALSS Control Panel, return to a low dose area and contact Chemistry management.

2.6.1 Refer to Enclosure 7.5 and troubleshoot as required to determine source of problem.

2.6.2 Notify the OSC/TSC.

2.6.3 **IF** necessary, request the OSC have Operations ensure the following breakers are closed (to ensure power availability).

- 3KTH1 Bkr. #8 Sampling/Control Panels Power Supply (located next to U3 sampling panel)
- MCC3XL Bkr. 4CT for 3DW-278 (DW Flush Supply to Post Accident Sample) (PALSS Control Panel)

2.7 **IF** reviewed and approved by a supervisor and one other individual who is familiar with this procedure, steps may be performed out of sequence.

2.8 Steps preceded by "____" in the left margin are sign off steps. These steps must be signed off before continuing. Steps preceded with " ☐ " (immediately to the left of the step) are check off steps and should be checked off as completed.

2.9 Independent Verification (designated by two sign-off steps) is a documented check by a second individual which helps to ensure the correct condition or position of plant components. Separate Verification (designated by SV) ensures individuals act separately and independently. Double Verification (designated by DV) ensures the "doer" and "verifier" independently decide that an action is correct prior to the "doer" performing the action. The "verifier" shall use a "hands on" approach to verify the action of the "doer".

CAUTION: Chemical hazards shall be known prior to use. For additional information and first aid requirements, refer to the MSDS sheet.

2.10 Personal protective requirements for chemicals used in this procedure are pH buffers 4.0, 7.0, and 10.0:

- lab coat
- gloves (rubber/vinyl)
- chemical splash goggles

2.11 **WHEN** flushing the desired sample to the waste tanks, request Operations add a second compressor on the GWD header because fresh fission gasses may cause a serious problem in the Aux. Building.

- **IF** possible, this increased vacuum should be maintained until sampling is complete.

2.12 All sample vials should be cleaned and rinsed to protect against chloride contamination.

- Do **NOT** place bare finger tips on the surface of the septum.

3. Apparatus

3.1 A minimum of 4 Lockable Glass (Gas) Syringes (1 to 2 ml size only)

3.2 Liquid Sample Carrier (Bucket, Etc.), Gas Syringe Carrier

3.3 Watch or Lab Timer

3.4 Plastic Bags

3.5 15 - 40cc Evacuated Sample Vial(s) for Liquid Sample

3.6 Nitrogen Supply Bottle with > 600 psi available. (with Two Stage Regulator; 0 to 200 psig on Delivery Stage) replace as required

4. Reagents

4.1 Buffer Solutions - Use purchased 4.00, 7.00 and/or 10.00 buffers or equivalent

5. Procedure

5.1 Prerequisites and Panel Preparation (preliminary)

5.1.1 Initiate Enclosure 7.7.

5.1.2 **IF** routing waste to the RBES or sampling from the RCS "J" Leg:

- Take Enclosure 7.6 to the responsible individual in Operations (designated by the OSC) for completion.
- Request Operations complete the appropriate step(s) of Enclosure 7.6.

5.1.3 Label glass vial(s) for collecting the liquid sample.

5.2 Panel Preparation (prior to sampling)

NOTE: **IF** any item on the control or sample panel is not clearly identified, refer to Enclosure 7.1 and 7.2.

☐ 5.2.1 Inform the U-3 Control Room that sampling of the RCS will be done via the PALSS panel.

- Identify the flowpath J-Leg, LPI **OR** Letdown.
- Recommend an extra waste gas compressor be placed into service.

Operator Notified: _____

5.2.2 At the Control Panel, ensure that SW 1 (valve power switch), is in the "OFF" position.

- Ensure PALSS safety switch is "ON".

CAUTION: Make the mating of connector cable 1 to connector 1 on the Junction Box the LAST cable connection made. **IF** this is not done last, the exposed pins of the other cables may become energized and become an electrical hazard.

☐ 5.2.3 Position the Control Panel using RP as a guideline, in the lowest dose area possible.

☐ 5.2.4 **IF** necessary, route and connect the six required cables (CON 6 - CON 1) from the Control Panel to the Junction Box, starting with connector 6 and ending with connector 1.

☐ 5.2.4.1 Connect CON-6 cable at both ends.

☐ 5.2.4.2 Connect CON-5 cable at both ends.

☐ 5.2.4.3 Connect CON-4 cable at both ends.

☐ 5.2.4.4 Connect CON-3 cable at both ends.

☐ 5.2.4.5 Connect CON-2 cable at both ends.

☐ 5.2.4.6 Connect CON-1 cable at the PALSS control panel end.

☐ 5.2.4.7 Connect CON-1 cable to the junction box last.

☐ 5.2.5 Ensure off all control and solenoid valves (no lights).

5.2.6 Position the following valves: (outside of Sample Panel)

CAUTION: Nitrogen cylinder must be replaced if pressure is < 600 psig in order to prevent backflow of fission gas into the cylinder.

☐ Open valve(s) on Nitrogen Supply Bottle (> 600 psi tank pressure required & ~100 psi delivery pressure)

☐ **IF** necessary, replace cylinder.

☐ Open 3IA-2423 (Instrument Air Supply).

NOTE: The following switches are found on the PALSS Control Panel.

☐ 5.2.7 Turn system power on by inserting Control Panel Key into (KS 1) Key Lock Switch and turning the key.

NOTE: The lights in the middle of each switch which controls a valve should be "OFF". The green lights should be "LIT" on the push-button switches, (PB 1) through (PB 8).

☐ 5.2.8 Ensure all lamps on the Control Panel are functioning by turning ON SW 2 (lamp test switch).

☐ 5.2.9 Make note of **OR** repair any not functioning properly. (The lamp test switch does not light).

☐ 5.2.9.1 Turn SW 2 (lamp test switch) to "OFF".

☐ 5.2.10 Turn SW 1 (valve power switch) to the "ON" Position.

NOTE: In an accident situation, waste will be routed to the RBES unless otherwise directed by supervision. The alternate route is the HAWT via PB1 (3LP-130).

_____ 5.2.11 **IF** routing waste to the RBES, open PB2 (3LP-65, 3B Emergency Sump Line Drain Block).

_____ 5.2.12 **IF** routing waste to the HAWT, open PB1 (3LP-130, Sample Return to High Activity Waste Tank).

5.3 Panel Preparation (pH Meter Standardization) (PALSS Control Panel)

5.3.1 Purge the pH housing with Nitrogen as follows:

NOTE: All other control valves must be closed.

- ☐ 5.3.1.1 Open 204
- ☐ 5.3.1.2 Open 206
- ☐ 5.3.1.3 Open 103
- ☐ 5.3.1.4 Open 102
- ☐ 5.3.1.5 Open 105
- ☐ 5.3.1.6 Open 202
- ☐ 5.3.1.7 Wait at least 2 minutes, close 105.

5.3.2 Pressurize Buffer Tank A as follows:

NOTE: SV 209 controls both buffer tanks (A and B).

- ☐ 5.3.2.1 Place 209 in the 'A' position.
- ☐ 5.3.2.2 Wait at least 30 seconds., then place 209 in the "OFF" position.
- ☐ 5.3.2.3 Close 202

5.3.3 Evacuate pH housing as follows:

- ☐ 5.3.3.1 Open 208
- ☐ 5.3.3.2 Open 201
- ☐ 5.3.3.3 **WHEN** the pressure on PG 4 stabilizes (normally < 2.0 PSIA),
  - ☐ A. Close 201
  - ☐ B. Record the pH Housing pressure from PG 4 **OR** PG 5.

    pH Housing Pressure for A Buffer = _____ PSIA
- ☐ 5.3.3.4 Close 102

☐ 5.3.3.5 Close 103

☐ 5.3.3.6 Close 206

☐ 5.3.3.7 Close 204

☐ 5.3.3.8 Close 208

5.3.4 Transfer A Buffer into the pH housing as follows:

☐ 5.3.4.1 Place 209 in the 'A' position.

☐ 5.3.4.2 Wait at least 1 minute, then place 209 in the "OFF" position.

5.3.5 Standardize the pH meter as follows:

NOTE: The following keys are located on the pH meter in the face of the PALSS control panel.

5.3.5.1 Use the "menu" key to move to the main menu., The display will show: ("Configuration, Calibration, Maintenance, I/O Setup").

5.3.5.2 Using the "arrow up or down" keys, move to and highlight "Calibration".

5.3.5.3 Press "enter".

5.3.5.4 Using the "arrow up or down" keys, move to and highlight "Calibration / Buffer Calibration pH".

5.3.5.5 Press the "Hold" key.

5.3.5.6 Press the "next" key to move to the next screen.

NOTE:
- A flashing value indicates the probe may be broken.
- A value that **CANNOT** be adjusted to within ± .5 pH offset will make the unit return to the calibration screen, indicating that the pH electrode may need to be replaced.

5.3.5.7 The display will show the pH of the 'A' buffer solution.

5.3.5.8 Wait for a stable reading, then using the "function keys, side to side" select the desired digit space and change the value on the display using the "arrow up and down" keys to match the actual 'A' buffer pH.

5.3.5.9 **WHEN** the unit display indicates the buffer pH, press the "ENTER" key.

5.3.5.10 Record the pH meter value set for the 'A' buffer pH.

'A' Buffer Solution pH _____

5.3.5.11 **WHEN** the unit successfully meets the preset specifications and the entered buffer value is displayed, press "next" until the screen with the following is visible:

SLOPE

Note: Buffer must be > 2 pH units away from the STD buffer.

NOTE: The unit should still be in the "hold" mode.

5.3.5.12 Press "next". The following screen should be visible:

SLOPE

Place electrode in Buffer Attention.
Wait for Stable Reading!

5.3.6 Flush the pH housing with DW as follows:

☐ 5.3.6.1 Open 101

☐ 5.3.6.2 Open 102

☐ 5.3.6.3 Open 105

☐ 5.3.6.4 Open PB-6 (3DW-278, DW Flush Supply to Post Accident Sample).

☐ 5.3.6.5 Wait at least 5 minutes, close 101.

☐ 5.3.6.6 Close PB-6 (3DW-278, DW Flush Supply to Post Accident Sample).

5.3.7 Purge the demineralized water out of the pH housing with nitrogen as follows:

- ☐ 5.3.7.1 Open 202
- ☐ 5.3.7.2 Open 204
- ☐ 5.3.7.3 Open 206
- ☐ 5.3.7.4 Open 103
- ☐ 5.3.7.5 Place 209 in the 'A' position.
- ☐ 5.3.7.6 Place 209 in the "OFF" position.
- ☐ 5.3.7.7 After at least 2 minutes, close 105.

5.3.8 Pressurize Buffer Tank B as follows:

- ☐ 5.3.8.1 Place 209 in the 'B' position.
- ☐ 5.3.8.2 Wait at least 30 seconds, place 209 in the "OFF" position.
- ☐ 5.3.8.3 Close 202

5.3.9 Evacuate pH housing as follows:

- ☐ 5.3.9.1 Open 208
- ☐ 5.3.9.2 Open 201
- ☐ 5.3.9.3 **WHEN** the pressure on PG 4 stabilizes (normally < 2.0 PSIA), close 201.
- ☐ 5.3.9.4 Record pH Housing pressure from PG 4.

  pH Housing Pressure for B Buffer = _____ PSIA
- ☐ 5.3.9.5 Close 102
- ☐ 5.3.9.6 Close 103
- ☐ 5.3.9.7 Close 206
- ☐ 5.3.9.8 Close 204
- ☐ 5.3.9.9 Close 208

5.3.10 Transfer B Buffer into the pH housing as follows:

☐ 5.3.10.1 Place 209 in the 'B' position.

☐ 5.3.10.2 Wait at least 1 minute, place 209 in the "OFF" position.

5.3.11 Calibrate the pH meter as follows: (pH meter on the face of the PALSS Control Panel)

NOTE: The unit should still be in the "HOLD" mode. This key causes the pH meter to maintain a constant output and alarm condition. This allows the electrode to be removed (optional) for calibration in a buffer without process upset. The temperature compensation feature is also disabled in the "HOLD" mode (this allows calibration of the meter to the particular temperature of the buffer used).

5.3.11.1 Press "next". The display will show the pH of the 'B' buffer as measured by the electrode.

5.3.11.2 Wait for a stable reading, then select the desired digit space using the "function keys side to side".

5.3.11.3 Adjust the value on the display using the "arrow up and down" keys, until the display matches the actual pH of the buffer solution.

5.3.11.4 Press "enter". This will set the instrument slope.

5.3.11.5 Record the pH meter value set for the 'B' buffer pH.

'B' Buffer Solution pH _____

5.3.11.6 **IF** the slope adjustment was successful, the Completed screen will be displayed:

SLOPE
Slope Completed
Slope Buffer Value Saved

5.3.11.7 Using the "hold" key, take the unit out of the hold mode.

NOTE: **IF** the calibration was not successful, the menu will return to the original Calibration Menu by itself and display an error code.

5.3.11.8 Use the "next" key to rotate back to the original Calibration menu screen.

5.3.11.9 Press the "Display" key. The pH meter is now in the sample measurement mode.

5.3.12 Flush the pH housing with DW as follows:

- ☐ 5.3.12.1 Open 101
- ☐ 5.3.12.2 Open 102
- ☐ 5.3.12.3 Open 105
- ☐ 5.3.12.4 Open PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)
- ☐ 5.3.12.5 Ensure the pH meter reads demin water header pH (~ 5 to 7) for an adequate flush.
- ☐ 5.3.12.6 Wait ≥ 3 minutes, close 101.
- ☐ 5.3.12.7 Close PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)

5.3.13 Purge the demineralized water out of the pH housing with nitrogen as follows:

- ☐ 5.3.13.1 Open 202
- ☐ 5.3.13.2 Open 204
- ☐ 5.3.13.3 Open 206
- ☐ 5.3.13.4 Open 103
- ☐ 5.3.13.5 Wait ≥ 2 minutes **OR** until pressure on PG 3 drops rapidly (below 50 psi), then close 105.
- ☐ 5.3.13.6 Place the 209 in the 'B' position.
- ☐ 5.3.13.7 Place the 209 in the "OFF" position.
- ☐ 5.3.13.8 Close 202
- ☐ 5.3.13.9 Close 204
- ☐ 5.3.13.10 Close 206
- ☐ 5.3.13.11 Close 103

☐ 5.3.13.12 Close 102

☐ 5.3.13.13 Close 105

5.4 Panel Preparation (pH Housing and Gas Tank(s) Evacuation) (PALSS Control Panel)

5.4.1 Evacuate pH housing and gas tanks as follows:

☐ 5.4.1.1 Open 208

☐ 5.4.1.2 Open 201

☐ 5.4.1.3 Open 203

☐ 5.4.1.4 Open 204

☐ 5.4.1.5 Open 205

☐ 5.4.1.6 Open 206

☐ 5.4.1.7 Open 207

☐ 5.4.1.8 Open 103

☐ 5.4.1.9 Open 102

☐ 5.4.1.10 Monitor the pressure in the pH housing and gas tanks on PG 5 **OR** PG 4.

- **WHEN** the pressure stabilizes (normally < 2.0 PSIA), close 201.

☐ 5.4.1.11 Close 208

5.4.2 pH Housing Pressure

☐ 5.4.2.1 Record pH Housing pressure from PG 5 (alternate PG 4).

pH Housing Pressure _____ PSIA

☐ 5.4.2.2 Close 102

☐ 5.4.2.3 Close 103

☐ 5.4.2.4 Close 206

☐ 5.4.2.5 Close 207

5.4.3 30 ml and 500 ml Gas Tanks Pressure

☐ 5.4.3.1 Record gas tank pressures from PG 5 (alternate PG 4).

Gas tanks (30ml and 500ml) pressure _____ PSIA

☐ 5.4.3.2 Close 205

☐ 5.4.3.3 Close 204

☐ 5.4.3.4 Close 203

5.5 Panel Operation (Reactor Coolant Sample Flush/Acquisition) (PALSS Control Panel)

NOTE: The sample will be taken via the LPI pump discharge, HPI Letdown, or the RCS "J-Leg" sample point.

CAUTION: 1. PB 6 (3DW-278) must be closed to prevent flow of RCS into the demineralized water header.

2. CV-102 and CV-105 must be closed to prevent overpressurization and failure of the pH housing.

_____ 5.5.1 Ensure closed the following valves:

5.5.1.1 Close PB-6 (3DW-278, DW Flush Supply to Post Accident Sample).

5.5.1.2 Close 102

5.5.1.3 Close 105

☐ 5.5.2 Ensure SS 3 (selector switch) is in the "PT 1" position.

_____ 5.5.3 **IF** sampling the RCS "J-Leg", then open PB 4 (3RC-179, Post Accident Sample Block).

_____ 5.5.4 **IF** sampling the LPI pump Discharge, then open PB 3 (3LP-126, Isolation for LP Sample).

_____ 5.5.5 **IF** sampling the HPI Letdown, then open PB 5 (3LP-124, Isolation for HP Sample Letdown).

☐ 5.5.6 Open 101

☐ 5.5.7 Open 104

CAUTION: Monitor PG 3 to ensure that the outlet pressure does **NOT** exceed 600 PSIG. Adjust slowly.

☐ 5.5.8 Open 401 to establish the maximum flow without exceeding 600 PSIG on PG 3.

☐ 5.5.9 Record the flowrate from FG1 _____ gpm.

☐ 5.5.10 Record the pressure from PG 3 _____ psig.

5.5.11 **IF** LT 3 (clogged filter light switch) comes on and remains on, but flow on FG-1 is > 1.5 gpm, continue with procedure.

- **IF** flow is < 1.5 gpm, contact Chemistry Staff for further instructions.
- **IF** directed by management, proceed to Enclosure 7.3.

☐ 5.5.12 Select the desired thermocouple to monitor the inlet **OR** outlet of the sample **OR** the cooling water using SS 1:

TE 1 - Measures sample inlet to heat exchanges.

TE 2 - Measures sample return from heat exchanger.

TE 3 - Measures cooling water inlet to heat exchanger.

TE 4 - Measures cooling water return from heat exchanger.

☐ 5.5.12.1 Switch SS 1 to "TE 1"

☐ 5.5.12.2 Record sample inlet temperature on TG 1.

INLET TEMPERATURE _____°F

☐ 5.5.12.3 Switch SS 1 to "TE 2".

☐ 5.5.12.4 Record sample outlet temperature on TG 2.

OUTLET TEMPERATURE _____°

5.5.13 After > 15 gallons have flowed through the system (calculate time based on FG-1 reading):

☐ 5.5.13.1 Slowly throttle 401 until fully closed.

☐ 5.5.13.2 Immediately close 104

☐ 5.5.13.3 Immediately close 101

☐ 5.5.13.4 Record 500 ml liquid tank pressure from PG 1.

Pressure = _____ PSIG

☐ 5.5.14 Move selector switch SS 3 to the "PT 2" position to measure discharge pressure of the injection valves.

NOTE: There are two continuous flow paths through the sample valve(s). When the valve(s) is opened, the sample loop is moved to the sample flow path. When the valve(s) is closed, the sample loop is moved to the sample injection (collection) flow path.

5.5.15 Ensure open the desired sample injection valve(s) of the 0.1 ml, 1 ml and/or 5 ml loop, respectively (normally the 5 ml and 1 ml loop are used):

☐ 503 (0.1 ml Loop)

☐ 502 (1 ml Loop)

☐ 501 (5 ml Loop)

☐ 5.5.16 Open 107

☐ 5.5.17 Slowly open 402 keeping flowrate on FG 2 < 300 ml/min.

NOTE: Greater than 40 PSIG sample pressure must be supplied to the injection valves.

5.5.18 After ≥ 5 minutes, close the sample injection valve(s) opened in Step 5.5.15.

☐ 503 (0.1 ml Loop)

☐ 502 (1 ml Loop)

☐ 501 (5 ml Loop)

5.5.19 Record sample time: _____

_____ 5.5.20 Close the sample valve selected in Step 5.5.3 or 5.5.4 or 5.5.5

- PB 4 (3RC-179, Post Accident Sample Block)
- PB 3 (3LP-126, Isolation for LP Sample)
- PB 5 (3LP-124, Isolation for HP Sample Letdown)

☐ 5.5.21 After 1 minute, close 402.

CAUTION: IF the pressure on PG-1 is > 100 psi or is increasing with time, contact Chemistry Staff and notify that RCS is leaking by sample valve.

☐ 5.5.22 After 1 minute, record the pressure on PG-1: _____psi

☐ 5.5.23 Close 107

5.6 Depressurization (PALSS Control Panel)

☐ 5.6.1 Ensure SS 3 (selector switch) is in the "PT 1" position.

☐ 5.6.2 Ensure closed 206

☐ 5.6.3 Ensure closed 207

☐ 5.6.4 Open 103

☐ 5.6.5 Wait ≥ 2 minutes.

NOTE: Pressure on PG 1 should be < 50 PSIG.

☐ 5.6.6 Record the pressure from PG 1 _____ PSIG.

5.7 Gas Collection (PALSS Control Panel)

5.7.1 Verify pressure in the 30 ml and 500 ml gas tank is ≤ 2.0 PSIA.

For 500 ml Gas Tank:

☐ 5.7.1.1 Open 205

☐ 5.7.1.2 Open 203

☐ 5.7.1.3 Record PG 5 (alternate gauge PG 4).

500 ml Gas Tank Pressure _____

☐ 5.7.1.4 Close 205

☐ 5.7.1.5 Close 203

For 30 ml Gas Tank:

☐ 5.7.1.6 Open 204

☐ 5.7.1.7 Open 203

☐ 5.7.1.8 Record PG 5 (alternate gauge PG 4).

30 ml Gas Tank Pressure _____

☐ 5.7.1.9 Close 204

☐ 5.7.1.10 Close 203

5.7.2 **IF** the pressure in the 30 ml and 500 ml Gas Tank is ≤ 2.0 PSIA, proceed to Step 5.7.5 **IF** the Nitrogen stripping method is to be used for gas collection and analysis.

5.7.3 **IF** the alternate method (Total Gas Method) is to be used, proceed to Step 5.7.6.

☐ 5.7.4 **IF** the pressure in the 30 ml **OR** 500 ml Gas Tank is > 2.0 PSIA, then evacuation of the tanks must be repeated as follows:

☐ 5.7.4.1 Close 103

☐ 5.7.4.2 Open 204

☐ 5.7.4.3 Open 205

☐ 5.7.4.4 Open 201

☐ 5.7.4.5 Open 208

☐ 5.7.4.6 Open 203

5.7.4.7 **WHEN** the reading from PG 5 (alternate gauge PG 4) is ≤ 2.0 PSIA, close

☐ A. 204

☐ B. 205

☐ C. 201

☐ D. 208

☐ E. 203

☐ 5.7.4.8 Open 103

5.7.4.9 **IF** the Nitrogen stripping method is to be used for gas collection and analysis, continue with Step 5.7.5.

5.7.4.10 **IF** the alternate method (Total Gas Method) is to be used, proceed to Step 5.7.6.

NOTE: Nitrogen Stripping Method is the typical method.

5.7.5 Nitrogen Stripping Method (Gas Analysis)

☐ 5.7.5.1 Ensure closed 205

☐ 5.7.5.2 Open 207

☐ 5.7.5.3 Open 106

NOTE: The pressure on PG-1 should be monitored for an increase of approximately 15 psi. Because PT-1 is a high range pressure transmitter the indicated reading on PG-1 will vary from calibration to calibration and may indicate anywhere from -15 to 15 psi initially.

☐ 5.7.5.4 For a 10 minute interval, periodically turn on 109 to vibrate 500 ml liquid tank, monitor the pressure on PG 1 (switch SS 3 to "PT 1").

☐ 5.7.5.5 Close 106

☐ 5.7.5.6 Open 205

☐ 5.7.5.7 Open 204

5.7.5.8 After ≥ 5 minutes when PG 4 (alternate PG 1) stabilizes, close:

☐ A. 204

☐ B. 205

☐ C. 207

☐ D. 103

5.7.5.9 Proceed to Section 5.8.

NOTE: Calculated method should be used only as an alternate.

5.7.6 Total Gas Method (Calculated)

☐ 5.7.6.1 Monitor PG 4.

☐ 5.7.6.2 **WHEN** the pressure shown on PG 4 is < 30 PSIA, the low range pressure transmitter, PT 5, can be used to obtain a more accurate pressure measurement.

- PT 5 can be used by opening 203.

☐ 5.7.6.3 Ensure SS 2 switch is in the "RD 2" position.

☐ 5.7.6.4 Record the initial temperature reading from TG 2 and pressure reading from PG 5.

TG 2 Init. Temp. Reading _____ °F

PG 5 Init. Press. Reading _____ PSIA

☐ 5.7.6.5 Open 206

☐ 5.7.6.6 Open 204

☐ 5.7.6.7 Turn on the vibrator using 109 and monitor PG 5.

☐ 5.7.6.8 **WHEN** the pressure of the 30 ml gas tank stabilizes, record the final pressure and temperature.

TG 2 Final Temp. Reading _____°F

PG 5 Final Press. Reading _____ PSIA

☐ 5.7.6.9 Close 203

☐ 5.7.6.10 Close 204

☐ 5.7.6.11 Close 206

☐ 5.7.6.12 Ensure 109 is off.

☐ 5.7.6.13 Close 103

☐ 5.7.6.14 Calculate the total amount of H_2 in the sample using Enclosure 7.4.

☐ 5.7.6.15 Report results on Enclosure 7.7.

5.8 Sample pH Measurement (PALSS Control Panel)

☐ 5.8.1 Ensure closed 206

☐ 5.8.2 Ensure closed 204

☐ 5.8.3 Ensure SS 3 switch is set on PT 1.

5.8.4 Pressurize liquid tank to at least 60 PSIG as monitored on PG 1 (alternate PG 4), as follows:

☐ 5.8.4.1 Open 202

☐ 5.8.4.2 Open 205

☐ 5.8.4.3 Open 207

☐ 5.8.4.4 Open 103

☐ 5.8.4.5 After 30 seconds, close 103.

☐ 5.8.4.6 Close 207

☐ 5.8.4.7 Close 205

☐ 5.8.4.8 Close 202

☐ 5.8.5 Open 102

5.8.6 Record pH on Enclosure 7.7.

☐ 5.8.7 Close 102

5.8.8 Notify OSC that RCS sampling via the PALSS is completed and that sample retrieval will begin following system flush.

OSC Person Notified: _____

5.9 System Flush (PALSS Control Panel)

NOTE:	Directions regarding sample panel flushing will be determined by management.

5.9.1 Ensure 204 and 206 remain closed and the sample injection valve(s) selected (501, 502 and/or 503) is turned off.

5.9.2 **IF** either LT 1 **OR** LT 2 indicator is illuminated:

☐ 5.9.2.1 Open 108

☐ 5.9.2.2 Turn on 110 (sump pump).

☐ 5.9.2.3 **WHEN** both LT1 and LT2 are out, close 108.

☐ 5.9.2.4 Turn off 110 (sump pump).

5.9.3 **IF** given the direction to flush the panel, flush the 500 ml liquid tank, pH housing, and sample injection valves as follows:

500 ml Liquid Tank

☐ 5.9.3.1 Open 101

☐ 5.9.3.2 Open 104

☐ 5.9.3.3 Open 401

☐ 5.9.3.4 Open PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)

pH Housing

☐ 5.9.3.5 Open 102

☐ 5.9.3.6 Open 105

Sample Injection Valves

☐ 5.9.3.7 Open 107

☐ 5.9.3.8 Open 402

☐ 5.9.3.9 Flush the sample panel until the general area dose rate on the exterior of the panel is ≤ 2 mR/hr **OR** a satisfactory level is achieved per RP.

☐ 5.9.3.10 Close 402

☐ 5.9.3.11 Close 107

☐ 5.9.3.12 Close 105

☐ 5.9.3.13 Close 102

☐ 5.9.3.14 Close 101

☐ 5.9.3.15 Close 104

☐ 5.9.3.16 Close 401

☐ 5.9.3.17 Close PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)

5.10 Liquid & Gas Sample Retrieval (PALSS Control Panel)

Liquid Sample Retrieval

☐ 5.10.1 Ensure open the waste route selected in Step 5.2.11 or 5.2.12:

- PB 1 (3LP-130, Sample Return to High Activity Waste Tank)

OR • PB 2 (3LP-65, 3B Emergency Sump Line Drain Block).

☐ 5.10.2 Ensure closed all other PB valves (motor operated).

☐ 5.10.3 **IF** LT 1 **OR** LT 2 is illuminated, perform Step 5.9.1.

☐ 5.10.4 Select the flow path for sample collection by turning CV 612 to the desired injection valve (0.1 ml, 1 ml, or 5 ml loop).

Sample Loop(s) Selected _____

☐ 5.10.5 Slowly turn CV 613 to the "N_2" position.

☐ 5.10.6 After collecting approximately 15 mls of liquid sample, turn CV 613 to the "VENT" position.

☐ 5.10.7 Wait ≥ 10 seconds for sample line depressurization.

☐ 5.10.8 Turn CV 612 to the "OFF" position.

☐ 5.10.9 As necessary for additional sample(s), repeat Steps 5.10.3 through 5.10.7.

Gas Sample Retrieval

☐ 5.10.10 **WHEN** possible, use the gas-tight syringe(s) to retrieve the gas sample(s) from the 30 ml gas tank keeping syringe vertical (needle down).

☐ 5.10.11 **IF** possible, place syringes in the gas locked position and store vertically (needle down).

5.11 30 ml Gas Tank and 500 ml Gas Tank Purge (PALSS Control Panel)

☐ 5.11.1 Verify Nitrogen supply still has ≥ 100 psig delivery pressure.

5.11.2 Allow all of the following valves to stay open ≥ 2 minutes except alternate the valve pairs 204/206 and 205/207 open and close within the 2 minute period:

☐ 5.11.2.1 Open 202

☐ 5.11.2.2 Open 204

☐ 5.11.2.3 Open 205

☐ 5.11.2.4 Open 206

☐ 5.11.2.5 Open 207

☐ 5.11.2.6 Open 103

☐ 5.11.2.7 Open 104

☐ 5.11.2.8 Open 401

☐ 5.11.2.9 After flushing for several seconds, close the following:

A. 204

B. 206

☐ 5.11.2.10 After additional flush for several seconds, open the following:

A. 204

B. 206

☐ 5.11.2.11 Close 205

☐ 5.11.2.12 Close 207

☐ 5.11.2.13 After several seconds, open the following:

A. 205

B. 207

☐ 5.11.2.14 **IF** the valves need further cycling (it has not been ≥ 2 minutes) return to Step 5.11.2.10.

☐ 5.11.2.15 **IF** the timer is ≥ 2 minutes, proceed to Step 5.11.3.

☐ 5.11.3 Close 202

☐ 5.11.4 Close 401

☐ 5.11.5 Close 104

☐ 5.11.6 Close 103

☐ 5.11.7 Open 201

☐ 5.11.8 Open 208

5.11.9 After ≥ 10 seconds, close the following:

☐ 5.11.9.1 206

☐ 5.11.9.2 207

☐ 5.11.9.3 204

☐ 5.11.9.4 205

☐ 5.11.9.5 201

☐ 5.11.9.6 208

☐ 5.11.10 Repeat Step 5.11.2 through 5.11.9 until dose rates of 30 ml and 500 ml tank are ≤ 10 mR/hr (at contact) **OR** a satisfactory level is achieved per RP.

5.12 System Shutdown

_____ 5.12.1 Ensure closed the following motor operated valves: (PALSS Control Panel)

☐ PB 1 (3LP-130, Sample Return to High Activity Waste Tank)

☐ PB 2 (3LP-65, 1B Emergency Sump Line Drain Block)

☐ PB 3 (3LP-126, Isolation for LP Sample)

☐ PB 4 (3RC-179, Post Accident Sample Block)

☐ PB 5 (3LP-124, Isolation for HP Sample Letdown)

☐ PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)

☐ PB 8 (3LP-129, Sample Drain to the High Activity Waste Tank)

_____ 5.12.2 Ensure closed the following solenoid valves: (PALSS Control Panel)

☐ 201

☐ 202

☐ 203

☐ 204

☐ 205

☐ 206

☐ 207

☐ 208

☐ 209

_____ 5.12.3 Ensure closed the following control valves: (PALSS Control Panel)

☐ 101

☐ 102

☐ 103

☐ 104

☐ 105

☐ 106

☐ 107

☐ 108

_____ 5.12.4 Return the valve power switch, SW 1, to the "OFF" position.

_____ 5.12.5 Return the key switch, KS 1, to the "OFF" position.

_____ 5.12.6 Close 3IA-2423 (Instrument Air Supply) (Outside the PALSS Sample Panel)

_____ 5.12.7 Ensure N_2 cylinder discharge pressure > 600 psi.

- **IF** necessary, replace cylinder.

_____ 5.12.8 Close N_2 Supply Bottle valves (Outside the PALSS Sample Panel)

NOTE: The following cable connections are located between the PALSS Control Panel and the cable junction box.

CAUTION: Make the disconnection of connector cable 1 from the Junction Box the FIRST cable disconnection. **IF** this is not done first, the exposed pins of the other cables may become energized and become an electrical hazard.

☐ 5.12.9 **IF** directed by Chemistry Staff, disconnect the following cables in order:

Staff notified _____ Check below as directed by Staff.

☐ Leave the power cables connected.

☐ Disconnect the power cables connected.

☐ 5.12.9.1 CON-1 from the junction box (this is the first cable disconnect made), then from the PALSS Control Panel.

☐ 5.12.9.2 CON-2 cable at both ends.

☐ 5.12.9.3 CON-3 cable at both ends.

☐ 5.12.9.4 CON-4 cable at both ends.

☐ 5.12.9.5 CON-5 cable at both ends.

☐ 5.12.9.6 CON-6 cable at both ends.

☐ 5.12.10 Store the control panel in the AB 1st floor hallway/corridor within ten (10) feet from the Unit 1 electrical junction box.

☐ 5.12.11 Ensure the control panel wheels are locked to prevent panel movement.

☐ 5.12.12 Ensure CV 609 is in the "AIR" position.

☐ 5.12.13 Ensure CV 610 is in the "NITROGEN" position.

☐ 5.12.14 Inform the OSC that flushing of the PALSS Panel has been completed.

OSC Person Notified: _____

5.13 Sample Analysis

NOTE: Steps 5.13.1 - 5.13.3 can be performed in any order. Substeps must be performed in the order written.

5.13.1 Gas (Nitrogen Stripping Method)

5.13.1.1 Analyze up to four syringes of stripped gas using LM-O-P008 (The Determination of Hydrogen in Gas Samples using the Carle Gas Chromatograph and the Spectra Physics Integrator).

5.13.1.2 Use the following formula to calculate results:

$$\%\ H_2 \frac{615.72\ cc}{0.50\ Kg} \times \frac{1}{100} = cc/Kg\ H_2$$

Where: % H_2 is determined from LM-O-P008

615.72 cc = 30 ml gas bomb + 500 ml gas bomb + tubing volume (volume occupied by sample gas).

0.50 Kg = collected sample size

$\frac{1}{100}$ = conversion of percent to decimal

5.13.1.3 Record results in cc/kg H_2 on Enclosure 7.7.

5.13.1.4 **IF** needed, reserve other stripped gas syringes for use as backups **OR** to perform a gas sample gamma spectra.

5.13.2 Liquid

5.13.2.1 Submit sample to count room for gamma spectra analysis. The sample may be counted in the rheodyne sample vial using the loop volume (preferred) or in a 50 ml bottle. **IF** a 50 ml bottle is used, refer to the following table for preparation guidelines:

PALSS Loop Size	Gamma Spectra Volume Ratio	Dilute sample from PALSS with demin. to: (mls)	mls of diluted sample to dilute to 50 mls for gamma spectra analysis
5.24	5/45	50	(50/5.24)*5 or ~ 48
5.24	1/49	100	(100/5.24)*1 or ~19
1.04	1/49	50	(50/1.04)*1 or ~48
1.04	.5/49.5	100	(100/1.04)*0.5 or ~48
0.10058	.1/49.9	50	(50/0.10058)*0.1 or ~50

5.13.2.2 Record results in mCi/ml on Enclosure 7.7 and attach GeLi Spectra.

5.13.2.3 Analyze PALSS sample for boron.

- To obtain a boron concentration that will correlate directly with the normal RCS, the dilution factor must be multiplied by the analyzed sample concentration (obtained from the Boron Titration).

$$\text{ppm B} = \text{measured ppm B} \times \frac{\text{Total dilution volume (sample loop + dilution water), mls}}{\text{sample loop volume, mls}}$$

5.13.2.4 Record results of boron sample analysis on Enclosure 7.7.

5.13.2.5 Perform a chloride analysis of the sample.

- To obtain a Cl concentration that will correlate directly with the normal RCS, the dilution factor must be multiplied by the analyzed sample concentration.

$$\text{ppb Cl} = \text{measured ppb Cl} \times \frac{\text{Total dilution volume (sample loop + dilution water), mls}}{\text{sample loop volume, mls}}$$

NOTE: **IF** the Cl results are below the Limit of detection (LOD) for the Cl analysis, multiply the LOQ by the dilution factor for reporting purposes (record as "< LOQ * dilution factor" instead of "T0").

5.13.2.6 Record results on Enclosure 7.7.

5.13.2.7 **IF** needed, reserve any remaining liquid sample for use as a backup.

5.13.3 **IF** approved by OSC & RP, prepare Panel for next use by performing the following: (PALSS Sample Panel)

- Fill buffer tanks(s) with ~ 600 mls of buffer solution for calibrating the pH meter.
  - This solution will be pressurized with nitrogen gas to at least 60 psig using the nitrogen purge system inside the PALSS sample panel.
  - Connect tank(s) to quick connect fittings inside sample panel.

NOTE:
1. Always fill Buffer Tank A with a pH 7 buffer. Buffer Tank B should be filled with a pH 4 buffer if expected pH < 7.0 **OR** a pH 10 buffer if expected pH > 7.0.
2. Buffer tanks may be pre-prepared and stored inside of PALSS sample panel. Verify that buffer expiration dates have not been exceeded.

- Fill the 50 ml sample flush cylinder with demineralized water for flushing the liquid sample from the Rheodyne sample injection valves.
  - While holding in a vertical position, attach the matching quick disconnects and fill the cylinder from the bottom to the top using demineralized water.
  - Connect to sample shelf inside sample panel.

- Replace Gas Bomb Septa.

5.13.4 Ensure all data is recorded and Enclosure 7.7 is complete.

5.13.5 Route this procedure along with the gamma spectra(s) to the OSC.

6. References

6.1 NUREG-0737, Section II.B.3

6.2 DPC System Radiation Protection Manual

6.3 Post Accident Liquid Sampling System Manual, Production Support Department, OM-311C-0331

6.4 ASTM Volume 11.01, D-1293-84 (1990)

6.5 DPC LM-O-P008

6.6 DPC LM-O-P004

6.7 ITS 5.5.4

7. Enclosures

7.1 Valve Arrangement Diagram (Control Panel)

7.2 Valve Arrangement Diagram (General - One Line)

7.3 PALSS Inlet Filter/Strainer Back Flush Procedure

7.4 Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

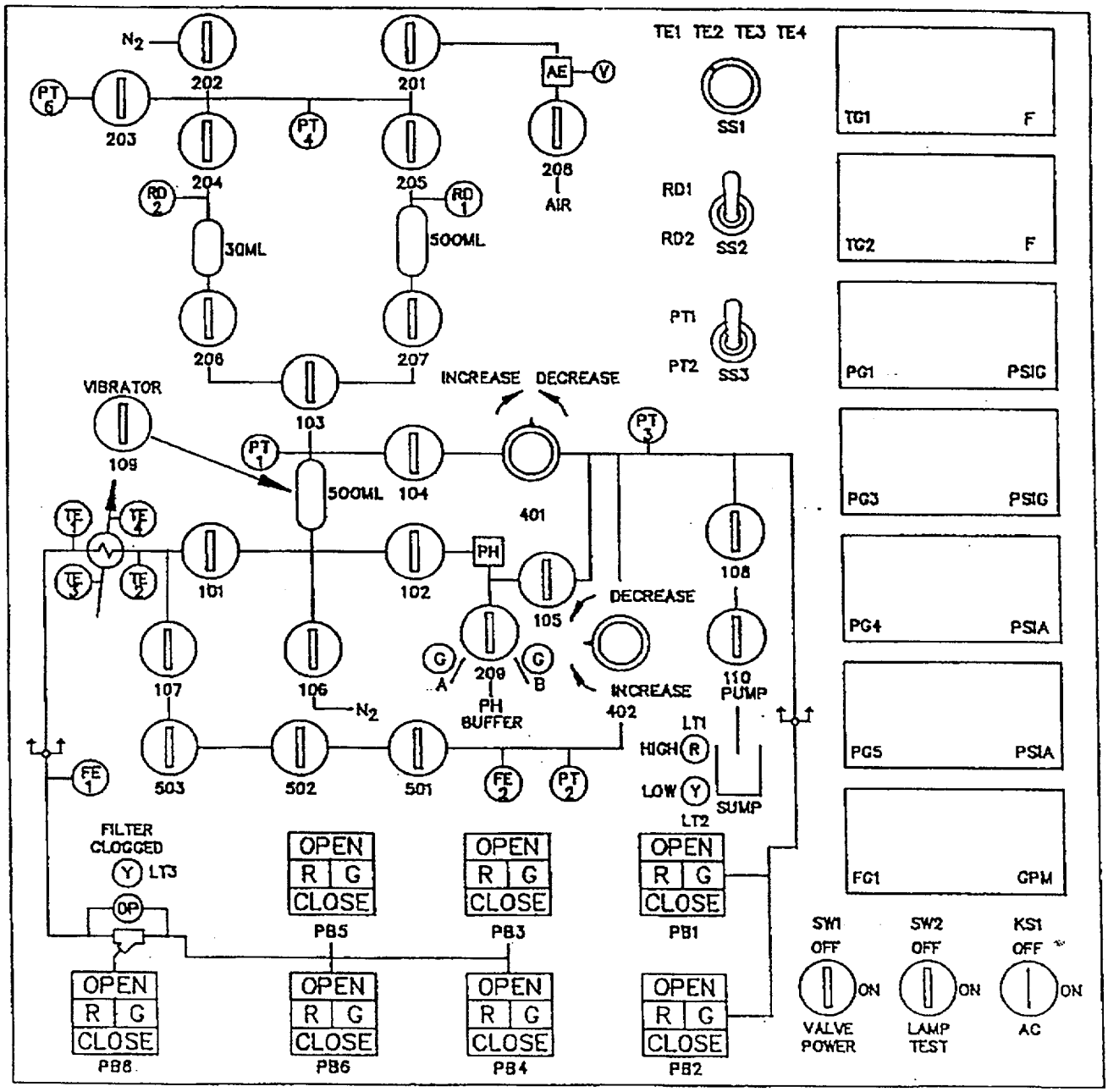
7.5 Unit 3 PALSS Power Supply

7.6 Operations Checklist for Unit 3 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

7.7 PALSS Authorization for Operation and Data Transmittal Form

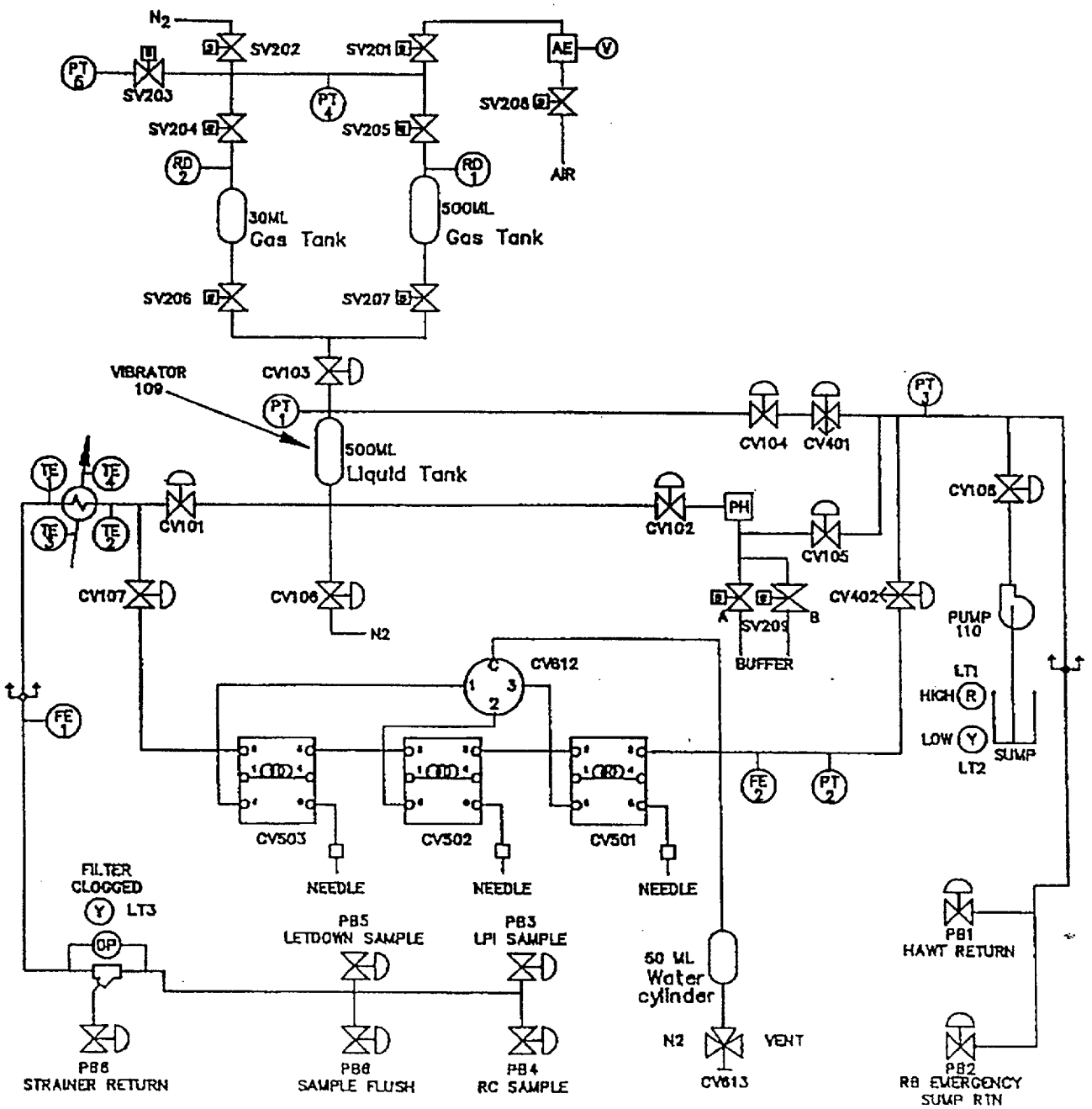
Enclosure 7.1

Valve Arrangement Diagram
(Control Panel)



Enclosure 7.2

Valve Arrangement Diagram
(General - One Line)



Enclosure 7.3

PALSS Inlet Filter/Strainer
Back Flush Procedure

1. Purpose

This enclosure gives instructions for back flushing the PALSS inlet filter/strainer.

2. Limits and Precautions

The following RCS sample valves must be closed to prevent contamination of the demineralized water header with reactor coolant: (PALSS Control Panel)

- PB 5 (3LP-124, Isolation for HP Sample Letdown)
- PB 3 (3LP-126, Isolation for LP Sample)
- PB4 (3RC-179, Post Accident Sample Block)

3. Procedure (PALSS Control Panel)

☐ 3.1 Ensure closed PB 5 (3LP-124, Isolation for HP Sample Letdown).

☐ 3.2 Ensure closed PB 3 (3LP-126, Isolation for LP Sample).

☐ 3.3 Ensure closed PB 4 (3RC-179, Post Accident Sample Block).

☐ 3.4 After ≥ 30 seconds, close 104.

☐ 3.5 Ensure SS 3 (selector switch) is in the "PT-1" position.

☐ 3.6 Monitor pressure on PG-1 for one minute.

☐ 3.6.1 **IF** the pressure on PG-1 > 60 psi **OR** is increasing with time, immediately contact Chemistry Staff and notify the RCS may be leaking by PB 5 (3LP-124, Isolation for HP Sample Letdown), PB 3 (3LP-126, Isolation for LP Sample) **OR** PB 4 (3RC-179, Post Accident Sample Block).

- Do **NOT** proceed without Staff approval.

☐ 3.7 Close 101

☐ 3.8 Open PB 8 (3LP-129, Sample Drain to the High Activity Waste Tank)

☐ 3.9 Open PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)

☐ 3.10 Backflush ≥ 5 minutes, then close:

☐ 3.10.1 PB 6 (3DW-278, DW Flush Supply to Post Accident Sample)

☐ 3.10.2 PB 8 (3LP-129, Sample Drain to the High Activity Waste Tank)

3.11 **IF** the purpose is to resume sampling, open:

- PB 5 (3LP-124, Isolation for HP Sample Letdown)

OR • PB 3 (3LP-126, Isolation for LP Sample)

OR • PB 4 (3RC-179, Post Accident Sample Block)

☐ 3.11.1 Open 104

☐ 3.11.2 Open 101

☐ 3.11.3 Return to procedural step allowing completion of the sampling process.

3.12 **IF** the clogged filter light is still "ON" and no flow is shown on FG 1, stop sampling.

3.13 Notify Chemistry Staff.

Staff Notified: _____

Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

1. Purpose

This enclosure provides guidance on calculations for hydrogen using Ideal Gas Laws.

2. Limits and Precautions

N/A

3. Procedure

3.1 Record the initial and final temperature and pressure readings from Steps 5.7.6.4 and 5.7.6.8.

Initial Temperature Reading _____ °F

Final Temperature Reading _____ °F

Initial Pressure Reading _____ PSIA

Final Pressure Reading _____ PSIA

3.2 Calculate the average gas temperature reading using the following equation:

$$T_{avg} = (T_{final} + T_{init})/2$$

where, T_{avg} = Average Gas Temperature, °C

T_{final} = Final Gas Temperature Reading, °C

T_{init} = Initial Gas Temperature Reading, °C

3.3 Calculate the differential gas pressure using the following equation:

$$P_{diff} = P_{final} - P_{init}$$

where, P_{diff} = Differential Gas Pressure, PSI

P_{final} = Final Gas Pressure Reading, PSIA

P_{init} = Initial Gas Pressure Reading, PSIA

Calculation of Hydrogen Concentration Using the Ideal Gas Law (Differential Pressure)

3.4 Calculate the hydrogen concentration of the trapped PALSS gas sample using the following equation:

$$H_2 = \frac{(3{,}719.83)(P_{diff})}{(T_{avg} + 273)} + \frac{(P_{final} - 0.69)}{0.769}$$

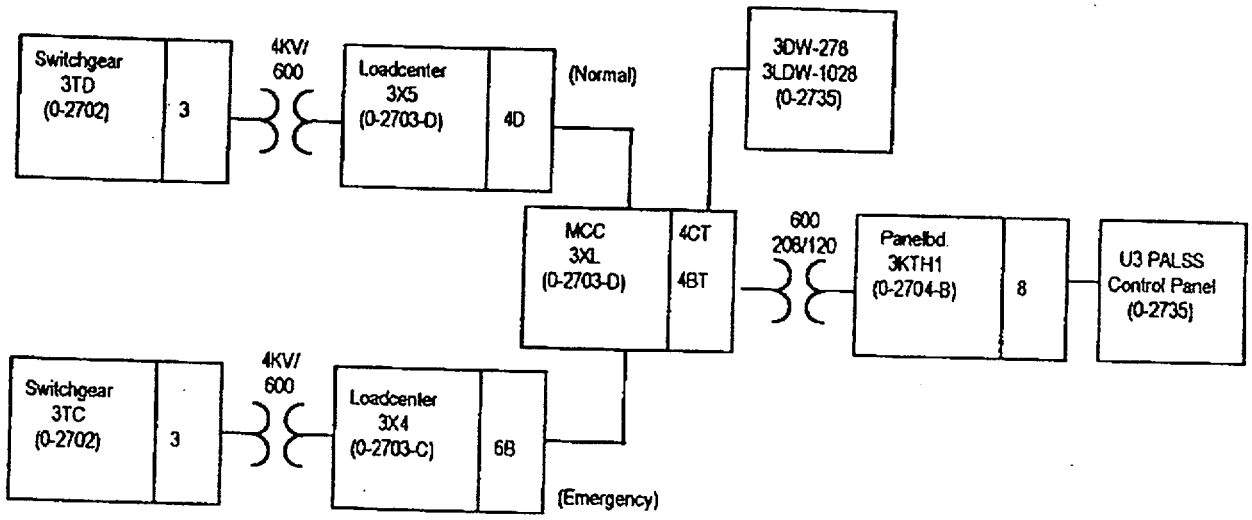
(H_2 in Gas Sample) (H_2 remaining in Liquid Sample)

where, H_2 = PALSS gas sample Hydrogen Concentration, cc/Kg

3.5 Record hydrogen concentration result from Step 3.4 above on Enclosure 7.7.

Enclosure 7.5

Unit 3 PALSS Power Supply



Enclosure 7.6

Operations Checklist for Unit 3 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

1. Purpose

This enclosure gives the valve lineups needed for routing reactor coolant from the RCS "J" Leg through the PALSS to the RBES.

2. Limits and Precautions

2.1 Demineralized water header should be in service and have at least 60 psi pressure. RCW (sample cooling supply) should also be in service.

3. Procedure

3.1 Establish communications with Chemistry personnel assigned to the task.

Chemistry personnel assigned: _____

> **CAUTION:** **IF** containment integrity is required or is to be considered, station personnel in constant communication with the Control Room in the vicinity of 3LP-65 ('3B' Emer Sump Line Drain Block) to immediately close 3LP-65 **IF** ES actuation occurs.

_____ _____ DV 3.2 Open 3LP-65 ('3B' Emer Sump Line Drain Block) (Unit 3 LPI Room) manual valve to be operated by reach rod from LPI Hatch Room 119 (on west wall ~ 9 ft. to the right of 1LP-22).

_____ 3.3 Record that the valve is open in OP/0/A/1102/020 (Shift Turnover).

3.4 Establish flow to the PALSS panel via the RCS "J" Leg as follows:

3.4.1 **IF** containment integrity is required or is being considered, assign an Operator to close 3RC-162, 3RC-163, 3RC-164, and 3RC-165 in case of an ES Actuation.

_____ _____ DV 3.4.2 Open 3RC-162 (RC Sample Valve). (inside RB, operated from Control Room)

_____ _____ DV 3.4.3 Open 3RC-163 (RC Sample Valve). (inside RB, operated from Control Room)

_____ _____ DV 3.4.4 Open 3RC-164 (RC Sample Isolation Valve). (Unit 3 LPI Room, operated by reach rod, LPI Hatch, Rm. 159 on SW wall next to spiral stairs)

Operations Checklist for Unit 3 PALSS Operating Procedure Valve Lineups to Route Reactor Coolant to the PALSS/Waste to the RBES

_____ _____ 3.4.5 Open 3RC-165 (RC Sample Isolation Valve (Solenoid Valve)). (Unit 3 LPI Room, operated by reach rod, LPI Hatch, Rm. 159 on SW wall next to spiral stairs)
DV

_____ 3.4.6 Record that 3RC-164 (RC Sample Isolation Valve) and 3RC-165 (Post Accident Sample Valve) are open in OP/0/A/1102/020 (Shift Turnover).

3.5 Chemistry will notify Operations when the RCS sample has been obtained

Operations notified: _____

3.6 Chemistry will ask Operations to close the following valves.

_____ _____ 3.6.1 3RC-165 (RC Sample Isolation Valve (Solenoid Valve)). (Unit 3 LPI Room, operated by reach rod, LPI Hatch, Rm. 159 on SW wall next to spiral stairs)
DV

_____ _____ 3.6.2 3RC-164 (RC Sample Isolation Valve). (Unit 3 LPI Room, operated by reach rod, LPI Hatch, Rm. 159 on SW wall next to spiral stairs)
DV

_____ _____ 3.6.3 3RC-163 (RC Sample Valve). (Reactor Building)
DV

_____ _____ 3.6.4 3RC-162 (RC Sample Valve). (Reactor Building)
DV

_____ 3.6.5 Record that containment isolation valves 3RC-164 (RC Sample Valve) and 3RC-165 (RC Sample Isolation Valve (Solenoid Valve)) are closed in OP/0/A/1102/020 (Shift Turnover).

3.7 Close 3LP-65 ('3B' Emer Sump Line Drain Block). (Unit 3 LPI Room)

3.8 Record that 3LP-65 ('3B' Emer Sump Line Drain Block) is closed in OP/0/A/1102/020 (Shift Turnover).

_____ 3.9 Ensure completed enclosure is maintained by Chemistry.

Enclosure 7.7

PALSS Authorization for Operation and Data Transmittal Form

Date _____

_____ **1. Verbal/written direction for sampling the Reactor Coolant via the PALSS has been received from the TSC/OSC.**

Sample Point: RCS "J-Leg" _____ Waste Route: RBES _____

LPI Pump Discharge_____ HAWT _____

HPI Letdown _____

Person Authorizing Sampling _____

_____ **2. The specific post-accident analysis requested by TSC/OSC:**

____ Boron = _____ppm

____ Hydrogen = _____cc/kg

____ Chloride = _____ppm

____ pH = _____

____ Gas Gamma (attach)

____ Liquid Gamma (attach)

____ Other (specify) _____

3. Have RP determine general area dose rate at the PALS valve panel and record below.

Dose rate (general area) = _____ r/hr

_____ **4. Determine by detailed planning meeting the exact course of action and data required.**

_____ **5. Evaluate the use of portable shielding, remove handling equipment, video equipment, etc., to minimize the exposure to personnel while sampling.**

_____ **6. Have RP determine 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.**

_____ **7. Determine how long to flush the PALSS sample panel, based on general area dose readings.**

_____ **8. Request RP to designate a route from PALSS to the Lab.**

Sample route designated:_____

_____

9. Evaluate the use of portable shielding, remove handling equipment, video equipment, etc., to minimize the exposure to personnel in the Lab for the required analyses.

(R06-97)

Duke Power Company

PROCEDURE PROCESS RECORD

INFORMATION ONLY

(1) ID No. CP/3/A/2002/005

Revision No 11

Continuous Use

PREPARATION

(2) Station Oconee Nuclear Station

(3) Procedure Title Post Accident Caustic Injection Into the Low Pressure Injection System

(4) Prepared By Roger D Smith Date 12/20/99

(5) Requires 10CFR50.59 evaluation?

- ☑ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By Dean Cantrell (QR) Date 12/28/99

Cross-Disciplinary Review By _____ (QR)NA N/C Date _____

Reactivity Mgmt. Review By _____ (QR)NA N/C Date _____

(7) Additional Reviews

QA Review By _____ Date _____

Reviewed By _____ Date _____

Reviewed By _____ Date _____

(8) Temporary Approval *(if necessary)*

By _____ (SRO/QR) Date _____

By _____ (QR) Date _____

(9) Approved By Bryan L Nees Date 12/29/99

PERFORMANCE *(Compare with control copy every 14 calendar days while work is being performed.)*

(10) Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____

Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification

- ☐ Yes ☐ NA Check lists and/or blanks initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ NA Listed enclosures attached?
- ☐ Yes ☐ NA Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ NA Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ NA Procedure requirements met?

Verified By _____ Date _____

(13) Procedure Completion Approved _____ Date _____

(14) Remarks *(Attach additional pages, if necessary)*

Post Accident Caustic Injection into the Low Pressure Injection System

1. Purpose

NOTE:	A control copy of this procedure shall be routed to the Emergency Preparedness Team within 3 working days after any approved changes.

1.1 This procedure is to provide instruction for caustic addition into the LPI System during a Loss of Coolant Accident. (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:

$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_20$

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

2. Limits and Precautions

2.1 The following safety equipment shall be worn when connecting/disconnecting caustic tote bins:

2.1.1 Chemical goggles

2.1.2 Face shield

2.1.3 Corrosive resistant suit, neoprene or chemrel

2.1.4 Corrosive resistant boots, neoprene or PVC

2.1.5 Corrosive resistant gloves, neoprene or PVC

2.2 Verify eyewash station and safety shower are operable prior to connecting/disconnecting caustic tote bins.

2.3 Chemical hazards shall be known prior to use. For additional information, refer to the MSDS sheets.

2.4 Under accident conditions, valve alignments shall **NOT** be made and injection shall **NOT** begin without prior authorization from the Operations Emergency Coordinator **OR** the Technical Support Center (TSC) / Operational Support Center (OSC)!

NOTE: An initial caustic add of 15 inches will neutralize an RCS inventory of 80,000 gallons with a boron concentration of 1800 ppm. This is a conservative initial add to allow immediate response to a large break LOCA.

2.5 An initial caustic add of 15 inches can be made without performing CSM 5.2, Enclosure 6.3 (Caustic Addition Calculations).

2.6 In the event of caustic spill, call 4911.

2.7 ITS 5.4.1.a and SLC 16.13.7 require that pH be measured **AND** that the addition of caustic to Reactor Coolant commence within 30 minutes AFTER switchover to recirculation mode of core cooling to adjust pH to a range of 7.0 to 8.0 WITHIN 24 hours.

2.8 The following safety and caustic addition equipment is stored in the brown storage container located in the Auxiliary Building, Unit 1 & 2 Chemical Addition Area:

Goggles	Boots	Flashlight
Face shield	Stainless steel flex hose	Bung Wrench
Corrosive suit	Tape Measure	
Gloves	Tank to valve adapter	

2.9 Keys to the brown storage container are stored with the caustic addition procedure in the OSC Chemistry Emergency Procedure Files and in the fireproof cabinet located in the Primary Chemistry lab office. All personnel in Primary Chemistry and Radwaste have also been issued individual keys.

2.10 Steps preceded with "☐" (immediately to the left of the step) are check off steps, and will be checked off as completed.

2.11 Steps preceded by bullets (•) may be performed in any sequence. Numbered steps may only be performed out of sequence if reviewed and approved by a Primary Staff person and one other individual who are familiar with this procedure (see NSD 704).

2.12 Independent Verification (designated by two sign-off steps) is a documented check by a second individual which helps to ensure the correct condition or position of plant components. Separate Verification (designated by SV) ensures individuals act separately and independently. Double Verification (designated by DV) ensures the "doer" and "verifier" independently decide that an action is correct prior to the "doer" performing the action. The "verifier" shall use a "hands-on" approach to verify the actions of the "doer".

2.13 Power to the caustic addition pump is provided through 3XL located near the LPI Hatch Area. For power supply diagram, see Enclosure 5.5.

3. Procedure

3.1 Upon notification from Operations Emergency Coordinator **OR** TSC / OSC, take the following actions to align the caustic addition system to the appropriate unit:

NOTE:	The following steps may be performed simultaneously to conserve time.

☐ Mark the current liquid level directly on the translucent tote bin container.

☐ Measure down from the liquid level mark 14 inches and mark this level directly on the tote bin.

☐ **IF** necessary, move the tote bin into position and connect the bin discharge to the Swagelock quick-connect fitting upstream of valve 3CA-36 (Caustic Pump Suction Tell Tale) (AB Elev 771 at base of Unit 3 NaOH pump) as follows:

☐ Remove dust cover from swagelock fitting on tote bin.

☐ Remove dust cover from swagelock fitting at 3CA-36 (Caustic Pump Suction Tell Tale) (AB Elev 771 at base of Unit 3 NaOH pump).

☐ Connect stainless steel flex hose to these fittings.

☐ 3.1.1 Make valve alignments per Enclosure 5.1 to allow caustic injection into the Low Pressure Injection (LPI) pump suction on Unit 3.

☐ 3.1.2 Vent the caustic tote bin by removing the tote bin fill cap.

☐ 3.1.3 Open the caustic tote bin outlet valve.

☐ 3.1.4 Notify Operations **OR** the OSC (if activated) that valve alignments for caustic injection are complete and ready to be initiated.

Operations or OSC Notified _____ Date/Time ____/____

☐ 3.1.5 Start the caustic addition pump at maximum flow setting. The caustic pump switch is located on the Chemical Addition Control Panel. The maximum pump capacity is approximately 2 gallons per minute.

CAUTION: The caustic pump has an average pump rate of 1.2 gallons per minute. To pump the initial setting of 15 inches will require 1.5 hours. A calculated volume should be initiated and completed within 30 minutes on turning the caustic pump on.

☐ 3.1.6 Calculate the total amount of caustic (in gallons) to be added for the neutralization of the borated water added to the system by using CSM 5.2.

☐ 3.1.7 Convert gallons from Step 3.1.6 to inches (in the 350 gallon tote bin) by dividing the number of gallons to be added by 8.1. Record the values below:

Gallons to be added _____ Inches to be added from the tote bin _____

☐ 3.1.8 Mark the calculated liquid level directly on the tote bin by measuring down from the original "current liquid level" mark made in Step 3.1.

NOTE: Use low dose waiting area as possible during addition

☐ 3.1.9 **WHEN** the caustic tote bin level reaches the desired level (as marked in Step 3.1) **OR WHEN** the caustic tote bin is empty, stop caustic addition pump using the switch located on the Chemical Addition Control Panel.

☐ 3.1.10 Close tote bin outlet valve.

☐ 3.1.11 Close 3CA-36 (Caustic Pump Suction Tell Tale) (AB Elev 771 at base of Unit 3 NaOH pump).

☐ 3.1.12 Record time and volume added on Enclosure 5.3.

☐ 3.1.13 **IF** necessary, replace the caustic tote bin as follows:

☐ 3.1.13.1 Replace tote bin fill cap.

☐ 3.1.13.2 Disconnect empty tote bin from swagelock fitting on stainless flex hose.

☐ 3.1.13.3 **IF** necessary, move tote bins and remove dust cover from swagelock fitting on new tote bin.

☐ 3.1.13.4 Connect stainless flex hose to the new tote bin.

☐ 3.1.13.5 **IF** pumping is to continue, mark the tote bin per Section 3.1 for the amount to be added from the new tote bin and go to Step 3.1.2.

☐ 3.1.14 Notify OSC caustic addition to U-3 LPI is complete and no further additions are in progress.

OSC Notified _____ Date/Time _____/_____

☐ 3.1.15 After caustic addition is complete, allow LPI recirculation time of 2 hours.

☐ 3.1.16 **WHEN** authorized by the TSC/OSC, have sample taken (per appropriate procedure) to determine the resultant pH of the reactor coolant.

☐ 3.1.17 **IF** pH is < 7.0:

- Calculate (refer to Chemistry Section Manual Section 5.2) the amount of caustic (in gallons) to be added to complete the neutralization of the borated water added to the system.
- Convert this number to inches (in the 350 gallon tote bin) by dividing the number of gallons to be added by 8.1 gallons/inch.
- Record the values below:

Gallons to be added: _____ Inches to be added from tote bin: _____

☐ 3.1.18 **IF** pH is > 7.0, go to Step 3.1.22.

☐ 3.1.19 Mark the current liquid level directly on the translucent tote bin container.

☐ 3.1.20 Measure down from this mark the number of inches calculated in Step 3.1.17 above. Mark this level directly on the tote bin.

☐ 3.1.21 Repeat Steps 3.1.1 through 3.1.18 until all necessary caustic (as determined by TSC/OSC) has been added.

☐ 3.1.22 After all necessary caustic has been added and upon authorization from the TSC/OSC, return the system to normal as follows:

☐ 3.1.22.1 Replace tote bin fill cap.

☐ 3.1.22.2 Disconnect empty tote bin from swagelock fitting on stainless flex hose.

☐ 3.1.22.3 Make alignments per Enclosure 5.2 to return valves to normal position.

4. References

4.1 Dwg. No. OFD-110A-3.8 Chemical Addition System (Primary Side Chemical Addition)

4.2 Dwg. No. OFD-102A-3.1, Low Pressure Injection System, Borated Water Supply and LPI Pump Suction.

4.3 CSM 5.2

4.4 ITS 5.4.1.a

4.5 New SLC 16.13.7

5. Enclosures

5.1 Valve Alignment for Caustic Injection on Unit 3

5.2 Normal Valve Alignment for Caustic Injection System on Unit 3

5.3 Caustic Mixing and Injection Record

5.4 Piping Diagram of Caustic Injection System for Unit 3. (For Information Only)

5.5 Unit 3 Caustic Pump Power Supplies

Enclosure 5.1

Valve Alignment for
Caustic Injection on Unit 3

Date_____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Open	3CA-103	Caustic Recirc Block	AB Rm. 157, Elev 771, hallway outside Unit 3 SS Filter Rm.
	_____	Closed	3CA-96	Caustic Recirc Block	AB Elev 771 at Unit 3 NaOH Pump Discharge
	_____	Closed	3CA-35	Caustic Pump Suction	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Open	3CA-36	Caustic Pump Suction Tell Tale	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Open	3CA-112	Caustic Pump Pressure Gauge Isolation	AB Elev 771 adjacent to but west of Unit 3 NaOH mix tank
	_____	Closed	3CA-58	Caustic to #3 LP Pump Suction Tell Tale	AB Rm. 157, Elev 783 Col. Q-91, Unit 3 SS Filter Rm.
	_____	Open	3CA-39	Caustic to Unit #3 LP Block (OPS)	AB Hall, Elev 783 Col. Q-91, outside 3 SS Filter Rm.
	_____	Open	3CA-62	Caustic to Unit #3 LP Block (OPS)	AB Rm. 252, Elev 783 Col. Q-91outside Unit 3 SS Filter Rm.
_____	_____	Open	3LP-51	LPI Sample Recirc. Isolation Valve (Ops)	AB Rm. 252, Elev 783 Col. R-90 outside Cooler Room

Enclosure 5.2

Normal Valve Alignment for Caustic Injection System on Unit 3

Date_____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Open	3CA-103	Caustic Recirc Block	AB Rm. 157, Elev 771, hallway outside Unit 3 SS Filter Rm.
	_____	Open	3CA-97	Caustic Recirc Block	AB Elev 771 overhead at Unit 3 NaOH mix tank
	_____	Open	3CA-96	Caustic Recirc Block	AB Elev 771 at Unit 3 NaOH Pump Discharge
	_____	Closed	3LWD-267	Caustic Tank Outlet Drain	AB Elev 771 at tank drain pipe of Unit 3 NaOH pump
	_____	Closed	3CA-34	Caustic Mix Tank Outlet	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Closed	3CA-35	Caustic Pump Suction	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Closed	3CA-36	Caustic Pump Suction Tell Tale	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Open	3CA-112	Caustic Pump Pressure Gauge Isolation	AB Elev 771 adjacent to but west of Unit 3 NaOH mix tank
	_____	Closed	3CA-58	Caustic to #3 LP Pump Suction Tell Tale	AB Rm. 157, Elev 783 Col. Q-91, Unit 3 SS Filter Rm.
	_____	Closed	3CA-39	Caustic to Unit #3 LP Block (OPS)	AB Hall, Elev 783 Col. Q-91, outside 3 SS Filter Rm.
	_____	Closed	3CA-62	Caustic to Unit #3 LP Block (OPS)	AB Rm. 252, Elev 783 Col. Q-91outside Unit 3 SS Filter Rm.
_____	_____	Closed	3LP-51	LPI Sample Recirc. Isolation Valve (Ops)	AB Rm. 252, Elev 783 Col. R-90 outside Cooler Room

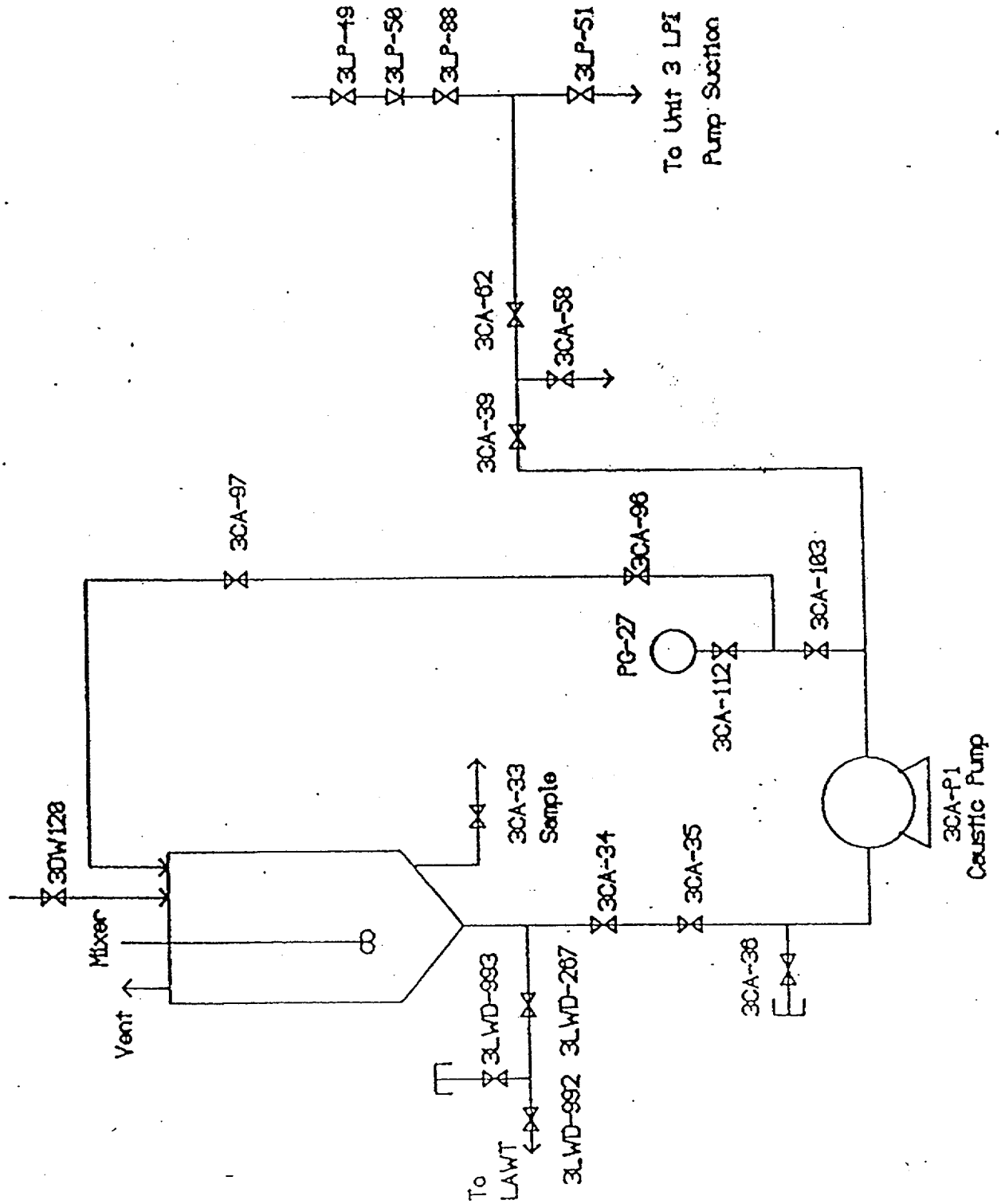
Enclosure 5.3

Caustic Mixing and Injection Record

Date/Time of Injection	Gal. NaOH

Enclosure 5.4

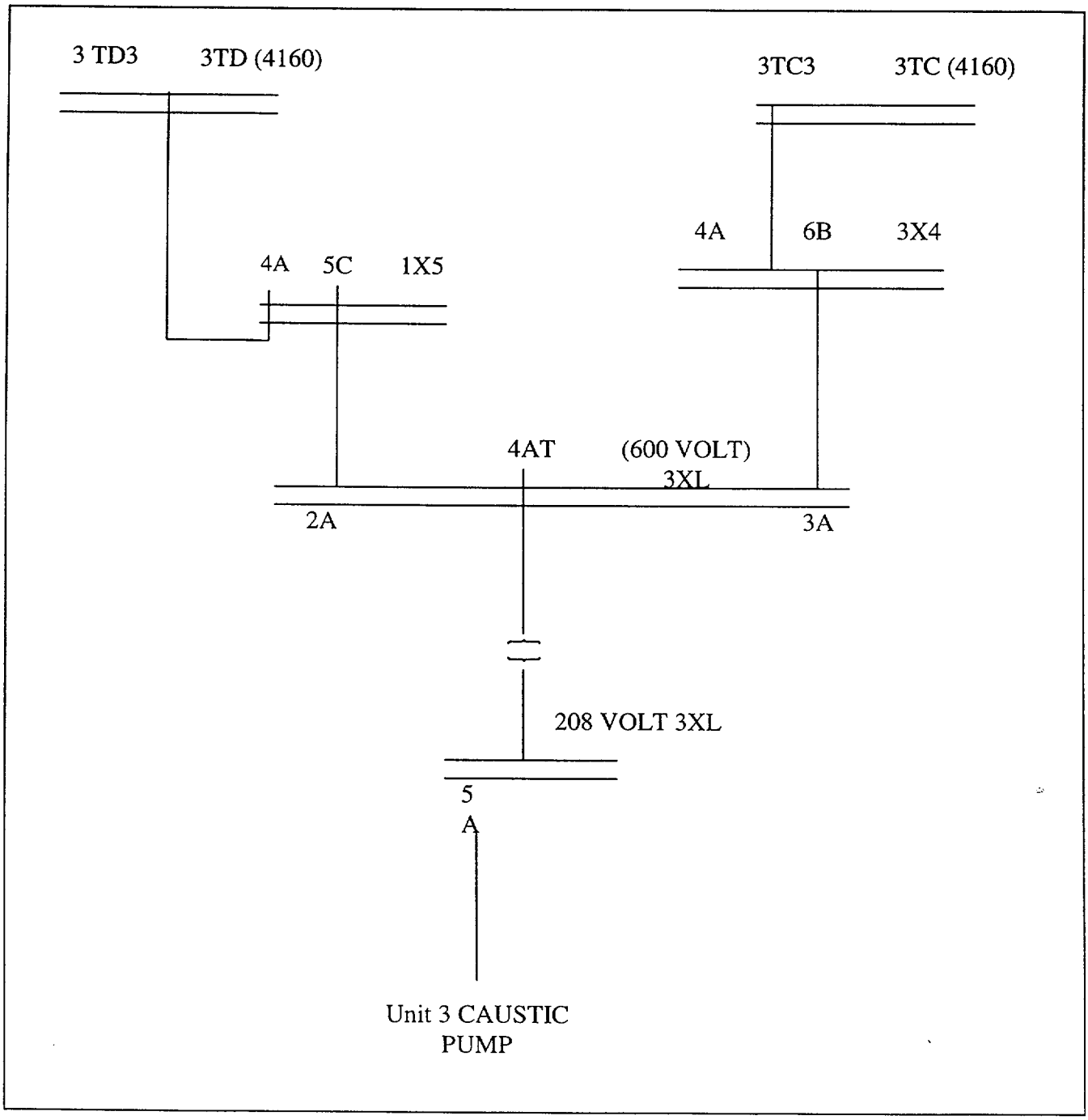
Piping Diagram of
Caustic Injection System for Unit 3



Enclosure 5.5

Unit 3 Caustic Pump Power Supplies

NOTE: Operations alternates the power logic as outlined. Verification will be required to establish which alignment is in use at the time of question.



(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. CP/1&2/A/2002/005
Revision No 12 13 P
Continuous Use

INFORMATION ONLY

PREPARATION

(2) Station Oconee Nuclear Station

(3) Procedure Title Post Accident Caustic Injection Into the Low Pressure Injection System

(4) Prepared By Roger O. Smith Date 12/20/99

(5) Requires 10CFR50.59 evaluation?
- ☑ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By _____ (QR) Date 12/27/99
Cross-Disciplinary Review By _____ (QR)NA N/A Date 12/27/99
Reactivity Mgmt. Review By _____ (QR)NA N/A Date 12/27/99

(7) Additional Reviews
QA Review By _____ Date _____
Reviewed By _____ Date _____
Reviewed By _____ Date _____

8) Temporary Approval *(if necessary)*
By _____ (SRO/QR) Date _____
By _____ (QR) Date _____

(9) Approved By _____ Date 12/29/99

PERFORMANCE ***(Compare with control copy every 14 calendar days while work is being performed.)***

(10) Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____
Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification
- ☐ Yes ☐ NA Check lists and/or blanks initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ NA Listed enclosures attached?
- ☐ Yes ☐ NA Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ NA Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ NA Procedure requirements met?

Verified By _____ Date _____

13) Procedure Completion Approved _____ Date _____

(14) Remarks *(Attach additional pages, if necessary)*

Post Accident Caustic Injection into the Low Pressure Injection System

1. Purpose

NOTE:	A control copy of this procedure shall be routed to the Emergency Preparedness Team within 3 working days after any approved changes.

1.1 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:

$4H_3BO_3 + 2NaOH \rightarrow Na_2B_4O_7 + 7H_20$

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

2. Limits and Precautions

2.1 The following safety equipment shall be worn when connecting/disconnecting caustic tote bins:

2.1.1 Chemical goggles

2.1.2 Face shield

2.1.3 Corrosive resistant suit, neoprene or chemrel

2.1.4 Corrosive resistant boots, neoprene or PVC

2.1.5 Corrosive resistant gloves, neoprene or PVC

2.2 Verify eyewash station and safety shower are operable prior to connecting/disconnecting caustic tote bins.

2.3 Chemical hazards shall be known prior to use. For additional information refer to the MSDS sheets.

2.4 Under accident conditions, valve alignments shall **NOT** be made and injection shall **NOT** begin without prior authorization from the Operations Emergency Coordinator **OR** the Technical Support Center (TSC)/Operational Support Center (OSC)!

NOTE: An initial caustic add of 15 inches will neutralize an RCS inventory of 80,000 gallons with a boron concentration of 1800 ppm. This is a conservative initial add to allow immediate response to a large break LOCA.

2.5 An initial caustic add of 15 inches can be made without performing CSM 5.2, Enclosure 6.3 (Caustic Addition Calculations).

2.6 In the event of a caustic spill, call 4911.

2.7 ITS 5.4.1.a and SLC 16.13.7 require that pH be measured **AND** that the addition of caustic to Reactor Coolant commence within 30 minutes AFTER switchover to Recirculation Mode of Core Cooling to adjust the pH to a range of 7.0 to 8.0 WITHIN 24 hours.

2.8 The following safety and caustic addition equipment is stored in the brown storage container located in the Auxiliary Building, Unit 1 & 2 Chemical Addition Area.

Goggles	Boots	Tape Measure
Face shield	Stainless Steel Flex	Flashlight
Corrosive suit	Hose	Bung Wrench
Gloves	Tank to valve adapter	

2.9 Keys to the brown storage container are stored with the caustic addition procedures in the OSC Chemistry Emergency Procedure Files and in the fireproof cabinet located in the Primary Chemistry lab office. All personnel in Primary Chemistry and Radwaste have also been issued individual keys.

2.10 Steps preceded with "☐" (immediately to the left of the step) are check off steps, and should be checked off as completed.

2.11 Steps preceded by bullets (•) may be performed in any sequence. Numbered steps may only be performed out of sequence **IF** reviewed and approved by a Primary Staff person and one other individual who are familiar with this procedure (see NSD 704).

2.12 Independent Verification (designated by two sign-off steps) is a documented check by a second individual which helps to ensure the correct condition or position of plant components. Separate Verification (designated by SV) ensures individuals act separately and independently. Double Verification (designated by DV) ensures the "doer" and "verifier" independently decide that an action is correct prior to the "doer" performing the action. The "verifier" shall use a "hands-on" approach to verify the action(s) of the "doer".

2.13 Power to the caustic addition pump is provided through 1XL located near the LPI hatch area. For power supply diagram, see Enclosure 5.7.

3. Procedure

3.1 Upon notification from Operations Emergency Coordinator **OR** TSC / OSC take the following actions to align the caustic addition system to the appropriate unit:

NOTE:	The following steps may be performed simultaneously to conserve time.

☐ Mark the current liquid level directly on the translucent tote bin container.

☐ Measure down from the liquid level mark 14 inches and mark this level directly on the tote bin.

☐ **IF** necessary, move the tote bin into position and connect the bin discharge to the Swagelock quick-connect fitting upstream of valve 1CA-36 (Caustic Pump Suction Tell Tale) (Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783) as follows:

☐ Remove dust cover from swagelock fitting on tote bin.

☐ Remove dust cover from swagelock fitting at CA-36 (Caustic Pump Suction Tell Tale) (Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783).

☐ Connect stainless steel flex hose to these fittings.

☐ 3.1.1 For Unit 1 **only**, make valve alignments per Enclosure 5.1 to allow caustic injection into the Low Pressure Injection (LPI) pump suction on Unit 1.

☐ 3.1.2 For Unit 2 **only**, make valve alignments per Enclosure 5.2 to allow caustic injection into the Low Pressure Injection (LPI) pump suction on Unit 2.

☐ 3.1.3 Vent the caustic tote bin by removing the tote bin fill cap.

☐ 3.1.4 Open the caustic tote bin outlet valve.

☐ 3.1.5 Notify Operations **OR** the OSC (if activated) that valve alignments for caustic injection are complete and ready to be initiated.

Operations or OSC Notified _____ Date/Time _____/_____

☐ 3.1.6 Start the caustic addition pump at maximum flow setting. The caustic pump switch is located on the Chemical Addition Control Panel. The maximum pump capacity is approximately 2 gallons per minute.

CAUTION: The caustic pump has an average pump rate of 1.2 gallons per minute. To pump the initial setting of 15 inches will require 1.5 hours. A calculated volume should be initiated and completed within 30 minutes on turning the caustic pump on.

☐ 3.1.7 Calculate the total amount of caustic (in gallons) to be added for the neutralization of the borated water added to the system by using CSM 5.2.

☐ 3.1.8 Convert gallons from Step 3.1.7 to inches (in the 350 gallon tote bin) by dividing the number of gallons to be added by 8.1. Record the values below:

Gallons to be added _____ Inches to be added from the tote bin _____

☐ 3.1.9 Mark the calculated liquid level directly on the tote bin by measuring down from the original "current liquid level" mark made in Step 3.1.

NOTE: Use low dose waiting area as possible during addition

☐ 3.1.10 **WHEN** the caustic tote bin level reaches the desired level (as marked in Step 3.1) **OR WHEN** the caustic tote bin is empty, STOP caustic addition pump using the switch located on the Chemical Addition Control Panel.

☐ 3.1.11 Close tote bin outlet valve.

☐ 3.1.12 Close CA-36 (Caustic Pump Suction Tell Tale) (Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783).

☐ 3.1.13 Record time and volume added on Enclosure 5.5.

☐ 3.1.14 **IF** necessary, replace the caustic tote bin as follows:

- ☐ 3.1.14.1 Replace tote bin fill cap.
- ☐ 3.1.14.2 Disconnect empty tote bin from swagelock fitting on stainless flex hose.
- ☐ 3.1.14.3 **IF** necessary, move tote bins and remove dust cover from swagelock fitting on new tote bin.
- ☐ 3.1.14.4 Connect stainless flex hose to the new tote bin.
- ☐ 3.1.14.5 **IF** pumping is to continue, mark the tote bin per Section 3.1 for the amount to be added from the new tote bin and go to Step 3.1.3.

☐ 3.1.15 Notify OSC that caustic addition to the LPI is complete and no further additions are in progress at this time.

OSC Notified _____ Date/Time _____/_____

☐ 3.1.16 After caustic addition is complete, allow LPI recirculation time of at least 2 hours.

☐ 3.1.17 **WHEN** authorized by the TSC/OSC, have sample taken (per appropriate procedure) to determine the resultant pH of the reactor coolant.

☐ 3.1.18 **IF** pH is < 7.0:

- Calculate (refer to Chemistry Section Manual Section 5.2) the amount of caustic (in gallons) to be added to complete the neutralization of the borated water added to the system.
- Convert this number to inches (in the 350 gallon tote bin) by dividing the number of gallons to be added by 8.1 gallons/inch.
- Record the values below:

  Gallons to be added: _____ Inches to be added from tote bin: _____

☐ 3.1.19 **IF** pH is > 7.0, go to Step 3.1.23.

☐ 3.1.20 Mark the current liquid level directly on the translucent tote bin container.

☐ 3.1.21 Measure down from this mark the number of inches calculated in Step 3.1.18 above. Mark this level directly on the tote bin.

☐ 3.1.22 Repeat Steps 3.1.1 through 3.1.19 until all necessary caustic (as determined by TSC/OSC) has been added.

☐ 3.1.23 After all necessary caustic has been added and upon authorization from the TSC/OSC, return the system to normal as follows:

☐ 3.1.23.1 Replace tote bin fill cap.

☐ 3.1.23.2 Disconnect empty tote bin from swagelock fitting on stainless flex hose.

☐ 3.1.23.3 For Unit 1 **only**, make alignments per Enclosure 5.3 to return valves to normal position.

☐ 3.1.23.4 For Unit 2 **only**, make alignments per Enclosure 5.3 to return valves to normal position.

4. References

4.1 Dwg. No. OFD-110A-1.8 Chemical Addition System (Primary Side Chemical Addition)

4.2 Dwg. No. OFD-102A-1.1 and OFD-102A-2.1 Low Pressure Injection System, Borated Water Supply and LPI Pump Suction.

4.3 CSM 5.2

4.4 ITS 5.4.1.a

4.5 SLC 16.13.7

5. Enclosures

5.1 Valve Alignment for Caustic Injection on Unit 1

5.2 Valve Alignment for Caustic Injection on Unit 2

5.3 Normal Valve Alignment for Caustic Injection System on Unit 1

5.4 Normal Valve Alignment for Caustic Injection System on Unit 2

5.5 Caustic Mixing and Injection Record

5.6 Piping Diagram of Caustic Injection System for Units 1 and 2. (For Information Only)

5.7 Unit 1&2 Caustic Pump Power Supplies

Enclosure 5.1

Valve Alignment for
Caustic Injection on Unit 1

Date_____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Closed	2CA-98	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
	_____	Closed	1CA-58	Caustic to #1 LP Pump Suction Tell Tale	Unit 1&2 LPI Hatch Area, AB, Elev 771, Col. T-72
	_____	Open	1CA-39	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm 118, Elev 771, Col. T-72
	_____	Open	1CA-62	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-72
_____	_____	Open	1LP-51	LPI Sample Recirc Isolation Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 061, Elev 771, Col. T-71
	_____	Open	CA-103	Caustic Recirc Line and Pressure Gauge Block	Downstream of 1&2 Caustic Pump and CA-37, Elev 783, Col. Q-67
	_____	Closed	CA-96	Caustic Recirc Block	Recirc Line tapping off between CA-103 & CA-112 returning to Caustic Mix Tank, Elev 783
	_____	Closed	CA-35	Caustic Pump Suction	Next valve after CA-34 Tank and upstream of Caustic Pump, Elev 783
	_____	Closed	CA-37	Caustic Header to Waste Evap. Feed Tank	First valve downstream of 1&2 Casutic Pump and upsteam of 1CA-39, Elev 783, Col. P-74
	_____	Open	CA-112	Caustic Pump Pressure Gauge Isolation	First valve downstream of PG-27 (Pressure Gauge) behind Caustic Mix Tank on West Wall, Elev 783
	_____	Open	CA-36	Caustic Pump Suction Tell Tale	Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783

Enclosure 5.2

Valve Alignment for
Caustic Injection System on Unit 2

Date_____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Closed	1CA-39	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm 118, Elev 771, Col. T-72
	_____	Closed	2CA-58	Caustic to #2 LP Pump Suction Tell Tale	Unit 1&2 LPI Hatch Area, AB Rm 119, Elev 771, Col. T-74
		Open	2CA-98	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
		Open	2CA-63	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
_____	_____	Open	2LP-51	LPI Sample Recirc Isolation Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 063, Elev 771, Col. T-71
	_____	Open	CA-103	Caustic Recirc Line and Pressure Gauge Block	Downstream of 1&2 Caustic Pump and CA-37, Elev 783, Col. Q-67
	_____	Closed	CA-96	Caustic Recirc Block	Recirc Line tapping off between CA-103 & CA-112 returning to Caustic Mix Tank, Elev 783
	_____	Closed	CA-35	Caustic Pump Suction	Next valve after CA-34 Tank and upstream of Caustic Pump, Elev 783
		Closed	CA-37	Caustic Header to Waste Evap. Feed Tank	First valve downstream of 1&2 Casutic Pump and upsteam of 1CA-39, Elev 783, Col. P-74
	_____	Open	CA-112	Caustic Pump Pressure Gauge Isolation	First valve downstream of PG-27 (Pressure Gauge) behind Caustic Mix Tank on West Wall, Elev 783
	_____	Open	CA-36	Caustic Pump Suction Tell Tale	Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783

Enclosure 5.3

Normal Valve Alignment for Caustic Injection System on Unit 1

Date _____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Closed	2CA-98	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
	_____	Closed	2CA-63	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
	_____	Closed	1CA-58	Caustic to #1 LP Pump Suction Tell Tale	Unit 1&2 LPI Hatch Area, AB, Elev 771, Col. T-72
	_____	Closed	1CA-39	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm 118, Elev 771, Col. T-72
	_____	Closed	1CA-62	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-72
_____	_____	Closed	1LP-51	LPI Sample Recirc Isolation Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 061, Elev 771, Col. T-71
	_____	Open	CA-103	Caustic Recirc Line and Pressure Gauge Block	Downstream of 1&2 Caustic Pump and CA-37, Elev 783, Col. Q-67
	_____	Open	CA-97	Caustic Recirc Block	Downstream of CA-96 and upstream of DW-120 on Caustic Mix Tank Recirc Line, Elev 783
	_____	Open	CA-96	Caustic Recirc Block	Recirc Line tapping off between CA-103 & CA-112 returning to Caustic Mix Tank, Elev 783
	_____	Closed	LWD-267	Caustic Tank Outlet Drain	Base of Caustic Mix Tank West Side, Elev 783
	_____	Closed	CA-34	Caustic Mix Tank Outlet	First valve from bottom of Caustic Mix Tank and upstream of Caustic Pump, Elev 783 Col. Q-68
	_____	Closed	CA-35	Caustic Pump Suction	Next valve after CA-34 Tank and upstream of Caustic Pump, Elev 783
	_____	Closed	CA-37	Caustic Header to Waste / RBCE Evap. Feed Tank	First valve downstream of 1&2 Casutic Pump and upsteam of 1CA-39, Elev 783, Col. P-74
	_____	Open	CA-112	Caustic Pump Pressure Gauge Isolation	First valve downstream of PG-27 (Pressure Gauge) behind Caustic Mix Tank on West Wall, Elev 783
	_____	Closed	CA-36	Caustic Pump Suction Tell Tale	Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783

Enclosure 5.4

Normal Valve Alignment for Caustic Injection System on Unit 2

Date_____

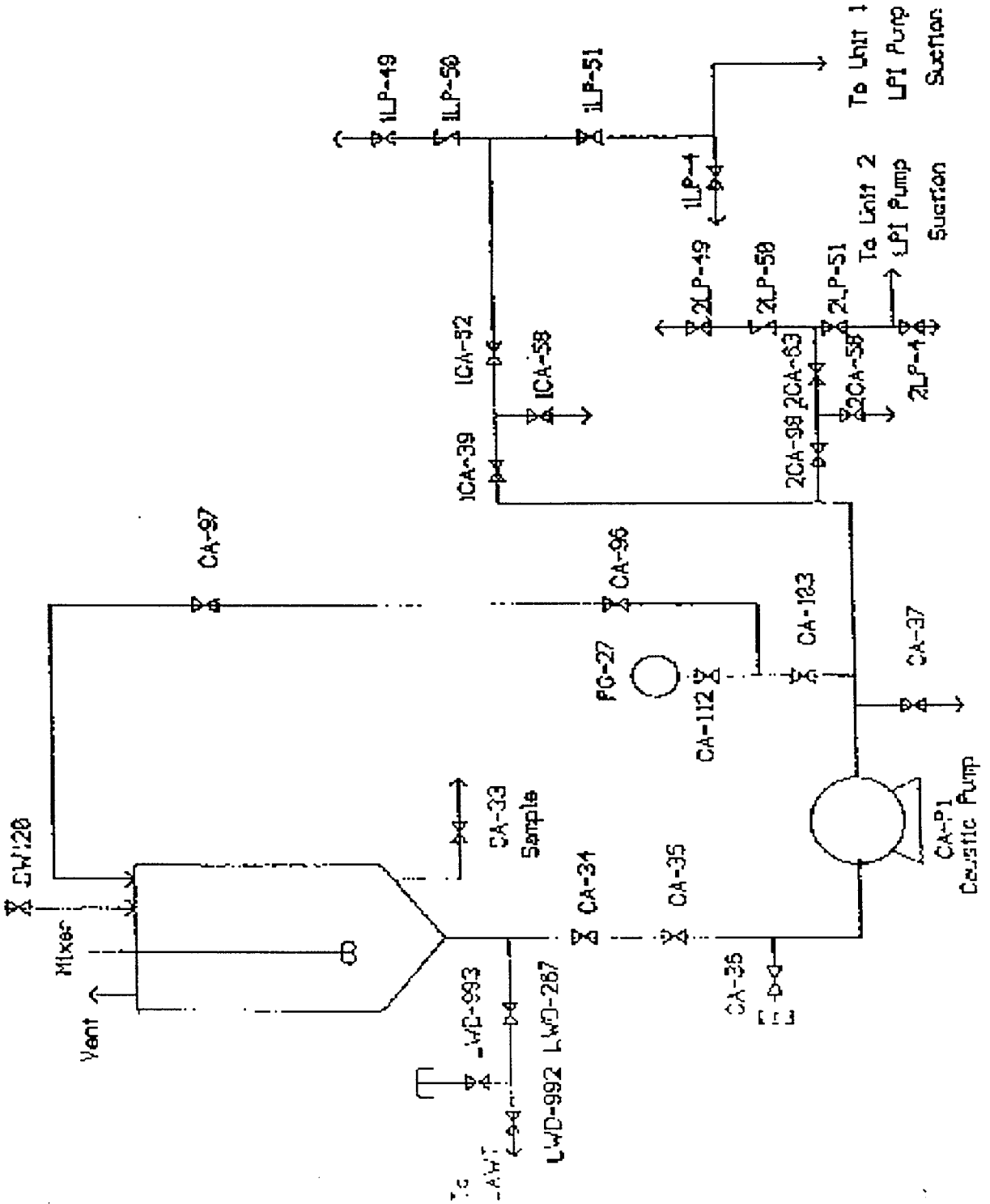
DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Closed	1CA-39	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm 118, Elev 771, Col. T-72
	_____	Closed	1CA-62	Caustic to Unit #1 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-72
	_____	Closed	2CA-58	Caustic to #2 LP Pump Suction Tell Tale	Unit 1&2 LPI Hatch Area, AB Rm 119, Elev 771, Col. T-74
	_____	Closed	2CA-98	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
	_____	Closed	2CA-63	Caustic to Unit #2 LP Block Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 119, Elev 771, Col. T-74
_____	_____	Closed	2LP-51	LPI Sample Recirc Isolation Valve (Ops)	Unit 1&2 LPI Hatch Area, AB Rm. 063, Elev 771, Col. T-71
	_____	Open	CA-103	Caustic Recirc Line and Pressure Gauge Block	Downstream of 1&2 Caustic Pump and CA-37, Elev 783, Col. Q-67
		Open	CA-97	Caustic Recirc Block	Downstream of CA-96 and upstream of DW-120 on Caustic Mix Tank Recirc Line, Elev 783
	_____	Open	CA-96	Caustic Recirc Block	Recirc Line tapping off between CA-103 & CA-112 returning to Caustic Mix Tank, Elev 783
	_____	Closed	LWD-267	Caustic Tank Outlet Drain	Base of Caustic Mix Tank West Side, Elev 783
	_____	Closed	CA-34	Caustic Mix Tank Outlet	First valve from bottom of Caustic Mix Tank and upstream of Caustic Pump, Elev 783 Col. Q-68
	_____	Closed	CA-35	Caustic Pump Suction	Next valve after CA-34 Tank and upstream of Caustic Pump, Elev 783
	_____	Closed	CA-37	Caustic Header to Waste / RBCE Evap. Feed Tank	First valve downstream of 1&2 Casutic Pump and upsteam of 1CA-39, Elev 783, Col. P-74
	_____	Open	CA-112	Caustic Pump Pressure Gauge Isolation	First valve downstream of PG-27 (Pressure Gauge) behind Caustic Mix Tank on West Wall, Elev 783
	_____	Closed	CA-36	Caustic Pump Suction Tell Tale	Bottom of 1&2 Caustic Mix Tank downstream of CA-35, Elev 783

Caustic Mixing and Injection Record

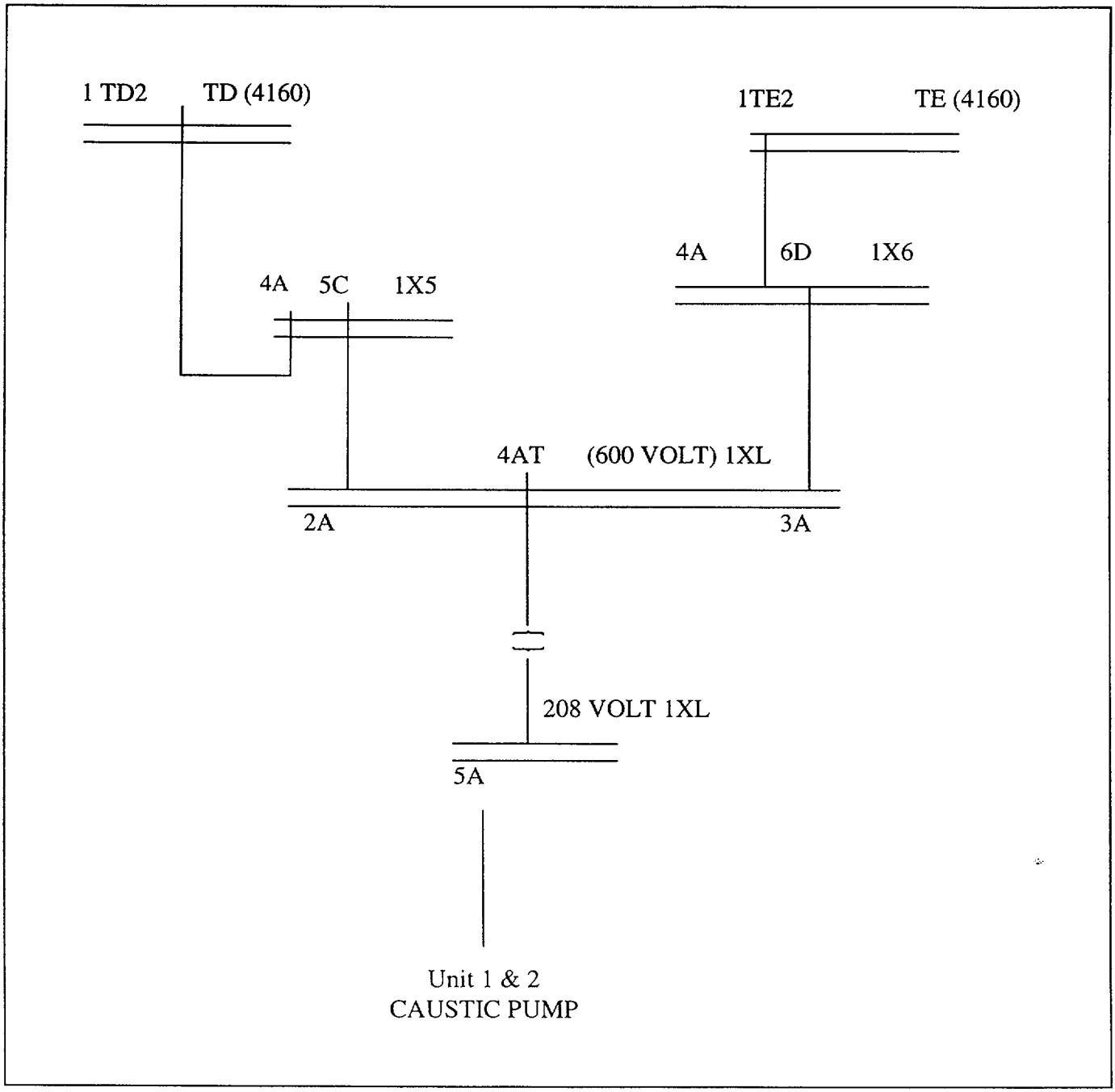
Date/Time of Injection	Gal NaOH

Enclosure 5.6

Piping Diagram of Caustic Injection System for Units 1 & 2



NOTE: Operations alternates the power logic as outlined. Verification will be required to establish which alignment is in use at the time of question.



(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. CP/3/A/2002/005
Revision No 11
Continuous Use

REPARATION

INFORMATION ONLY

(2) Station Oconee Nuclear Station

(3) Procedure Title Post Accident Caustic Injection Into the Low Pressure Injection System

(4) Prepared By Roger D Smith Date 12/20/99

(5) Requires 10CFR50.59 evaluation?
- ☑ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By Dean Cantrell (QR) Date 12/28/99
Cross-Disciplinary Review By _____ (QR)NA N/C Date _____
Reactivity Mgmt. Review By _____ (QR)NA N/C Date _____

(7) Additional Reviews
QA Review By _____ Date _____
Reviewed By _____ Date _____
Reviewed By _____ Date _____

(8) Temporary Approval *(if necessary)*
By _____ (SRO/QR) Date _____
By _____ (QR) Date _____

(9) Approved By Byron L. Nunn Date 12/29/99

PERFORMANCE ***(Compare with control copy every 14 calendar days while work is being performed.)***

(10) Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____
Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____
Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification
- ☐ Yes ☐ NA Check lists and/or blanks initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ NA Listed enclosures attached?
- ☐ Yes ☐ NA Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ NA Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ NA Procedure requirements met?

Verified By _____ Date _____

(13) Procedure Completion Approved _____ Date _____

(14) Remarks ***(Attach additional pages, if necessary)***

Post Accident Caustic Injection into the Low Pressure Injection System

1. Purpose

NOTE:	A control copy of this procedure shall be routed to the Emergency Preparedness Team within 3 working days after any approved changes.

1.1 This procedure is to provide instruction for caustic addition into the LPI System during a Loss of Coolant Accident. (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:

$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_20$

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

2. Limits and Precautions

2.1 The following safety equipment shall be worn when connecting/disconnecting caustic tote bins:

2.1.1 Chemical goggles

2.1.2 Face shield

2.1.3 Corrosive resistant suit, neoprene or chemrel

2.1.4 Corrosive resistant boots, neoprene or PVC

2.1.5 Corrosive resistant gloves, neoprene or PVC

2.2 Verify eyewash station and safety shower are operable prior to connecting/disconnecting caustic tote bins.

2.3 Chemical hazards shall be known prior to use. For additional information, refer to the MSDS sheets.

2.4 Under accident conditions, valve alignments shall **NOT** be made and injection shall **NOT** begin without prior authorization from the Operations Emergency Coordinator **OR** the Technical Support Center (TSC) / Operational Support Center (OSC)!

NOTE: An initial caustic add of 15 inches will neutralize an RCS inventory of 80,000 gallons with a boron concentration of 1800 ppm. This is a conservative initial add to allow immediate response to a large break LOCA.

2.5 An initial caustic add of 15 inches can be made without performing CSM 5.2, Enclosure 6.3 (Caustic Addition Calculations).

2.6 In the event of caustic spill, call 4911.

2.7 ITS 5.4.1.a and SLC 16.13.7 require that pH be measured **AND** that the addition of caustic to Reactor Coolant commence within 30 minutes AFTER switchover to recirculation mode of core cooling to adjust pH to a range of 7.0 to 8.0 WITHIN 24 hours.

2.8 The following safety and caustic addition equipment is stored in the brown storage container located in the Auxiliary Building, Unit 1 & 2 Chemical Addition Area:

Goggles	Boots	Flashlight
Face shield	Stainless steel flex hose	Bung Wrench
Corrosive suit	Tape Measure	
Gloves	Tank to valve adapter	

2.9 Keys to the brown storage container are stored with the caustic addition procedure in the OSC Chemistry Emergency Procedure Files and in the fireproof cabinet located in the Primary Chemistry lab office. All personnel in Primary Chemistry and Radwaste have also been issued individual keys.

2.10 Steps preceded with "☐" (immediately to the left of the step) are check off steps, and will be checked off as completed.

2.11 Steps preceded by bullets (•) may be performed in any sequence. Numbered steps may only be performed out of sequence if reviewed and approved by a Primary Staff person and one other individual who are familiar with this procedure (see NSD 704).

2.12 Independent Verification (designated by two sign-off steps) is a documented check by a second individual which helps to ensure the correct condition or position of plant components. Separate Verification (designated by SV) ensures individuals act separately and independently. Double Verification (designated by DV) ensures the "doer" and "verifier" independently decide that an action is correct prior to the "doer" performing the action. The "verifier" shall use a "hands-on" approach to verify the actions of the "doer".

2.13 Power to the caustic addition pump is provided through 3XL located near the LPI Hatch Area. For power supply diagram, see Enclosure 5.5.

3. Procedure

3.1 Upon notification from Operations Emergency Coordinator **OR** TSC / OSC, take the following actions to align the caustic addition system to the appropriate unit:

NOTE:	The following steps may be performed simultaneously to conserve time.

☐ Mark the current liquid level directly on the translucent tote bin container.

☐ Measure down from the liquid level mark 14 inches and mark this level directly on the tote bin.

☐ **IF** necessary, move the tote bin into position and connect the bin discharge to the Swagelock quick-connect fitting upstream of valve 3CA-36 (Caustic Pump Suction Tell Tale) (AB Elev 771 at base of Unit 3 NaOH pump) as follows:

- ☐ Remove dust cover from swagelock fitting on tote bin.
- ☐ Remove dust cover from swagelock fitting at 3CA-36 (Caustic Pump Suction Tell Tale) (AB Elev 771 at base of Unit 3 NaOH pump).
- ☐ Connect stainless steel flex hose to these fittings.

☐ 3.1.1 Make valve alignments per Enclosure 5.1 to allow caustic injection into the Low Pressure Injection (LPI) pump suction on Unit 3.

☐ 3.1.2 Vent the caustic tote bin by removing the tote bin fill cap.

☐ 3.1.3 Open the caustic tote bin outlet valve.

☐ 3.1.4 Notify Operations **OR** the OSC (if activated) that valve alignments for caustic injection are complete and ready to be initiated.

Operations or OSC Notified _____ Date/Time ____/____

☐ 3.1.5 Start the caustic addition pump at maximum flow setting. The caustic pump switch is located on the Chemical Addition Control Panel. The maximum pump capacity is approximately 2 gallons per minute.

CAUTION: The caustic pump has an average pump rate of 1.2 gallons per minute. To pump the initial setting of 15 inches will require 1.5 hours. A calculated volume should be initiated and completed within 30 minutes on turning the caustic pump on.

☐ 3.1.6 Calculate the total amount of caustic (in gallons) to be added for the neutralization of the borated water added to the system by using CSM 5.2.

☐ 3.1.7 Convert gallons from Step 3.1.6 to inches (in the 350 gallon tote bin) by dividing the number of gallons to be added by 8.1. Record the values below:

Gallons to be added _____ Inches to be added from the tote bin _____

☐ 3.1.8 Mark the calculated liquid level directly on the tote bin by measuring down from the original "current liquid level" mark made in Step 3.1.

NOTE: Use low dose waiting area as possible during addition

☐ 3.1.9 **WHEN** the caustic tote bin level reaches the desired level (as marked in Step 3.1) **OR WHEN** the caustic tote bin is empty, stop caustic addition pump using the switch located on the Chemical Addition Control Panel.

☐ 3.1.10 Close tote bin outlet valve.

☐ 3.1.11 Close 3CA-36 (Caustic Pump Suction Tell Tale) (AB Elev 771 at base of Unit 3 NaOH pump).

☐ 3.1.12 Record time and volume added on Enclosure 5.3.

☐ 3.1.13 **IF** necessary, replace the caustic tote bin as follows:

☐ 3.1.13.1 Replace tote bin fill cap.

☐ 3.1.13.2 Disconnect empty tote bin from swagelock fitting on stainless flex hose.

☐ 3.1.13.3 **IF** necessary, move tote bins and remove dust cover from swagelock fitting on new tote bin.

☐ 3.1.13.4 Connect stainless flex hose to the new tote bin.

☐ 3.1.13.5 **IF** pumping is to continue, mark the tote bin per Section 3.1 for the amount to be added from the new tote bin and go to Step 3.1.2.

☐ 3.1.14 Notify OSC caustic addition to U-3 LPI is complete and no further additions are in progress.

OSC Notified _____ Date/Time _____/_____

☐ 3.1.15 After caustic addition is complete, allow LPI recirculation time of 2 hours.

☐ 3.1.16 **WHEN** authorized by the TSC/OSC, have sample taken (per appropriate procedure) to determine the resultant pH of the reactor coolant.

☐ 3.1.17 **IF** pH is < 7.0:

- Calculate (refer to Chemistry Section Manual Section 5.2) the amount of caustic (in gallons) to be added to complete the neutralization of the borated water added to the system.
- Convert this number to inches (in the 350 gallon tote bin) by dividing the number of gallons to be added by 8.1 gallons/inch.
- Record the values below:

Gallons to be added: _____ Inches to be added from tote bin: _____

☐ 3.1.18 **IF** pH is > 7.0, go to Step 3.1.22.

☐ 3.1.19 Mark the current liquid level directly on the translucent tote bin container.

☐ 3.1.20 Measure down from this mark the number of inches calculated in Step 3.1.17 above. Mark this level directly on the tote bin.

☐ 3.1.21 Repeat Steps 3.1.1 through 3.1.18 until all necessary caustic (as determined by TSC/OSC) has been added.

☐ 3.1.22 After all necessary caustic has been added and upon authorization from the TSC/OSC, return the system to normal as follows:

☐ 3.1.22.1 Replace tote bin fill cap.

☐ 3.1.22.2 Disconnect empty tote bin from swagelock fitting on stainless flex hose.

☐ 3.1.22.3 Make alignments per Enclosure 5.2 to return valves to normal position.

4. References

4.1 Dwg. No. OFD-110A-3.8 Chemical Addition System (Primary Side Chemical Addition)

4.2 Dwg. No. OFD-102A-3.1, Low Pressure Injection System, Borated Water Supply and LPI Pump Suction.

4.3 CSM 5.2

4.4 ITS 5.4.1.a

4.5 New SLC 16.13.7

5. Enclosures

5.1 Valve Alignment for Caustic Injection on Unit 3

5.2 Normal Valve Alignment for Caustic Injection System on Unit 3

5.3 Caustic Mixing and Injection Record

5.4 Piping Diagram of Caustic Injection System for Unit 3. (For Information Only)

5.5 Unit 3 Caustic Pump Power Supplies

Enclosure 5.1

Valve Alignment for
Caustic Injection on Unit 3

Date_____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Open	3CA-103	Caustic Recirc Block	AB Rm. 157, Elev 771, hallway outside Unit 3 SS Filter Rm.
	_____	Closed	3CA-96	Caustic Recirc Block	AB Elev 771 at Unit 3 NaOH Pump Discharge
	_____	Closed	3CA-35	Caustic Pump Suction	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Open	3CA-36	Caustic Pump Suction Tell Tale	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Open	3CA-112	Caustic Pump Pressure Gauge Isolation	AB Elev 771 adjacent to but west of Unit 3 NaOH mix tank
	_____	Closed	3CA-58	Caustic to #3 LP Pump Suction Tell Tale	AB Rm. 157, Elev 783 Col. Q-91, Unit 3 SS Filter Rm.
	_____	Open	3CA-39	Caustic to Unit #3 LP Block (OPS)	AB Hall, Elev 783 Col. Q-91, outside 3 SS Filter Rm.
	_____	Open	3CA-62	Caustic to Unit #3 LP Block (OPS)	AB Rm. 252, Elev 783 Col. Q-91outside Unit 3 SS Filter Rm.
_____	_____	Open	3LP-51	LPI Sample Recirc. Isolation Valve (Ops)	AB Rm. 252, Elev 783 Col. R-90 outside Cooler Room

Enclosure 5.2

Normal Valve Alignment for Caustic Injection System on Unit 3

Date_____

DV	*Init*	*Position*	*Valve No.*	*Valve Name*	*Location*
	_____	Open	3CA-103	Caustic Recirc Block	AB Rm. 157, Elev 771, hallway outside Unit 3 SS Filter Rm.
	_____	Open	3CA-97	Caustic Recirc Block	AB Elev 771 overhead at Unit 3 NaOH mix tank
	_____	Open	3CA-96	Caustic Recirc Block	AB Elev 771 at Unit 3 NaOH Pump Discharge
	_____	Closed	3LWD-267	Caustic Tank Outlet Drain	AB Elev 771 at tank drain pipe of Unit 3 NaOH pump
	_____	Closed	3CA-34	Caustic Mix Tank Outlet	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Closed	3CA-35	Caustic Pump Suction	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Closed	3CA-36	Caustic Pump Suction Tell Tale	AB Elev 771 at base of Unit 3 NaOH pump
	_____	Open	3CA-112	Caustic Pump Pressure Gauge Isolation	AB Elev 771 adjacent to but west of Unit 3 NaOH mix tank
	_____	Closed	3CA-58	Caustic to #3 LP Pump Suction Tell Tale	AB Rm. 157, Elev 783 Col. Q-91, Unit 3 SS Filter Rm.
	_____	Closed	3CA-39	Caustic to Unit #3 LP Block (OPS)	AB Hall, Elev 783 Col. Q-91, outside 3 SS Filter Rm.
	_____	Closed	3CA-62	Caustic to Unit #3 LP Block (OPS)	AB Rm. 252, Elev 783 Col. Q-91outside Unit 3 SS Filter Rm.
_____	_____	Closed	3LP-51	LPI Sample Recirc. Isolation Valve (Ops)	AB Rm. 252, Elev 783 Col. R-90 outside Cooler Room

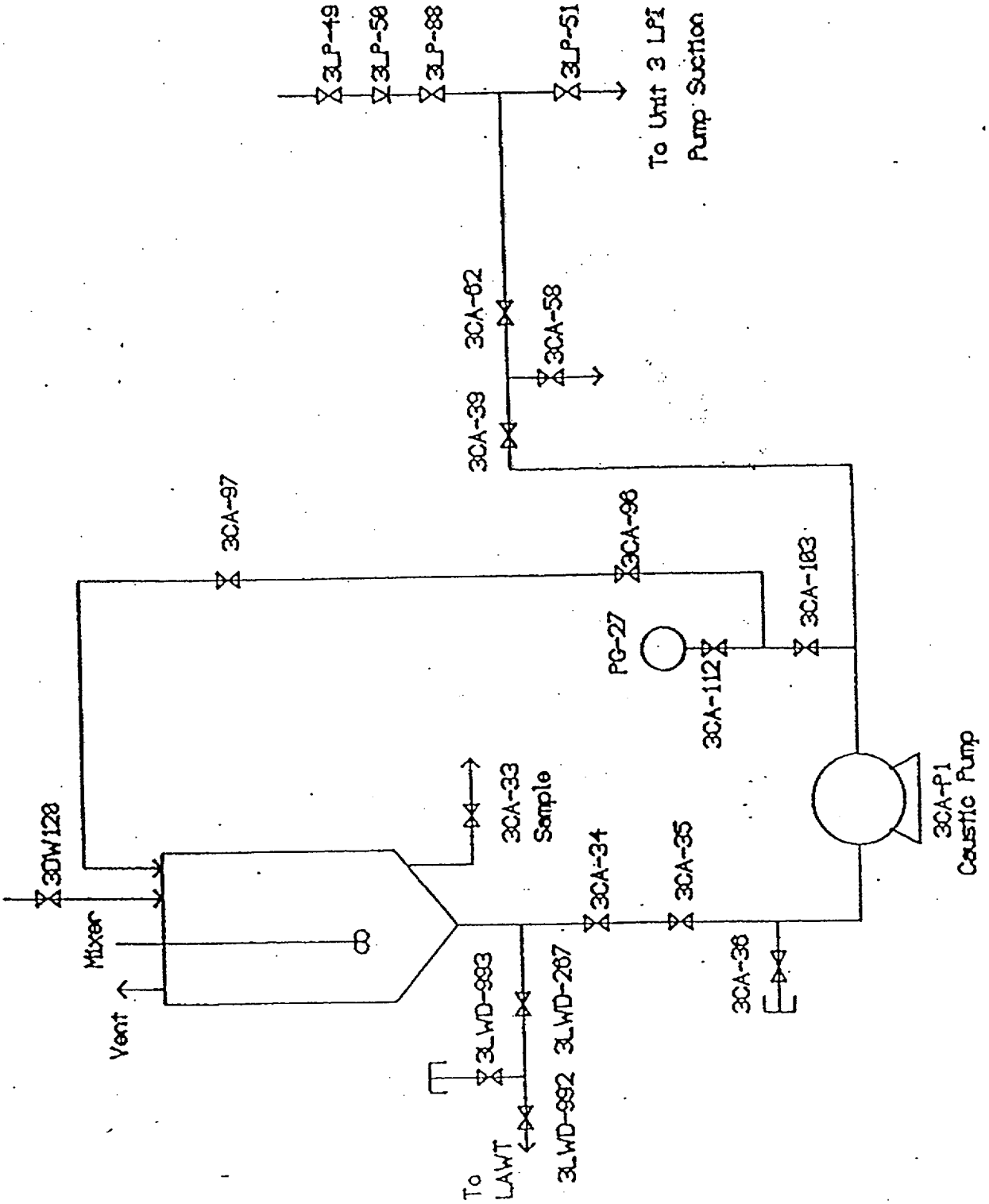
Enclosure 5.3

Caustic Mixing and Injection Record

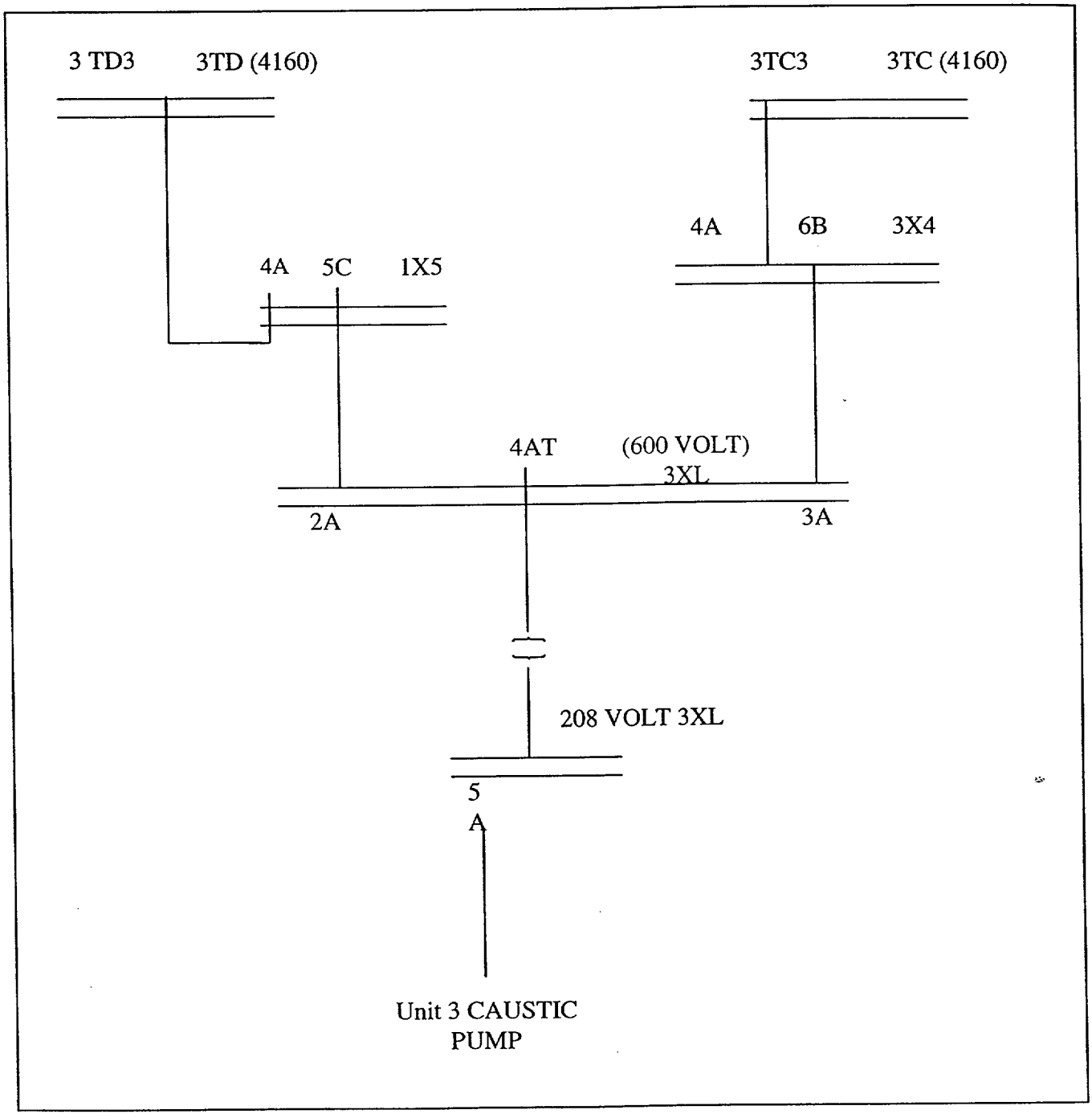
Date/Time of Injection	Gal. NaOH

Enclosure 5.4

Piping Diagram of
Caustic Injection System for Unit 3



NOTE: Operations alternates the power logic as outlined. Verification will be required to establish which alignment is in use at the time of question.



INFORMATION ONLY

CHEMISTRY MANUAL 5.2
POST ACCIDENT PROCEDURE USE GUIDELINES

REVISION NUMBER	ISSUE DATE
Original	07/15/82
1	10/25/95
2	01/20/97
3	04/07/97
4	11/20/97
5	08/17/98
6	03/16/99
7	12/28/99

Prepared by: Pam Mettle for Charles McElwain Date: 12/27/99

10CFR50.59 required: Yes ✓ No _____

Approval: Byron L. Rees Date: 12/28/99

Control Copies delivered to Emergency Planning: Susan Neal

Date: 12/28/99

DUKE POWER COMPANY OCONEE CHEMISTRY MANUAL

Post Accident Procedure Use Guidelines

1. Purpose

NOTE: A 50.59 screening is required to make major changes to this section. Minor changes per NSD 703 can be made without a 50:59.

NOTE: Seven Control copies and one Information Only copy of this CSM shall be routed to the Emergency Preparedness Team within three (3) working days following any approved changes/modifications.

This section provides guidelines on the administration and use of chemistry post accident procedures and the precautions that should be observed during the use of these procedures. Special attention is given to limits and precautions associated with the execution of a procedure during a projected accident. Personnel requirements and procedure work locations will be given for personnel exposure consideration. Also, a listing of RIAs of interest to Chemistry for planning and assessment activities is included in Enclosures 6.1 and 6.2. This information is intended only as guidelines with the knowledge that an actual accident situation may deviate greatly from a projected scenario.

2. Guidelines

2.1 Limits and Precautions

NOTE: These Limits and Precautions do not apply to the task for Addition of Caustic to the LPI (RCS) System. This task is a "time critical task" and therefore is not subject to the below Limits and Precautions.

2.1.1 Valve alignments should **NOT** be made and samples should **NOT** be taken without prior authorization from the TSC/OSC.

2.1.2 Do **NOT** attempt any phase of sampling or analysis without Radiation Protection coverage.

2.1.3 ALL personnel will need prior authorization from the OSC to exceed any exposure limit.

2.1.4 Radiation levels of the sampling and analysis area should be measured continuously during all phases of sampling, sample preparation, and analysis.

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

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

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

2.1.4.4 All personnel working in the lab area and transporting samples shall monitor their personal dosimetry frequently to avoid exceeding maximum dose limits.

2.1.5 The post accident analysis should be done in a fume hood and/or other precautions should be taken to avoid the release of gaseous activity.

2.1.6 Radiation exposure to an individual during all phases of sampling should be limited so as not to exceed an annual accumulative exposure of 2 rem whole body; 50 rem skin of whole body; 50 rem extremities; or 15 rem eye respectively. All personnel will need prior authorization from the TSC/OSC 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.

2.2 Waste Disposal

2.2.1 Determine by detailed planning meeting, the exact course of action to be taken. Under no condition should liquid or solid wastes be disposed of without prior specific RP directions.

2.2.2 Designate a sealable carboy as the "Post Accident Lab Waste" container. This container should be shielded and used as an interim liquid waste disposal container for all liquid analytical waste.

2.2.3 Request RP to designate an area where the "RCS Flush" bottle(s), "RCS Sample" bottle(s) and "Post Accident Lab Waste" container may be stored until final disposal.

2.2.4 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.

2.3 Procedures

2.3.1 CP/1,2,3/A/2002/001 Unit One, Two, or Three Primary Sampling System

Description - Defines the steps necessary to sample tanks, systems, etc., associated with the primary system to determine various chemical concentrations and radioactive isotopes.

Personnel - One (1) Chemistry technician - to sample
One (1) RP technician

Precautions - Personnel should expect high dose rates and possible airborne activity. Use applicable RIA's listed in Enc. 6.1 and 6.2. Some sample points will be at system pressure.

CAUTION:	If the hydrogen purge unit is in service on Unit 2 or 3 the ventilation flow path for the Primary and waste sample hoods has been isolated. The hydrogen purge unit will typically not be placed into service for about 7 days after a LOCA and then only if the hydrogen recombiner is out of service. The hydrogen purge unit must be secured prior to sampling.

Use - This procedure should be used to obtain reactor coolant samples when possible. Other primary systems and tanks such as LPI, BWST, SFP, etc. can be sampled using these procedures.

Location - Third floor Aux building - Primary sample hoods; First floor Aux building - Waste sample hoods

2.3.2 CP/1,2,3/A/2002/004 C Operating Procedure for the Post Accident Liquid Sampling (PALSS) System

Description - Outlines method to sample primary coolant using the remotely operated PALSS sampling system. System can sample from RCS "J-Leg", LPI Pump Discharge, and HPI Letdown.

Personnel - One (1) Chemistry technician - panel operation
One (1) person to communicate with control room for LP-65 (if required)
One (1) Radiation Protection technician.

Precautions - Because of location of sample panels, personnel may be in high radiation area with airborne activity. Evaluate shuttle of personnel to and from lower dose areas. Use the readings from applicable RIAs listed in Enc. 6.1 and 6.2 to plan sampling activities.

Use - This procedure should be used to sample primary coolant when significant fuel damage is expected. System is designed to limit personnel exposure during sampling. Sample point for RCS "J-Leg" needs flow through that loop to ensure representative sample. If significant loss of coolant has occurred, need to also sample LPI Pump Discharge.

Location - First floor auxiliary building Near 1 & 2 Waste Disposal Hood - Units 1 & 2; Near 3 Waste Disposal Hood - Unit 3

2.3.3 CP/0/A/2002/004E Reactor Coolant Sampling During an Appendix "R" Accident

Description - This procedure provides instruction on sampling the RCS via an ice cooled sampler installed on the discharge side of valve 1, 2, 3 RC-179 of the affected unit during an Appendix "R" accident situation.

Personnel - Two (2) Chemistry Technicians
One (1) Radiation Protection Technician
Two (2) I&E Technicians

Precautions - Personnel should expect normal dose rates and a high probability of airborne activity due to fission gas release during sample flush to floor drain. Sample temperature & pressure will be very high & if not cooled properly will flash to steam.

Use - This procedure should only be used during an Appendix "R" fire when all power is lost. It should be considered the last alternative for Reactor coolant sampling.

Location - Unit 1, 2, 3 LPI Pump rooms

2.3.4 CP/1&2,3/A/2002/005 Post Accident Caustic Injection Into the Low Pressure Injection System

NOTE: This is a "time critical task" and must be initiated immediately when recirculation mode off the RBES has been established.

Description - Outlines the method used to raise the pH of the primary coolant to ~ 7.0 - 8.0 following a LOCA. Caustic additions will improve the iodine liquid partition factor and inhibit hydrogen gas formation. Use Enc. 6.3 to calculate quantity of caustic required for addition.

Personnel - Two (2) Chemistry technicians (desirable, but not required)
One (1) Radiation Protection tech (desirable, but not required)
Two (2) additional OSC personnel to move Caustic (desirable, but not required)

Precautions - High radiation areas and airborne activity may be a concern. Use readings from applicable RIAs listed in Enc. 6.1 and 6.2 to plan addition. Establish Low Dose Waiting Areas as needed. Heat Stress conditions may also be a concern.

Use - This procedure should be used when a significant loss of coolant to the Reactor Building has occurred and there is concern about an Iodine release and/or hydrogen gas formation. The LPI System MUST be in service and taking suction from the emergency sump.

Location - Units 1&2 - 2nd floor of the Aux. Bldg, Chemical Addition Area
Unit 3 - 1st floor of the Aux Bldg, Chemical Addition Area

2.3.5 LM-O-P003C Determination of Boron by Manual Colorimetric Titration

Description - Outlines the use of manual potentiometric titrations to determine boron concentration. The range for this analysis is between 100 and 2500 ppm. Samples with concentrations greater than 1000 ppm must be diluted for dose and time considerations.

Personnel- One (1) Chemistry technician
One (1) Radiation Protection technician

Precautions - Personnel should expect high dose rates and possible airborne activity. Use the readings from applicable RIAs listed in Enc. 6.1 and 6.2 to determine if the Primary Lab is available for use.

Use - This procedure should be used to analyze for boron whenever conditions have resulted in the loss of the normal analytical instrumentation, such as an Appendix "R" Accident.

Location - Rooms 329 and 330.

2.3.6 LM-O-P919 Boron Analysis By Mettler DL-58 Titration

Description - This method covers the precise determination of boron concentration in the 0.2 – 10,000 ppm range in high purity water (RCS) using the Mettler DL-58 Titration System.

Personnel - One (1) Chemistry technician
One (1) Radiation Protection technician

Precautions - Personnel should expect high dose rates and possible airborne activity. Use the readings from applicable RIAs listed in Enc. 6.1 and 6.2 to determine if the Primary Lab is available for use.

Use - This procedure should be used as the primary method for determining boron concentration.

Location - Rooms 329 and 330.

2.3.7 LM-O-P914 The Analysis of Water Using the Dionex DX-500 Ion Chromatograph

Description - Outlines the use of ion chromatograph in determination of chloride concentration in primary coolant when fuel failure is expected.

Personnel - One (1) Chemistry technician
One (1) Radiation Protection technician

Precautions - Personnel should expect high dose rates and possible airborne activity. If too much dilution is required based on dose consideration, then this procedure could not be utilized. Use the readings from applicable RIAs listed in Enc. 6.1 and 6.2 to determine if the Dionex Lab is available for use.

Use - This procedure should be used when dose consideration allows a reasonable expectancy of being able to detect chloride at the dilution required.

Location - Room 330.

2.3.8 LM-O-P008 The Determination of Hydrogen in Gas Samples Using the Carle Gas Chromatograph

Description - This procedure covers the use of the Carle Series 100 and 400 Analytical Gas Chromatographs to determine the concentration of hydrogen in gas samples.

Personnel - One (1) Chemistry technician
One (1) Radiation Protection technician

Precautions - Personnel should expect high dose rates and possible airborne activity. Use the readings from applicable RIAs listed in Enc. 6.1 and 6.2 to determine if the Primary Lab is available for use.

Use - This procedure should be used in an accident situation to analyze for hydrogen concentration.

Location - Rooms 329 and 330.

2.3.9 LM-O-G004 Determination of Gamma Isotopic Activity

Description - Outline of method used to prepare sample for gamma isotopic analysis.

Personnel - One (1) Chemistry technician
One (1) Radiation Protection technician

Precautions - Personnel should expect high dose rates and possible airborne activity. Utilize remote handling when possible. Use the readings from applicable RIAs listed in Enc. 6.1 and 6.2 to determine if the Primary Lab and Count Room are available for use.

Use - This procedure should be used when a gamma isotopic analysis is required.

Location - Rooms 329 and 330.

3. Additional Information

3.1 Tank volumes:

Quench Tank	5,834 gallons
BWST	388,000 gallons
CBAST	22,440 gallons
BAMT	2,500 gallons
BHUT	82,000 gallons
LDST	4,488 gallons (31.26 gal/in)
CFT	10,470 gallons
SFP (1&2)	546,000 gallons
SFP (3)	374,000 gallons
LiOH	30 gallons
NaOH	100 gallons
MWT	20,200 gallons
HAWT	2,000 gallons
LAWT	3,000 gallons

3.2 System Volumes:

RCS (cold/hot)	88,000/60,000 gallons
Reactor Building	1,910,000 ft^3 free volume
CST	30,000 gallons
Waste Gas	23,800 ft^3
Hotwell	150,000 gallons
OTSG (Secondary Side)	28,000 gallons

3.3 Cooler Supplies:

Quench Tank	-	CC
Decay Heat	-	LPSW
Letdown	-	CC
Seal Return	-	RCW
RBCU	-	LPSW
CC	-	LPSW
RCW	-	CCW
Pri Sample	-	RCW
PALSS	-	RCW

4. Suggested Actions

4.1 Normal Operating Conditions:

Observation: Loose part or mechanical failure has caused suspected loss of some fuel integrity.

Actions:

- Do not over react, close coordination with OPS and RP will be necessary to understand where and how to sample coolant.
- First find out exact status of unit (subcritical, pressure, temperature, # of RCP on, letdown flow rate, area monitor readings?)
- If the unit is shutdown, then remember that samples will show normal coolant fission product spiking - must compare to earlier unit trip results.
- Have RP survey letdown piping (if in service) and compare to normal values before deciding which method to use in sampling.
- For truly mechanical damage, gap activity isotope should increase (Xenons, Kryptons, iodines) with much smaller increases in (Strontium, Barium, Cesium, less mobile isotopes).
- With gap activity release, degassing of coolant fission gases will be much more pronounced. Appropriate respiratory protection should be considered while sampling.

4.2 Overheat Condition Without Fuel Melt

Observation: RB pressure and temperature increase. Suspect loss of coolant to Reactor Building.

Actions:

- If ES actuation occurs, then letdown will be automatically secured thus rendering normal sample point useless (Ops may manually override)

- Make immediate plans to move necessary equipment to RW facility or Environmental lab for chemical analysis of boron and pH. Dose rates may render Primary lab useless.

- Before deciding which sample location to use, a careful evaluation of all data should be performed.

  1. Boron concentration can be calculated based on injection volumes and known concentrations.

  2. RIA readings from RIA 57, 58 can closely estimate failed fuel percentage without need for sampling.

  3. If recirculation of water through vessel is not available, the PALS J-leg sample will not be representative.

  4. Core exit thermocouple readings and mapping can aid in estimating area and extent of core damage.

- If electrical system load shed has occurred, then many of the normal power supplies to the Chemistry group may be unavailable without Operations assistance.

4.3 Fuel Melt

Actions:

- All of Section 4.2 action items are applicable.
- Expect higher levels of Barium, Strontium and Praesyodimium from fuel matrix loss.
- Expect high suspended solids in any sampling attempted.
- Both hydrogen percentage and RIA 57, 58 readings can and should be used in lieu of sampling, at least until dose levels have significantly dropped.
- Boron as a criticality concern should be minimal - weighing the small benefit of a sample versus the extreme risk to an individual(s) should be considered.

5. References

5.1 ONS Post Accident Procedures

5.2 ONS OFD Drawings

5.3 ONS UFSAR

5.4 ONS ITS

6. Enclosures

6.1 RIAs of Interest to Chemistry

6.2 Location of Sample Points for Multipoint RIAs

6.3 Caustic Addition Calculations

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

6.5 Technical Basis for Caustic Addition Calculations

6.6 Quarterly Inspection of Post Accident Equipment

Enclosure 6.1
RIAs of Interest to Chemistry
Sheet 1 of 2

RIA #	RANGE	LOCATION	INFORMATION USED FOR
1RIA-4 2RIA-4 3RIA-4	0.1 - 10e7 mR/hr	Reactor Building Entrance/ Personnel Hatch	Indicates a LOCA with moderate to severe fuel damage; 2RIA-4 is located near the Primary Lab and Count Room - Readings used to assess the need to prepare alternate labs
RIA-8	0.1 - 10e7 mR/hr	Primary Chemistry Lab	Used to assess the need to prepare the alternate Primary Lab and/or Count Room
1RIA-10 2RIA-10 3RIA-10	0.1 - 10e7 mR/hr	Unit 1 Primary Sample Hood Unit 2 Primary Sample Hood Unit 3 Primary Sample Hood	Used for planning sampling. Readings will be high once sampling is started if significant fuel damage has occurred
1RIA-12 3RIA-12	0.1 - 10e7 mR/hr	Unit 1&2 Boric Acid Mix Tank Unit 3 Boric Acid Mix Tank	Readings used for planning chemical additions (ie: Caustic Additions)
1RIA-13 3RIA-13	0.1 - 10e7 mR/hr	Unit 1&2 Waste Sample Hood Unit 3 Waste Sample Hood	Used for planning sampling activities from the PALS. Readings may be high if significant fuel damage has occurred
1RIA-15 3RIA-15	0.1 - 10e7 mR/hr	Unit 1&2 HPI Pump Room Unit 3 HPI Pump Room	Provide preliminary indications of significant fuel damage
1RIA-16,17 2RIA-16,17 3RIA-16,17	0.01 - 10e3 mR/hr	Unit 1 'A & B' Main Steam Lines Unit 2 'A & B' Main Steam Lines Unit 3 'A & B' Main Steam Lines	Readings > background from these RIAs are indications of primary/secondary steam generator tube leaks
3RIA-19	0.1 - 10e7 mR/hr	Laundry and Hot Shower Tank Room	Used for planning Unit 3 caustic; readings may be high if significant fuel damage has occurred due to being near LDST
1RIA-31 3RIA-31	10 - 10e6 CPM	Behind air compressors in Turbine Building Basement, west of Unit 2 Powdex North of sewage ejectors at Unit 3, west wall of Turbine Building	Multipoint RIA that monitors LPSW effluents from LPI Cooler, and CC Cooler. Readings > background indicate a primary coolant leak into the LPSW System. See Enc. 6.2 for sample point locations.
1RIA-32 3RIA-32	10 - 10e6 CPM	Monitor on first floor of Aux Building; sample points are located in various room/areas throughout the Aux Building	Multipoint RIA that measures airborne activity levels in various locations (up to 24) through the Aux Building. Used to plan sampling and chemical addition activities. See Enc. 6.2 for sample point locations.

Enclosure 6.1
RIAs of Interest to Chemistry
Sheet 2 of 2

RIA #	RANGE	LOCATION	INFORMATION USED FOR
1RIA-35 2RIA-35 3RIA-35	10 - 10e6 CPM	Behind air compressors in Turbine Building Basement, west of Unit 2 Powdex Same location as 3RIA-31	Monitors LPSW discharge from the Building. Readings > background are indicators of primary coolant leak into the LPSW System; RIA-31 readings will increase also.
1RIA-40 2RIA-40 3RIA-40	10 - 10e6 CPM	Unit 1 CSAE Off Gas Discharge Unit 2 CSAE Off Gas Discharge Unit 3 CSAE Off Gas Discharge	Monitors CSAE Off Gas effluent to each unit vent. Indicates steam generator tube leaks.
1,2,3 RIA-57&58	1 - 10e7 R/hr	Unit 1 Reactor Building Unit 2 Reactor Building Unit 3 Reactor Building	Measures activity in the Rx building during a LOCA. Readings from these RIAs can be related to % failed fuel.

Enclosure 6.2
Location of Sample Points for Multipoint RIAs
Sheet 1 of 2

1RIA-31 SAMPLE POINTS

1RIA-31-1	LPI/Decay Heat Cooler 1A Outlet
1RIA-31-2	LPI/Decay Heat Cooler 1B Outlet
1RIA-31-3	RB Component Cooler 1A Outlet
1RIA-31-4	RB Ventilation (Cooling) Unit 1A Outlet
1RIA-31-5	RB Ventilation (Cooling) Unit 1B Outlet
1RIA-31-6	RB Ventilation (Cooling) Unit 1C Outlet
1RIA-31-7	LPI/Decay Heat Cooler 2A Outlet
1RIA-31-8	LPI/Decay Heat Cooler 2B Outlet
1RIA-31-9	RB Component Cooler 2B Outlet
1RIA-31-10	RB Ventilation (Cooling) Unit 2A Outlet
1RIA-31-11	RB Ventilation (Cooling) Unit 2B Outlet
1RIA-31-12	RB Ventilation (Cooling) Unit 2C Outlet

3RIA-31 SAMPLE POINTS

3RIA-31-1	LPI/Decay Heat Cooler 3A Outlet
3RIA-31-2	LPI/Decay Heat Cooler 3B Outlet
3RIA-31-3	RB Component Cooler 3B Outlet
3RIA-31-4	RB Ventilation (Cooling) Unit 3B Outlet
3RIA-31-5	RB Ventilation (Cooling) Unit 3A Outlet
3RIA-31-6	RB Ventilation (Cooling) Unit 3C Outlet

Enclosure 6.2
Location of Sample Points for Multipoint RIAs
Sheet 2 of 2

1RIA-32 SAMPLE POINTS

1RIA-32-1	Unit 1 Pipe Rooms; Elevation 758 and 771
1RIA-32-2	Unit 2 Pipe Rooms; Elevation 758 and 771
1RIA-32-3	Spent Resin Storage Tanks, Condensate Test Tanks, Unit 1 Letdown Storage Tank, Boric Acid Mix Tank
1RIA-32-4	RC Bleed Evaporator Room, Unit 1&2 Miscellaneous Waste Holdup Tank, Unit 2 Letdown Storage Tank
1RIA-32-5	Waste Drumming Area
1RIA-32-6	Miscellaneous Waste Evaporator Room
1RIA-32-7	Unit 1 RC Bleed Transfer Pump, Unit 1 RC Bleed Holdup Tanks, Unit 1 Concentrated Boric Acid Storage Tank
1RIA-32-8	Unit 2 RC Bleed Transfer Pump, Unit 2 RC Bleed Holdup Tanks, Unit 2 Concentrated Boric Acid Storage Tank
1RIA-32-10	Waste Gas Compressor, RC Bleed Evaporator Feed Tank
1RIA-32-11	Unit 1 Pipe Rooms; Elevations 783-796
1RIA-32-12	Unit 2 Pipe Rooms; Elevations 783-796

3RIA-32 SAMPLE POINTS

3RIA-32-1	Unit 3 Pipe Rooms; Elevation 758 and 771
3RIA-32-2	Unit 3 Pipe Rooms; Elevations 783-796
3RIA-32-3	RB Component Coolers, Letdown Filters, Hatches, Waste Gas Compressor Room, Waste Gas Decay Tanks
3RIA-32-4	Unit 3 RC Bleed Holdup Tanks, Unit 3 Concentrated Boric Acid Storage Tank, Unit 3 Miscellaneous Waste Holdup Tank Area
3RIA-32-5	High Activity Spent Resin Storage Tank, Boric Acid Mix Tank and Pumps, Spent Resin Storage Tank Area

Enclosure 6.3
Caustic Addition Calculations
Sheet 1 of 4

1. Initial Conditions for Injection

1.1 An emergency is in effect due to a LOCA.

1.2 The Low Pressure Injection (LPI) system is in operation with the LPI pumps taking suction from the BWST.

1.3 The Reactor Building Emergency Spray system may or may not be in operation from the BWST through the spray headers.

1.4 The addition of caustic SHALL begin WITHIN thirty (30) minutes AFTER switchover to the recirculation mode of core cooling. The recirculation mode is in effect whenever the suction for the LPI pumps' is isolated from BWST & aligned to the Reactor Bldg. Emergency Sump.

1.5 The addition of caustic will be made upon authorization of the TSC/OSC, or upon notification by Operations when the TSC/OSC has not yet been activated.

2. Bases for Caustic Addition Calculations

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

2.1.1 An accurate estimation of the volume of borated water being used as the core flooding coolant;

2.1.2 The boron concentration of the core flooding coolant;

2.1.3 One (1) pound of caustic neutralizing seventeen (17) pounds of H_3BO_3 to a pH of 7.5.

2.2 If the total volumes of the CFTs and BWST are used, then the maximum amount of caustic required for neutralization of the borated water to a pH of 7.5 is 700 gallons. The amount of 700 gallons has been calculated with the following considerations:

2.2.1 Both CFTs and the BWST have a total volume of 403,000 gallons with a boron concentration of 2300 ppm;

2.2.2 The RCS has a volume of 88,000 gallons with a boron concentration of 1000 ppm.

2.3 Boric Acid for the purposes of these calculations behaves as a simple monoprotic acid.

Enclosure 6.3
Caustic Addition Calculations
Sheet 2 of 4

3. Calculations of the Amount of Caustic required for Neutralization to a pH of 7.5 Based on Core Flooding Coolant Boron Content.

NOTE:	Calculate the quantity of caustic as outlined below or use the computer program by opening DAE, Department Applications, Nuclear Generation, Oconee Desktop; Oconee Information Library; Chemistry Information Library; CUG-S-19-Caustic.

Date _____ Time _____ Unit _____ By _____

CFT 'A' Boron _____ CFT 'B' Boron _____ RCS Boron _____

BWST Boron _____ BWST Vol. dumped to RCS _____

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

$$\text{Lbs. CFT } H_3BO_3 = \frac{(\_\_\_\_\text{ppm})\ (15{,}000\ \text{gal})\ (8.34\ \text{lbs/gal})}{(1 \times 10^6)\ (0.175)} = \_\_\_\_$$

3.2 The RCS has a volume of 88,000 gal. Calculate the lbs. H_3BO_3 in the RCS:

$$\text{Lbs. RCS } H_3BO_3 = \frac{(\_\_\_\_\text{ppm})\ (88{,}000\ \text{gal})\ (8.34\ \text{lbs/gal})}{(1 \times 10^6)\ (0.175)} = \_\_\_\_$$

3.3 The BWST has a total volume of 388,000 gal. Obtain from Operations an estimate of the volume of borated water that has been dropped from the BWST: _____ gal. Calculate the lbs. H_3BO_3 added to the core from the BWST:

$$\text{Lbs. BWST } H_3BO_3 = \frac{(\_\_\_\_\text{ppm})\ (\_\_\_\_\text{gal})\ (8.34\ \text{lbs/gal})}{(1 \times 10^6)\ (0.175)} = \_\_\_\_$$

Enclosure 6.3
Caustic Addition Calculations
Sheet 3 of 4

3.4 Calculate the Gal. NaOH required to adjust the borated water of the CFT's and the RCS to 7.5.

$$\text{Gal. 35\% NaOH required} = \frac{(1 \text{ lb NaOH})(\text{lbs CFT } H_3BO_3 + \text{lbs RCS } H_3BO_3 + \text{lbs BWST } H_3BO_3)(1 \text{ Gal. 35\% NaOH})}{(17 \text{ lbs } H_3BO_3)(4 \text{ lbs NaOH})}$$

= _____ Gallons

3.5 For the initial caustic addition, it is recommended that only half of the calculated amount should be added. Note that if using the computer program to calculate the initial addition, the results have already been halved. This is clearly stated by the computer program. Record the actual amount to be added below.

Amount of 35% NaOH to add _____ gallons.

Enclosure 6.3
Caustic Addition Calculations
Sheet 4 of 4

4. Calculation of the amount of 35% caustic required for neutralization of a pH between 7.0 and 8.0 based on core flooding coolant actual pH.

NOTE: Calculate as outlined below or use the computer program by opening DAE, Department Applications, Nuclear Generation, Oconee Desktop; Oconee Information Library; Chemistry Information Library; CUG-S-19-Caustic.

Date _____ Time _____ Unit _____ By _____

4.1 Core Coolant pH _____.

4.2 Core Coolant Boron Concentration (approximately) in ppm is _____.

4.3 Core Coolant Volume (RCS, BWST vol. dumped, CFTs) in gallons is _____.

4.4 Calculate the volume of 35% NaOH required to adjust the core coolant water to a pH between 7.0 and 8.0.

$$\text{35\% NaOH to Add} = ((4.7 \times 10^{-6} - 1.6 \times 10^{-13}/10^{-pH})\text{ppm B} - 10^{-pH} + 10^{pH-14}) * V * 0.0829$$

Where,

Gallons	=	Volume in gallons of 35% NaOH to add to the Reactor Coolant
B	=	Reactor Coolant boron concentration in ppm
V	=	Volume of reactor cooling water (including BWST, CFT, etc.) in gallons
8.29×10^{-2}	=	Conversion Factor
pH	=	Actual measured pH of reactor coolant water.
Gals 35% NaOH	=	_____ Gallons

NOTE :

1. This volume does not account for the associated piping volume between the caustic injection tank and the suction of the low pressure injection pump.

2. If reactor coolant pH is between 7.0 and 8.0, this formula "MAY" produce a negative number which means that no caustic addition is necessary.

Enclosure 6.4
$\bar{E}$, A and R Values for 1% Failed Fuel and DBA
Sheet 1 of 1

1% Failed Fuel:

$\bar{E} \sim 0.34$ MeV/dis.

A ~ 0.293 mCi/ml

R = 0.18 mR/hr-mCi at lm 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 uCi/ml

R = 0.58 R/hr-Ci at lm for $\bar{E} \sim 1.14$ MeV

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

Enclosure 6.5
Technical Basis for Caustic Addition Calculations
Sheet 1 of 3

Initial Addition Based on Pounds of Boric Acid:

The initial addition is based on the ability of one pound of caustic to neutralize 17 pounds of boric acid. This value was calculated using the methodology described in the Babcock & Wilcox Water Chemistry Manual (BAW-1385), Section 8 (1990 revision) and was confirmed by benchtop titration studies. Please reference Memo to File, dated 1-24-96, "Results of Caustic Titration Study", File #OS-715.00 for further details.

Subsequent Additions Based on Measured pH:

The basic assumption is that boric acid (H_3BO_3) behaves as a simple monoprotic acid versus the complex monoprotic acid that it is. Thus, it was assumed that when boric acid is placed in water only the H_2BO_3 borate ion is produced. Typically, boric acid in water will produce 3 to 4 different borate ions (Ref.: B&W or Westinghouse literature on boric acid). The equation will therefore read as follows:

$$H_3BO_3 \;<\!\!-\!\!-\!\!>\; H^+ + H_2BO_3^-$$

where the acid dissociation constant (K_a) equation would be

$$K_a = \frac{\{H_2BO_3^-\}\,\{H^+\}}{\{H_3BO_3\}} \qquad \text{(Eqn. 1)}$$

The pH equations for the hydrogen and hydroxyl ion are as follows:

$$pH = -\text{Log}\{H^+\} \qquad \text{(Eqn. 2)}$$

$$10^{-14} = \{H^+\}\,\{OH^-\} \qquad \text{(Eqn. 3)}$$

For calculation simplification purposes, it is assumed that the only species contributing to the neutralization equation listed below are NaOH, H_3BO_3, and H_2O:

$$\{Na^-\} + \{H^-\} - \{OH^-\} - \{H_2BO_3^-\} = 0 \qquad \text{(Eqn. 4)}$$

By substituting Equations 1, 2, and 3 above into equation 4 and solving for the sodium ion concentration, the amount of caustic added to the reactor coolant water can be determined given the system pH. The equation would be:

$$\{Na^-\} = K_a\{H_3BO_3\}/(10^{-pH}) + 10^{14-pH} - 10^{-pH} \qquad \text{(Eqn. 5)}$$

Enclosure 6.5
Technical Basis for Caustic Addition Calculations
Sheet 2 of 3

Since it is desired to adjust the system pH to a point between 7.0 and 8.0, then the desired amount of sodium necessary to achieve a system pH of 7.5 can be determined by solving equation 5 above for a pH equal to 7.5. Therefore, subtracting the sodium concentration calculated at the actual system pH from the sodium concentration at the desired pH of 7.5 yields the amount of sodium necessary for pH adjustment.

At a pH of 7.0, the terms 10^{-pH} and 10^{14-pH} cancel each other. This leaves the following equation:

$$\{Na^+\} = (K_a'\{H_3BO_3\}/(10^{-pH'})) - (K_a\{H_3BO_3\}/(10^{-pH}) \quad \text{(Eqn. 6)}$$
$$+ 10^{pH-14} - 10^{-pH})$$

where " ' " represents the terms for when pH is 7.0.

Substituting A for the term $K_a'/(10^{-pH'})$ and B for K_a the above equation becomes,

$$\{Na^+\} = (A - B/(10^{-pH}))\ \{H_3BO_3\} - 10^{pH-14} \quad \text{(Eqn. 7)}$$
$$+ 10^{-pH}$$

Next, using conversion factors and solving for sodium in terms of gallons of 35% NaOH to add, the equation becomes,

$$\text{35\% NaOH to Add (Gallons)} = ((A-B/(10^{-pH}))\text{ppm B} - 10^{pH-14} + 10^{-pH}) \text{ *V*0.0829} \quad \text{(Eqn. 8)}$$

where,

ppm B	=	boron concentration of reactor cooling water
V	=	volume of reactor cooling water to pH adjust, gallons
pH	=	pH of reactor cooling water after making initial caustic add
0.0829	=	conversion factor
A & B	=	coefficients for boric acid dissociation constants at 25° C.

Enclosure 6.5
Technical Basis for Caustic Addition Calculations
Sheet 3 of 3

The 0.0829 conversion factor came from the conversion of Na ion concentration to gallons of 35% NaOH. The number was reached by the following equations:

Gallons 35% NaOH = (moles Na / liters soln.) * (gals soln.) * (1 mole NaOH / 1 mole Na) 35% * (3.785 liters soln. / 1 gal soln.) * (40.01 gms NaOH / 1 mole NaOH) * (100 gms soln. / 35 gms NaOH) * (1 cubic centimeter / 1.38 gms) * (1 liter 35% naOH / 1000 cubic centimeters 35% NaOH) * (1 gal 35% NaOH / 3.785 liters 35% NaOH)

Gallons 35% NaOH = (moles Na / liters soln.) * (gals soln.) * 0.0829
(liter soln. * gal 35% NaOH) / (gal soln. * moles Na)

The initial guesses for the A and B coefficients were calculated from apparent monoprotic dissociation constants using a pH - specific conductivity computer program. The initial coefficients were $A = 9 \times 10^{-6}$ and $B = 3.09 \times 10^{-13}$. Laboratory data was then utilized to fine tune the coefficients. Titrations of various boron concentrations resulted in coefficients $A = 4.7 \times 10^{-6}$ and $B = 1.6 \times 10^{-13}$. Thus, the formula for calculating the quantity of caustic to add based on pH as shown in Enc. 6.3 is:

$$\text{35\% NaOH to Add} = ((4.7 \times 10^{-6} - 1.6 \times 10^{-13}/10^{-pH})\text{ppm B} \quad -10^{-pH} + 10^{pH-14}) * V * 0.0829 \qquad \text{(Eqn. 9)}$$

Reference: Memo to File, dated 5/29/89, "pH Adjustment of Reactor Coolant During a LOCA Using Sodium Hydroxide", File #OS-715.00.

Enclosure 6.6
Quarterly Inspection of Post Accident Equipment
Sheet 1 of 1

1. Caustic addition equipment stored in the brown cabinet in AB, 2nd floor ~10 ft North of 1 & 2 Chemical Addition Area:

Goggles	Face shield	Bung Wrench
Corrosive suit	Gloves	Flashlight
Boots	Stainless steel flex hose	
Tank to valve adapter	Tape measure	

2. Appendix 'R' sampling apparatus stationed in each units respective LPI room:

	UNITS		
	1 (RM-61)	**2 (RM-63)**	**3 (RM-82)**
Sample cooler	_____	_____	_____
Ice container (30 gal. drum)	_____	_____	_____
Glass thermometer	_____	_____	_____
Plastic liter bottles (3)	_____	_____	_____
Tygon tubing for cooler	_____	_____	_____
Plastic sleeving for drum drain	_____	_____	_____