Énergie NB Power

Quality today…for an assured future

0087-78210-3002-001-OM-A-02

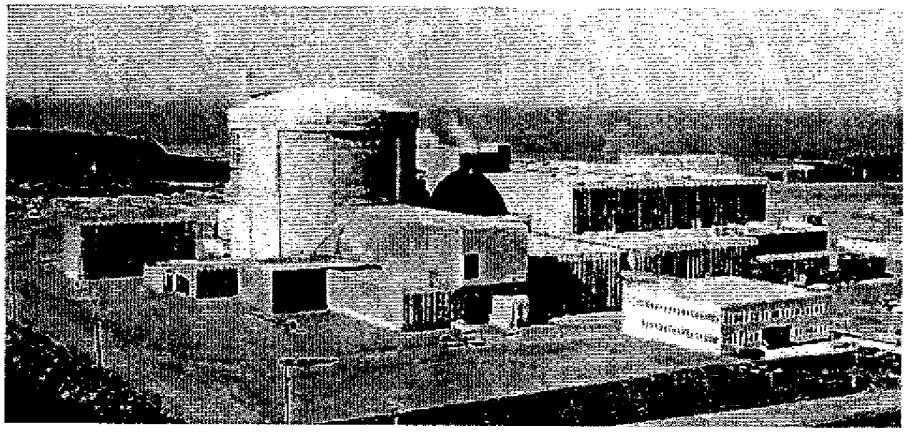
POINT LEPREAU GENERATING STATION

OPERATING MANUAL

PLANT CHEMISTRY CONTROL

OM-78210

(3)



ISSUED BY: _____ DATE: January 16/03
Operations Superintendent / Delegate

TRACKED BY: _____ DATE: 2003-01-07
PJ Fitzgerald

REGISTERED 2003-01-17

PREPARED BY: D. Alward	APPROVED BY OSP: D. Hamilton	DATE:	REV:	PAGE:
		2003-01-06	2	1 of 156

REVISION RECORD

Rev #	Page	Section	Comments
2	14	3.4	REVISED OM-78210 reference column to indicate section corrections.
	17	4.1.3	ADDED note to section.
	18	4.1.4	ADDED "or any shutdown" to Gd, pHa, cond parameters.
	19, 20	4.1.5	ADDED Conditions and Actions for conductivity, pHa, and gadolinium parameters.
	23	4.1.8	ADDED statement to Step 1.
	116	4.20.5	REVISED amount of morpholine to add to TARCW.
	117		REVISED low hydrazine action limit to 0.10 mg/kg.
			REVISED amount of hydrazine to add to IACC.
	120	4.21.3	REVISED conductivity High Specification and Upper Control Limit.
	126	4.21.5	REVISED conductivity specification Action Limit.
	148	5.5	DELETED "Exit Procedure" from exit of Governing Condition box.
	149	5.6	REWORDED Action box to "Establish Maximum Boiler Blowdown".

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

1.0 SCOPE

Under normal operating conditions, this Operating Manual provides:

- centralized information to guide chemistry department personnel in the performance of their duties.
- specifications and corrective actions to guide supervisory and operating personnel in the satisfactory chemical operation of the station.

2.0 OBJECTIVES

Chemistry control is required to maintain the integrity of process systems necessary for the safe and efficient operation of the station.

The objectives of this manual are:

- to identify chemical specifications and corrective actions necessary for the operation of the station.
- to describe chemical work packages and reporting schemes for plant staff.

3.0 WORK PROCEDURES

3.1 General

The chemistry department is responsible for ensuring the proper chemistry control of plant process systems. This is achieved through routine sampling, monitoring, analysis, reporting, review and corrective actions.

Chemistry activities are performed according to approved procedures which include analytical. chemistry and instrument procedures.

3.2 Responsibilities

The Chemical Superintendent is responsible for the review and approval of chemistry documentation and for ensuring adequate monitoring, control and review is carried out to maintain proper process chemistry. Monthly reports on plant chemistry performance are submitted to station management.

The Chemical Supervisors are responsible for the preparation and updating of chemical routines, co-ordination of work activities and the review of all chemistry data and related forms/logs to ensure proper system operation, monitoring and control is maintained.

The Chemical Maintainers are responsible for the sampling, analysis, operation and chemical control of process systems. Routine and non-routine analysis/tasks are performed as required by specified chemistry routines and assigned work, or by requests from other plant personnel.

3.3 Chemistry Reporting and Review

Chemistry requests from other plant personnel are generally requested by:

1. Chemistry Laboratory Request for Analysis Form
2. Liquid Effluent Pump Out Authorization Form
3. D_2O Transfer Form
4. Notifications

These forms are initiated by the person requesting the analysis with the necessary information recorded on the form. The completed laboratory copies are retained in the chemistry laboratory for a minimum period of one year and reviewed by the Chemical Supervisors. Other copies are retained by the appropriate individual or work group as specified on the forms.

3.0 WORK PROCEDURES (Cont'd)

3.3 Chemistry Reporting and Review (Cont'd)

In addition, gamma scans, calibration reports, chemistry Maintenance Plans, Water Treatment Plant status and regeneration forms and Condensate Polisher Regeneration SOSs are routinely reviewed by the Chemical Supervisors.

The Chemistry Data Management and Scheduling System is utilized for chemistry data storage, routine scheduling and reporting for plant process systems. Work sheets are utilized to identify scheduled routines to the shift Chemical Maintainers and to allow recording of data as analysis are performed. Data is entered into the database by the maintainer following completion of work, thus maintaining the database current up to the present shift. Work sheets are retained for approximately two months for reference and are not formally reviewed.

Data exception and detail summary reports are routinely submitted and reviewed by the Chemical Supervisors. Additionally, summary reports and trends are submitted on a monthly basis and when desired for other time periods.

The database is considered the master record and the hardcopy reports are retained for reference only in the event of computer hardware failures. No archiving program is maintained for these reports, as proper backup and recovery procedures are in place for the database (maintained by Health Physics).

Log books are utilized in the Chemistry Laboratory, Water Treatment Plant and Condensate Polisher areas. Entries pertinent to chemistry control and operation of systems are recorded. Log books are routinely submitted to Document Control staff for vault storage and indefinite retention.

3.0 WORK PROCEDURES (Cont'd)

3.4 OP&P Requirements

It is intended that the table below will provide a guide for Operations and Chemistry personnel with respect to the requirements of OP&P. The parameters list and the limits are given to indicate when a violation of OP&P has occurred. The appropriate OP&P section is also referenced.

PARAMETER	OM-78210 Reference	OP&P Reference	OP&P LIMITS/IMPLICATIONS
Failed Fuel (immediate limit)	4.2	3.02 3.06	• **IF** GFP unavailable **AND** RP greater than 80%, **SAMPLE** BOTH loops 1/shift. • I-131 must be less than 1.25 E 8 Bq/kg. Corrective action required. • Reactor Shutdown if I-131 greater than 5.00 E 8 Bq/kg.
PHT Impurities (8 hour limit)	4.2	3.03.1	• Dissolved Oxygen must be less than 0.01 mg/kg. • Chloride must be less than 0.2 mg/kg. • Nitrate must be less than 0.2 mg/kg. • Total Organic Carbon must be less than 1.0 mg/kg.
PHT Isotopic (immediate limit)	4.2	3.10	• Isotopic must always be greater than 97.43%wt D2O.
Heat Transport Pressure Boundary (immediate limit)	4.10	3.03.7	• **INVESTIGATE** any apparent increase in gamma activity, tritium or D_2O content in the boiler blowdown or boiler steam samples. • **IF** on-line radiation monitor is unavailable, **SAMPLE** boiler blowdown for H-3 (1 sample per boiler per shift).
Generator Hydrogen Purity (8 hour limits)	4.15	4.09	• Generator hydrogen purity must be greater than 90% vol. • Generator hydrogen dewpoint must be less than -18°C.
Turbine Regulating Oil (action limits as stated)	4.17	4.07	• Moisture must be less than 2000 mg/kg. (24h action limit) • Neutralization number must be less than 0.50 mg KOH/g FRF. (7 day action limit) • Electrical resistivity must be greater than 1.0 E9 ohm/cm. (24h action limit) **NOTE**: It may take up to 30 days for the chemistry to change.

3.0 WORK PROCEDURES (Cont'd)

3.4 OP&P Requirements (Cont'd)

PARAMETER	OM-78210 Reference	OP&P Reference	OP&P LIMITS/IMPLICATIONS
Moderator Cover Gas (immediate limit)	4.1	3.08.1 R99 Section 1.1 (q)	• Deuterium concentration measured at any location in the system must be less than 4% vol at all times. • **IF** on-line monitor is unavailable, **INCREASE** sample frequency to 2/shift.
Liquid Zone Control Cover Gas (immediate limit)	4.8	R99 Section 1.1 (q)	• Hydrogen concentration measured at any location in the system must be less than 4% vol at all times. • **IF** on-line monitor is unavailable, **INCREASE** sample frequency to 1/shift.
Vault Cover Gas (immediate limit)	4.3	R99 Section 1.1 (q)	• Hydrogen concentration measured at any location in the system must be less than 4% vol at all times. • **IF** on-line monitor is unavailable, **INCREASE** sample frequency to 2/shift.
Boiler contaminants (8 hour limits)	4.10	3.03.2	• Chloride and silica must be less than 1.0 mg/kg. • Sulfate must be less than 0.1 mg/kg. • Dissolved oxygen must be less than 0.005 mg/kg.
Condensate and feedwater (8 hour limits)	4.10	3.03.2	• Sodium must be less than 0.005 mg/kg. • Feedwater dissolved oxygen must be less than 0.005 mg/kg. • Condensate dissolved oxygen must be less than 0.05 mg/kg.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System

4.1.1 Summary

Chemical control of the Moderator System is required to:

- control the reactivity of the reactor by the use of soluble neutron poisons (boron and gadolinium nitrate).
- minimize corrosion of the system materials.
- minimize the rate of radiolysis of the heavy water and hence minimize the amount of deuterium and oxygen in the cover gas.

Heavy water purity is maintained via the purification loop which contains D+/OD- ion exchange resin.

4.1.2 Sample Point and Sample Origin

3261-V37 .....Main System

3261-SS5.....Main System

3261-V26 .....IX01

3261-V27 .....IX02

3261-V28 .....IX03

3261-V29 .....IX04

3261-V30 .....IX05

3261-V42 .....Purification Outlet

3261-V43 .....IX Column Common Outlet

3271-SS2.....3271-TK1 Boron

3271-SS1.....3271-TK3 Gadolinium

63495-V163, Y132 ....Recombination Unit Inlet

63495-V164, Y132 ....Recombination Unit Outlet

3261-SS6.....Moderator Collection Tank

3261-V41 .....Moderator Collection Tank

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.3 Specifications

NOTE

While shut down (Poison Outage or GSS), any unplanned and confirmed decrease in Main Moderator conductivity or gadolinium, or increase in pHa, must be reported to the Shift Supervisor.

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Conductivity (mS/m)	-	0.20	-	0.10
*pHa	4.5	7.0	5.0	6.5
Chloride (mg/kg)	-	0.1	-	0.01
Fluoride (mg/kg)	-	0.1	-	0.01
Nitrate (mg/kg) Purification Outlet	-	0.01	-	Detectable
Dissolved D_2 (ml/kg)	-	7.0	-	3.0
Total Organic Carbon (mg/kg)	-	1.0	-	1.0
Boron (mg/kg) 3271-TK1	4940	5230	5030	5230
Gadolinium (mg/kg) 3271-TK3	1790	2400	1930	2230
D_2O (% by weight)	99.75	-	99.90	-
Deuterium (% by Volume)	-	4.0	-	1.0
Oxygen (% by Volume)	0.5	2.0	1.0	2.0
Nitrogen (% by Volume)	-	2.0	-	1.0

*pHa analysis required only if conductivity is greater than 0.2 mS/m.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pHa	Main System	Conductivity greater than 0.2 mS/m
"	Conductivity	Main System	1/7 days
"	Chloride	Main System	2/7 days
"	Fluoride	Main System	2/7 days
"	Total Organic Carbon	Main System	1/28 days
"	Nitrate	Purification Outlet	2/7 days
"	Dissolved D_2	Main System	2/7 days
"	Gd, pHa, Cond (GSS or any shutdown)	Main System	2/day
"	Boron	Main System	1/7 days
"	Boron	Purification Outlet	1/7 days
"	Gadolinium	Main System	2/7 days
"	Boron	3271-TK1	1/7 days
"	Gadolinium	3271-TK3	1/7 days
"	% D_2O	Main System	2/7 days
"	Tritium	Main System	1/28 days
"	Radionuclides	Main System	1/28 days
"	Radionuclides	Purification Outlet	1/28 days
"	% D_2O	Moderator Collection	Upon Request from Operations
"	Conductivity	Moderator Collection	
"	Boron	Moderator Collection	
"	Total Organic Carbon	Moderator Collection	
"	pHa	Moderator Collection	
"	Chlorides	Moderator Collection	
"	Gadolinium	Moderator Collection	
On-line (AI 1046)	Conductivity	Main System	Continuous
On-line (AI 1047)	Conductivity	Purification Outlet	Continuous
63495-AE6	% D_2	RU Inlet	10/hour
63495-AE6	% O_2	RU Inlet	10/hour
63495-AE6	% N_2	RU Inlet	10/hour

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.5 Corrective Actions

Parameter	Condition	Actions
Conductivity (Main System)	HIGH	1. **CONFIRM** analysis. 2. **ASSESS** IX column performance. 3. **MEASURE** pHa.
	DECREASING TREND (Unplanned)	This applies while shut down: 1. **CONFIRM** analysis. 2. **INFORM** Shift Supervisor.
pHa (Main System)	HIGH or LOW	1. **CONFIRM** analysis. 2. **ASSESS** IX column performance.
	INCREASING TREND (Unplanned)	This applies while shut down: 1. **CONFIRM** analysis. 2. **INFORM** Shift Supervisor.
Chloride (Main System)	HIGH	1. **CONFIRM** analysis. 2. **CHECK** chloride at outlet of IX columns in service. 3. **IF** chloride is detectable, **REPLACE** resin. 4. **PLACE** another IX column in service.
Fluoride (Main System)	HIGH	1. **CONFIRM** analysis. 2. **CHECK** fluoride at outlet of IX column(s) in service. 3. **IF** fluoride is detectable, **REPLACE** resin. 4. **PLACE** another IX Column in service.
Nitrate (Purification outlet)	HIGH	1. **CONFIRM** analysis. 2. **CHECK** nitrate at outlet of IX column(s) in service. 3. **IF** nitrate is detectable, **REPLACE** resin. 4. **PLACE** another IX Column in service.
Dissolved D_2 (Main System)	HIGH	1. **CONFIRM** analysis. 2. **CHECK** conductivity of main system. 3. **ASSESS** IX column performance. **CHECK** conductivity at column outlet. 4. **IF** conductivity is greater than 0.010 mS/m, **REPLACE** resin. 5. **PLACE** another IX Column in service.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
*Boron (3271-TK1)	LOW	1. **CONFIRM** analysis. 2. **ADD** enough boric anhydride (B_2O_3) to bring boron concentration within control limits. 3. **Refer To** OM-32710 and 32710-FP-01.
Boron (3271-TK1)	HIGH	1. **CONFIRM** analysis. 2. **DRAIN** solution from tank and **REPLACE** with D_2O to bring Boron concentration within control limits. 3. **Refer To** OM-32710 and 32710-FP-01.
**Gadolinium (3271-TK3)	LOW	1. **CONFIRM** analysis. 2. **ADD** sufficient gadolinium nitrate [$Gd(NO_3)_3.6H_2O$] to bring Gd concentration within control limits. 3. **Refer To** OM-32710 and 32710-FP-01.
Gadolinium ***(3271-TK3)	HIGH	1. **CONFIRM** analysis 2. **DRAIN** solution from tank and **REFILL** with D_2O to bring Gd concentration within control limits. 3. **Refer To** OM-32710 and 32710-FP-01.
Gadolinium (Main System)	DECREASING TREND (Unplanned)	This applies while shut down: 1. **CONFIRM** analysis. 2. **INFORM** Shift Supervisor.
% D_2O (Main System)	LOW	1. **CONFIRM** analysis. 2. **INITIATE** action to upgrade the moderator D_2O to 99.90% or greater.

* B_2O_3 used must have been isotopically verified.
CONFIRM that a valid certificate is available for the lot number used.

** Gadolinium used must have been isotopically verified.
CONFIRM that a valid certificate is available for the lot number used.

*** TK3 can be operated in the HIGH Gd condition provided Operations concurs and with the approval of Chemistry and the System Specialist.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
% Deuterium (RU Inlet)	greater than 0.5%	1. **OBTAIN** sample from RU outlet to check RU performance.
% Deuterium (RU Inlet)	greater than 2%	1. **CONFIRM** by lab analysis. 2. **CHECK** RU performance. 3. **DETERMINE** the cause and **INITIATE** corrective action for D_2 excursion. **Refer To** OM-32310, "D_2 EXCURSION".
% Deuterium (RU Inlet)	greater than 4%	1. **CONFIRM** by lab analysis. 2. **DETERMINE** the cause and **INITIATE** corrective action for D_2 excursion. **Refer To** OM-32310, "D_2 EXCURSION".
% Oxygen (RU Inlet)	greater than 2%	1. **CONFIRM** by lab analysis. 2. **CHECK** RU performance. 3. **IF** no D_2 is detected, **PURGE** with helium, until % O_2 is less than 2%.
% Oxygen (RU Inlet)	less than 1%	1. **CONFIRM** by lab analysis. 2. **ADD** O_2 to cover gas so that RU Inlet is within control limits. **NOTE** that % D_2 must be less than 2%.
% Nitrogen (RU Inlet)	greater than 2%	1. **CONFIRM** by lab analysis. 2. **PURGE** cover gas system with helium until % N_2 is less than 0.5%.
% D_2O (Moderator Collection)	LOW	1. **CONFIRM** analysis. 2. **IF** within 0.01% of current moderator isotopic **AND** greater than 99.75% D_2O, **RETURN** to main moderator.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Conductivity (Moderator Collection)	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.10 mS/m, **CHECK** for chlorides and nitrates. • **IF** Cl or NO_3 are greater than 0.01 mg/kg, **PROCESS** through clean-up.
Total Organic Carbon (TOC)	HIGH	1. **CONFIRM** analysis. 2. **IF** TOC is greater than 1.0 mg/kg, **PROCESS** through clean-up.
pHa (Moderator Collection)	HIGH or LOW	1. **CONFIRM** analysis. 2. **IF** pHa is less than 4.5 or greater than 7.0, **PROCESS** through clean-up.
Boron (Moderator Collection)	Detectable	1. **CONFIRM** analysis. 2. **IF** boron is greater than the current concentration in Main Moderator, **NOTIFY** the Control Room.
Chloride (Moderator Collection)	HIGH	1. **CONFIRM** analysis. 2. **IF** chloride is greater than 0.01 mg/kg, **PROCESS** through clean-up.
Gadolinium (Moderator Collection)	Detectable	1. **CONFIRM** analysis. 2. **IF** Gadolinium is greater than the current concentration in Main Moderator, **NOTIFY** the Control Room.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

4.1.6 Purification Circuit

There are five ion exchange columns (3221-IX1-IX5), each containing 0.200 m^3 of resin. The columns' resin types and uses are:

IX1-IX5: IRN-150 type or equivalent resin removes all ions including boron. Under normal conditions, two of these columns are used for boron control, one for use with high concentrations of boron, the other for low concentrations. The remaining three are used as required. **Refer To** OM-32210 for further details on use of IX columns.

The normal flow through each ion-exchange column is 8.3 kg/s. Figure 4.1.1 gives purification flow rate vs clean-up half time. Figure 4.1.2 gives purification clean-up times at various flow rates.

4.1.7 Abnormal Conditions

1.	Moderator, Main System During Start-up	a) Conductivity will be greater than 0.10 mS/m due to the presence of gadolinium nitrate, i.e. 0.208 mS/m per mg Gd/kg D_2O b) Gadolinium concentration must be greater than 17.4 mg Gd/kg D_2O during GSS and approximately 0.5 to 2.0 mg Gd/kg D_2O when used for xenon simulation. c) Dissolved deuterium may be higher than normal due to impurities in the moderator.
2.	On-line Gas Chromatograph is unavailable	a) Lab analysis a minimum of twice per shift with no power changes or upset conditions. b) Lab analysis within 15 minutes of a power change of 20% RP c) Lab analysis once per hour until gaseous D_2 concentration is steady.

4.1.8 Shut Down Chemistry Control

Normal chemical control is maintained during shutdown conditions except in the following cases:

1. The moderator contains gadolinium as a result of SDS2 injection, GSS or xenon simulation. There is no purification flow. The Main Moderator must be sampled for gadolinium, pHa, and conductivity to confirm purification valves are not passing.

2. The cover gas is being purged. There is no recombination unit assessment.

3. The moderator is drained. There is no control.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

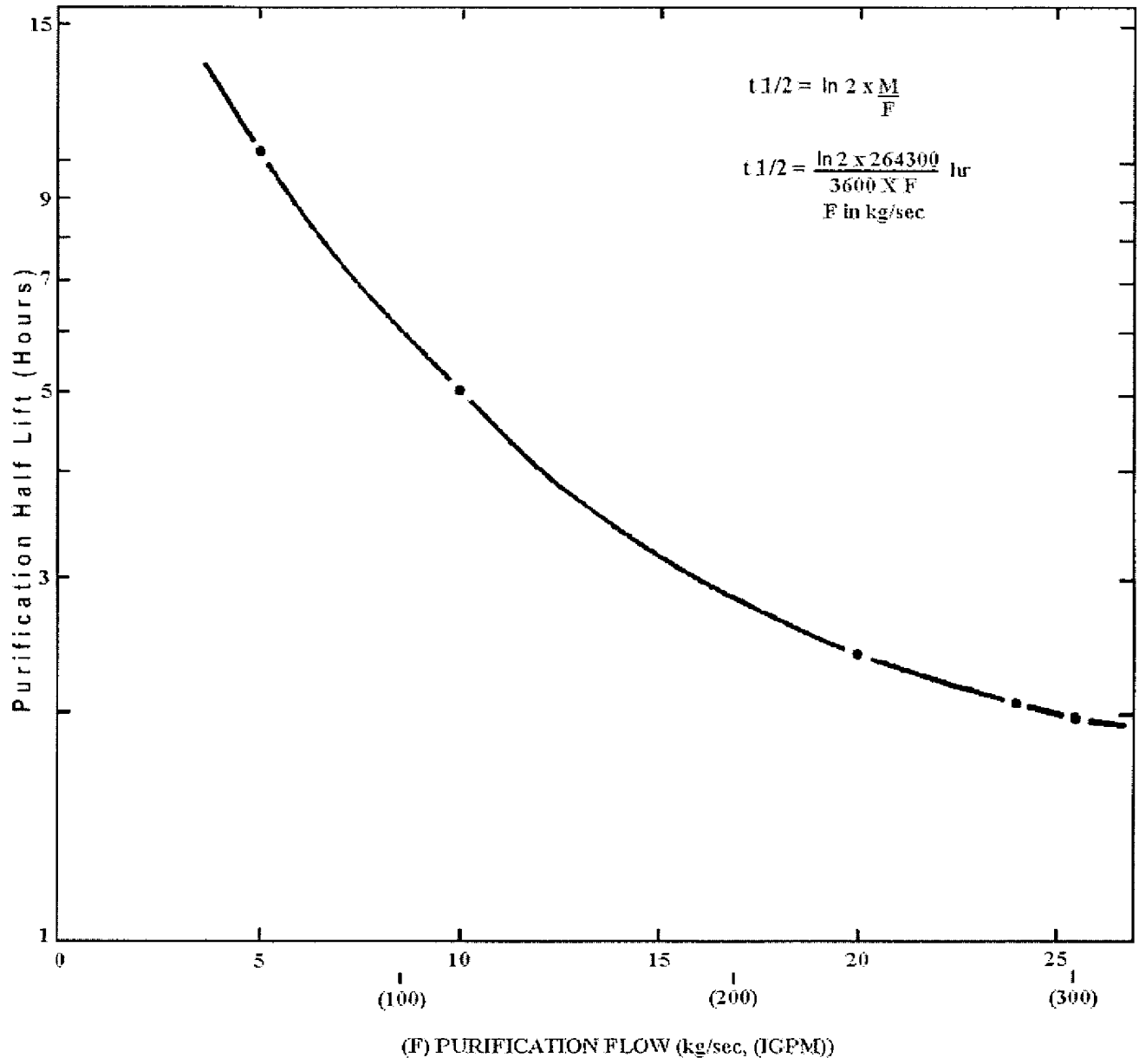


Figure 4.1.1 - Moderator Purification Flow Rate vs. Clean-up Half Time

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.1 32100, 32210, 32310, 32510, 32710 - Moderator System (Cont'd)

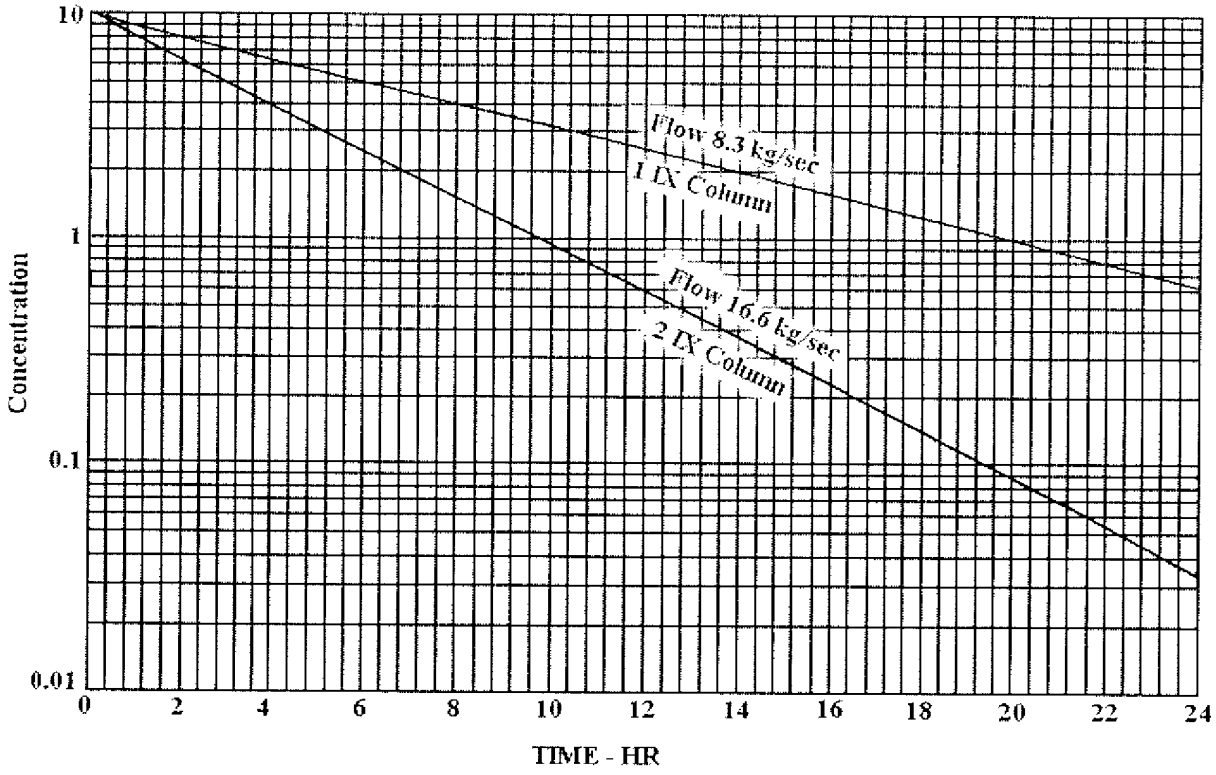


Figure 4.1.2 - Moderator Purification Clean-up time for Various Flow Rates

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System

4.2.1 Summary

Chemistry Control of the Primary Heat Transport System is required to:

1. Minimize the corrosion of system components.
2. Limit the rate of production of radioactive corrosion products.
3. Ensure efficient removal of radioactive corrosion products and soluble fission products.

Purity of the PHT heavy water is maintained via the purification loop which contains Li+/OD- ion exchange resin.

Isotopic Concentration: the isotopic concentration of the PHT D_2O must remain ≥0.15 wt% below the Moderator D_2O isotopic concentration.

4.2.2 Sample Points and Sample Origin

3371-V76, SS5	3312-P2 Discharge (Loop I)
3371-V74, SS3	3312-P4 Discharge (Loop II)
3371-V3,V72, SS1	3335-IX1 Outlet
3371-V4,V72, SS1	3335-IX2 Outlet
63495-V168, Y132	3333-TK1
3371-FR4	3311-B02
3371-FR2	3311-B04
3371-V77, SS6	3381-TK1

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
pHa	10.2	10.8	10.2	10.4
Conductivity (mS/m)	0.92	3.66	0.92	1.46
Lithium (mg/kg)	0.35	1.4	0.35	0.55
Chloride (mg/kg)	-	0.2	-	0.01
Fluoride (mg/kg)	-	0.1	-	0.01
%D_2O (wt%)	98.6		99.0	99.6
Dissolved D_2 (ml/kg)	3.0	10.0	4.0	10.0
Dissolved O_2 (mg/kg)	-	0.010	-	0.010
Total Organic Carbon (TOC)(mg/kg)	-	1.0	-	0.5
Suspend Solids (mg/kg)	-	0.1	-	0.05
I-131 (MBq/kg)	-	500	-	0.1
D_2 (% by volume)	-	4.0	-	2.0
O_2 (% by volume)	-	1.0	-	0.5
N_2 (% by Volume)	-	6.0	-	4.0
% D_2O (wt%) D_2O Collection	98.0	-	98.0	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.4 Sampling and Sample Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pHa	Loop I	3/7 days
"	pHa	Loop II	3/7 days
"	pHa	IX1 Outlet	3/7 days
"	pHa	IX2 Outlet	3/7 days
"	Conductivity	Loop I	3/7 days
"	Conductivity	Loop II	3/7 days
"	Conductivity	IX1 Outlet	3/7 days
"	Conductivity	IX2 Outlet	3/7 days
"	Lithium	Loop I	3/7 days
"	Lithium	Loop II	3/7 days
"	Lithium	IX1 Outlet	3/7 days
"	Lithium	IX2 Outlet	3/7 days
"	Chloride	Loop I	1/14 days
"	Chloride	Loop II	1/14 days
"	Chloride	IX1 Outlet	1/14 days
"	Chloride	IX2 Outlet	1/14 days
"	Fluoride	Loop I or Loop II	1/91 days
"	Fluoride	IX1 Outlet	As Required
"	Fluoride	IX2 Outlet	As Required
"	% D_2O	Loop I	1/7 days
"	% D_2O	Loop II	1/7 days

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.4 Sampling and Sample Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency
Lab	Dissolved D_2/H_2	Loop I	3/7 days
"	Dissolved D_2/H_2	Loop II	3/7 days
"	Dissolved O_2	Loop I	1/14 days
"	Dissolved O_2	Loop II	1/14 days
"	TOC	Loop I	1/14 days
"	TOC	Loop II	1/14 days
"	Suspended Solids	Loop I	1/28 days
"	Suspended Solids	Loop II	1/28 days
"	Tritium	Loop I	1/28 days
"	Tritium	Loop II	1/28 days
"	Radionuclides	Loop I	1/7 days
"	Radionuclides	Loop II	1/7 days
"	Radionuclides	IX1 Outlet	1/7 days
	Radionuclides	IX2 Outlet	1/7 days
On-line (3371-AT1)	Dissolved D_2	3312-P4	Continuous
On-line (3371-AT2)	Dissolved O_2	3312-P4	Continuous
On-line (63495-AE6)	% D_2	3333-TK1	2/hour
On-line (63495-AE6)	% O_2	3333-TK1	2/hour
On-line (63495-AE6)	% N_2	3333-TK1	2/hour
Lab	% D_2O	3381-TK1	As Required

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.5 Corrective Actions

Parameter	Condition	Actions
pHa (Loop I or Loop II)	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** lithium concentration. **IF** out of specification, **MAKE** addition or removal as required. **Refer To** 33710-CP05, CP04. 3. **ASSESS** IX column performance.
Conductivity (Loop I or Loop II)	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** lithium and pH. **IF** out of specification, **CORRECT** as required. 3. **IF** pH and lithium are in spec, **CHECK** IX column performance, and **IF** necessary, **REPLACE**.
Lithium (Loop I or Loop II)	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** IX column performance. 3. **IF** columns are not exhausted, **CHECK** pH and **ADD** or **REMOVE** lithium as required. **Refer To** 33710-CP05, CP04.
Chloride (Loop I or Loop II)	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.010 mg/kg, **CHECK** IX column performance, and **IF** required, **REPLACE** resin.
Fluoride (Loop I or Loop II)	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.010 mg/kg, **CHECK** fluoride at column outlet. **IF** required, **REPLACE** resin.
% D_2O (Loop I or Loop II)	LOW	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. 3. **RAISE** PICA (as reportable). 4. **NOTIFY** Shift Supervisor of requirement for raising PHT D_2O isotopic.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
% D_2O (Loop I or Loop II)	HIGH	1. **DETERMINE** the Moderator and PHT isotopics. 2. Is PHT isotopic greater than (Moderator Isotopic - 0.15%)? 3. **NOTIFY** SS of results. 4. **STOP** PHT upgrading and/or moderator downgrading as necessary.
Dissolved D_2 (Loop I or Loop II)	LOW or HIGH	1. **CONFIRM** analysis. 2. a) **IF** less than 4 ml/kg, **ADD** H_2. b) **IF** greater than 10 ml/kg, degas PHT. 3. **OBTAIN** samples 2 hours after the addition or degassing step to establish the equilibrium concentration.
Dissolved O_2 (Loop I or Loop II)	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.010 mg/kg, **CHECK** dissolved D_2 concentration. **IF** required, **ADD** H_2.
Suspended Solids (Loop I or Loop II)	HIGH	1. **CHECK** that there were no transients during sample periods, i.e. a) reactor trip b) turbine trip c) power change of 20% RP d) PHT warm up/cool down e) PHT pressure change of 0.7 MPa. 2. **INCREASE** purification flow to maximum. 3. **CHECK** system dissolved O_2/D_2, pH, conductivity and lithium. 4. **CORRECT** as required.
% D_2	HIGH	1. **CONFIRM** analysis. 2. **IF** D_2 concentration is greater than 2%, **PURGE** cover gas system until D_2 concentration is less than 2.0%.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
% O_2	HIGH	1. **CONFIRM** analysis. 2. **IF** O_2 concentration is greater than 0.5%, **PURGE** cover gas system with helium until oxygen concentration is less than 0.5%.
Total Organic Carbon (TOC) (Loop I or Loop II)	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.5 mg/kg. a) **CHECK** for oil contamination. b) **CHECK** for resin fines. 3. **NOTIFY** Shift Supervisor and System Specialist.
% N_2	HIGH	1. **CONFIRM** analysis. 2. **IF** N_2 concentration is greater than 4%, **PURGE** cover gas system until nitrogen concentration is less than 1%.
I-131 (Loop I or Loop II)	HIGH	1. **CONFIRM** analysis. 2. **IF** I-131 concentration is 0.1 MBq/kg or greater, **NOTIFY** Shift Supervisor. 3. **IF** I-131 concentration is greater than 125 MBq/kg, **Refer To** Figure 4.2.1 for appropriate actions.
% D_2O (D_2O Collection)	LOW	1. **CONFIRM** analysis. 2. **IF** within 0.1% D_2O (wt) of the current Heat Transport System isotopic **AND** 98.0% D_2O or greater, **RETURN** to the PHT System. **Refer To** OM-33810.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

4.2.6 Purification Circuit

There are two ion exchange columns (3335-IX1 and IX2), each containing 1 m^3 of IRN-154 resin, or Purolite NRW37-LI-LC or equivalent. This is a Li+/OD- type resin capable of removing cationic and anionic impurities. The resin must be deuterated before it is placed in service (**Refer To** OM-33360). The details of resin changing are included in OM-34510.

Normal (maximum) purification flow is 24 kg/s which gives a clean-up half-time of 60 minutes. **Refer To** Figure 4.2.2 for clean-up half-life vs purification flow rate.

Purification flow should be maintained at all times during reactor operation to ensure activity transport is minimized in the system.

A clean-up half-time of 60 minutes should be maintained during normal operations as well as immediately following a shutdown and immediately prior to start-up depending on availability.

4.2.7 Abnormal Conditions

1. On-line gas chromatograph:	a) Lab analysis 1/day on out of service. PHT storage tank cover gas. b) Lab analysis **prior to** and 2 hours **after** hydrogen addition.
2. Gaseous Fission Product: Monitor out of service.	Lab analysis on both loops 1/shift (OP&P Requirement).

4.2.8 Shutdown Chemistry Control

Normal chemical control is maintained during shutdown conditions except for dissolved oxygen and dissolved deuterium. H_2 is not added when the reactor is cold and depressurized so there is no means of dissolved oxygen control. During shutdown maintenance, part of the system is nitrogen blanketted to minimize air in-leakage.

System purification should remain in service when possible to minimize the formation of lithium carbonates and subsequent system pH reduction.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

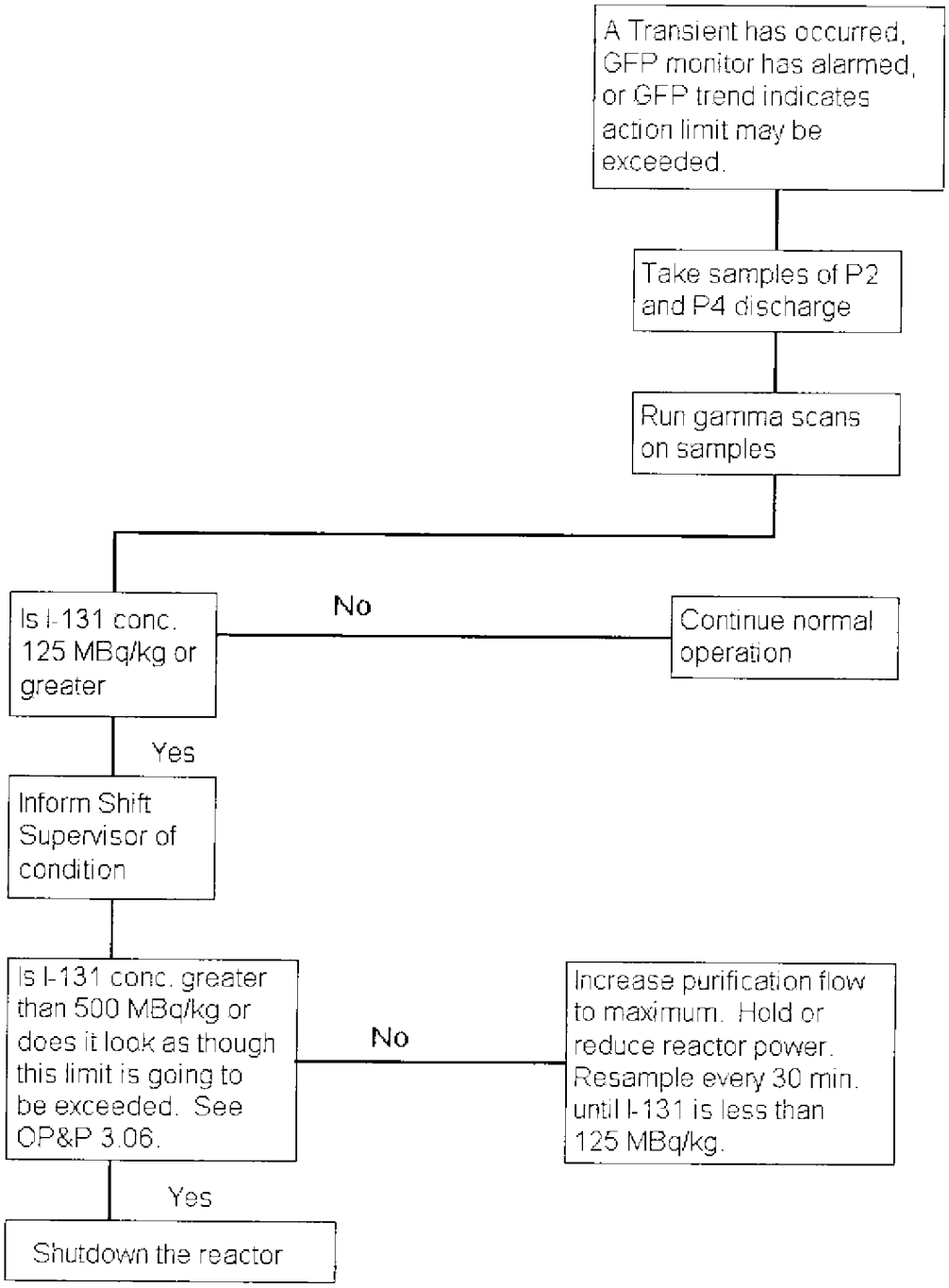


Figure 4.2.1 - Chemical Control Following Transient

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.2 33100, 33300, 33340, 33350, 33810 - PHT System (Cont'd)

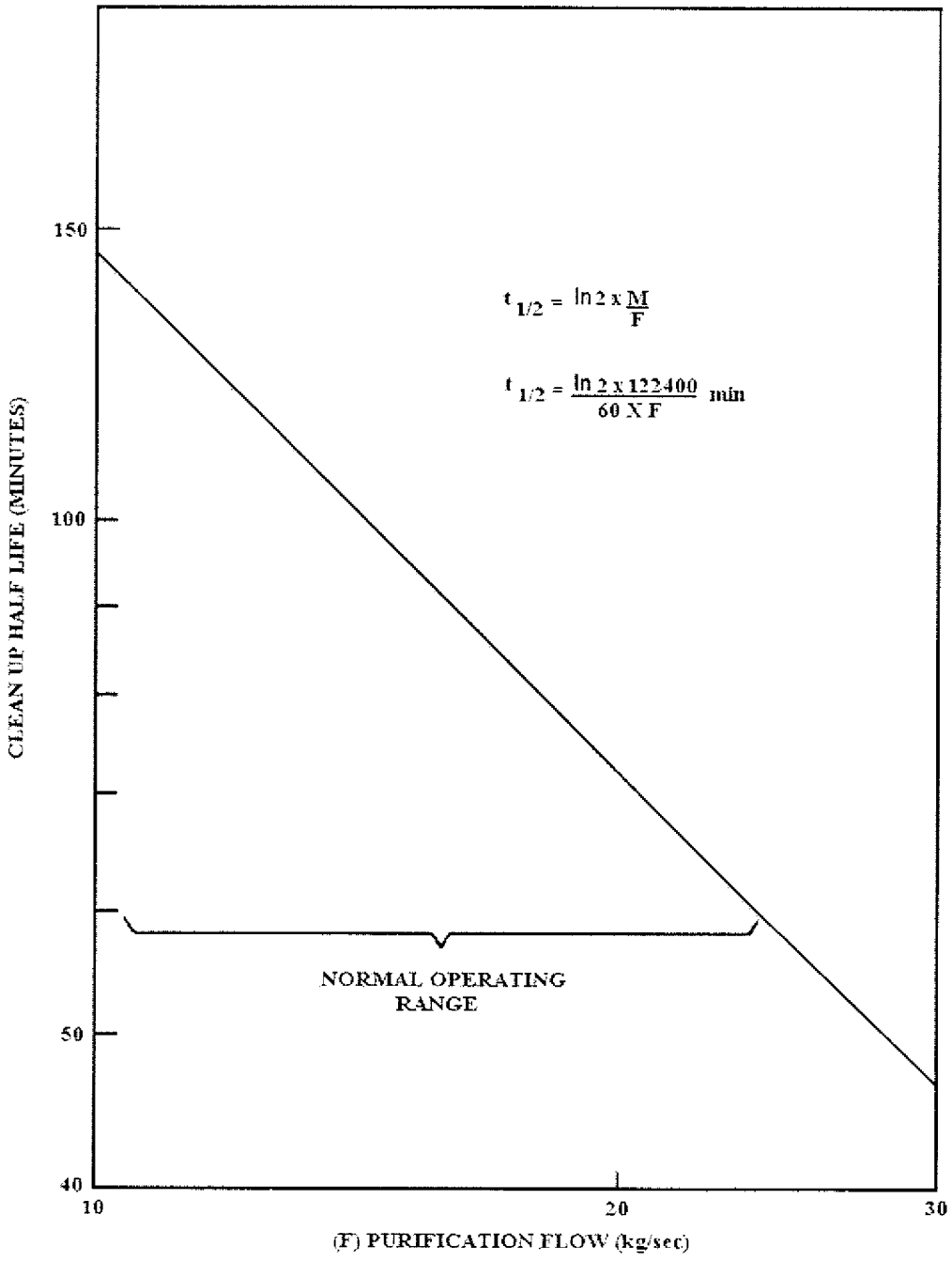


Figure 4.2.2 - PHT Purification Flow Rates vs Clean-up Half Time

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.3 34110 - Shield Cooling System

4.3.1 Summary

Chemistry control of the Shield Cooling System is required to:

- minimize corrosion of the system components.
- removal of impurities from the system.
- maintain the concentration of H_2 and O_2 in the nitrogen cover gas below their explosive limits.

Purity of the water is maintained via the purification loop which contains Li+/OH- ion exchange resin.

4.3.2 Sample Points and Sample Origin

3411-V112	Main System
3411-V111	3411-IX1 Outlet
3411-V23	Main System when IX1 is out service

4.3.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
pH	9.85	10.65	10.0	10.5
Conductivity (mS/m)	1.70	11.0	2.30	7.50
Lithium (mg/kg)	0.48	3.0	0.7	2.2
Chloride (mg/kg)	-	2.0	-	0.05
H_2 (% by Volume)	-	4.0	-	2.0
O_2 (% by Volume)	-	2.0	-	1.0

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.3 34110 - Shield Cooling System (Cont'd)

4.3.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pH	Main System	2/7 days
"	pH	IX1 Outlet	1/7 days
"	pH	Vault Leak	1/28 days
"	Conductivity	Main System	2/7 days
"	Conductivity	IX1 Outlet	1/7 days
"	Conductivity	Vault Leak	1/28 days
"	Lithium	Main System	2/7 days
"	Lithium	IX1 Outlet	1/7 days
	Chloride, NO_2, NO_3, NH_3	Main System	1/7 days
	Chloride, NO_2, NO_3, NH_3	IX1 Outlet	1/7 days
	Tritium	Main System	1/28 days
	Tritium	Vault Leak	1/28 days
	Suspended Solids	Main System	1/91 days
	% H_2	Vault Cover Gas	1/7 days
	% O_2	Vault Cover Gas	1/7 days
On-line (63411-AE1)	% H_2	Vault Cover Gas	Continuous

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.3 34110 - Shield Cooling System (Cont'd)

4.3.5 Corrective Actions

Parameter	Condition	Actions
pH (Main System)	LOW	1. **CONFIRM** analysis. 2. **CHECK** lithium concentration. **IF** required to bring concentration within control limits, **ADD** lithium. **Refer To** 34110-FP02. 3. **RESAMPLE** after 2 hours. 4. **ASSESS** IX Column performance. 5. **PERFORM** suspended solids analysis.
pH	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 10.5, **CHECK** lithium concentration. **PLACE** on feed and bleed to bring pH within specification. More demineralized water may increase H_2 concentration. **MONITOR** Vault Cover Gas H_2 concentration. 3. **SAMPLE** at 1 hour intervals until pH is in spec. 4. **PERFORM** suspended solids analysis.
Conductivity (Main System)	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** pH, Li, NO_2, NO_3, NH_3, and conductivity at IX1 inlet and outlet. 3. **PERFORM** corrective actions specified for the out-of-spec conditions or diagnostic indications. 4. **PERFORM** suspended solids analysis.
Lithium (Main System)	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** pH and conductivity at IX1 inlet and outlet. 3. **PERFORM** corrective actions specified for the out-of-spec conditions. 4. **PERFORM** suspended solids analysis.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.3 34110 - Shield Cooling System (Cont'd)

4.3.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Chloride (Main System)	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.05 mg/kg, **CHECK** chloride on IX1 outlet. 3. **IF** chloride is out of spec, **REPLACE** resin.
% H_2 (Vault Cover Gas)	HIGH	1. **CONFIRM** analysis. 2. **IF** % H_2 is greater than 2%, **MAXIMIZE PURGE** with N_2 while maintaining cover gas pressure. **MAINTAIN MAXIMUM PURGE** until H_2 levels are less than 2%. 3. **ASSESS** Cl, NO_2, NO_3, NH_3, and **IF** necessary, **REPLACE** IX1 resin.
% O_2 (Vault Cover Gas)	HIGH	1. **CONFIRM** analysis. 2. **IF** % O_2 is greater than 1%, **MAXIMIZE PURGE** with N_2 while maintaining cover gas pressure. **MAINTAIN MAXIMUM PURGE** until O_2 levels are less than 1%.

4.3.6 Purification Circuit

There is one ion exchange column (3411-IX1) which contains 0.2 m^3 of IRN-154 resin, or Purolite NRW37-LI-LC resin, or equivalent. This is a Li+/OH- type resin capable of removing both cationic and anionic impurities. The resin does not require deuteration.

Maximum flow through the column is 8.47 l/s which gives a clean-up half-time of approximately 12 hours for a system volume of 524 m^3.

Another means of purification is by feed and bleed. The system is flushed to active drainage using fresh demineralized water makeup. This type of purification is used for clean-up of chemical impurities only. It is not used for radioactivity clean up.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.3.7 Abnormal Conditions

Vault Cover Gas analysis required twice per shift if H_2 monitor, AE1 is out of service.

4.3.8 Shutdown Chemistry Control

None.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.4 34310 - Dousing / Containment System

4.4.1 Summary

Chemistry control of the Dousing System is required to minimize corrosion of carbon and stainless steel components.

4.4.2 Sample Points and Sample Origin

3431-V27 Dousing Tank

4.4.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Hydrazine (mg/kg)	50	100	75	-

4.4.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Hydrazine	Dousing Tank	1/183 days
"	Tritium	Dousing Tank	1/183 days
"	Suspended Solids	Dousing Tank	1/183 days

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.4 34310 - Dousing / Containment System (Cont'd)

4.4.5 Corrective Actions

Parameter	Condition	Actions
Hydrazine	LOW	1. **CONFIRM** analysis. 2. **IF** N_2H_4 is less than 75 mg/kg **ADD** sufficient hydrazine to bring the N_2H_4 residual to 75 mg/kg or greater. a) **DRAIN** 2300 litres of water from the dousing tank via an in board valve and its associated drain valve. b) **INJECT** hydrazine into the dousing tank fill line through 3431-V26. **NOTE** that 200 litres of 35% catalyzed hydrazine will increase the concentration by 25 mg/kg. c) **FLUSH** the hydrazine into the dousing tank by adding demin water to bring the level back to normal.

4.4.6 Purification Circuit

There is no purification circuit associated with this system.

4.4.7 Abnormal Conditions

None.

4.4.8 Shutdown Chemistry Control

Normal chemical control is maintained during shutdown conditions.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.5 34320 - Emergency Core Cooling System

4.5.1 Summary

Chemistry Control the Emergency Core Cooling System is required to minimize the corrosion of the carbon steel components.

4.5.2 Sample Points and Sample Origin

3432-V108 .....ECC High Pressure

3432-V125 .....ECC Medium Pressure

3432-Y1 via V30.....ECC Medium Pressure

4.5.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
pH	10.0	10.5	10.0	10.5
Lithium (mg/kg)	1.0	2.0	1.0	2.0
Hydrazine (mg/kg)	5.0	100	50	-
Chloride (mg/kg)		1.0	-	1.0
Suspended Solids (mg/kg)		1.0	-	1.0

4.5.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pH	ECC High Pressure	4/year
"	pH	ECC Medium Pressure	4/year
"	Hydrazine	ECC High Pressure	4/year
"	Hydrazine	ECC Medium Pressure	4/year
"	Chloride	ECC High Pressure	4/year

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.5 34320 - Emergency Core Cooling System (Cont'd)

4.5.4 Sampling and Sampling Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency
Lab	Chloride	ECC Medium Pressure	4/year
"	Suspended Solids	ECC High Pressure	4/year
"	Suspended Solids	ECC Medium Pressure	4/year
"	Lithium	ECC High Pressure	4/year
"	Lithium	ECC Medium Pressure	4/year
"	Conductivity	ECC High Pressure	4/year
"	Conductivity	ECC Medium Pressure	4/year
"	Tritium	ECC High Pressure	4/year
"	Tritium	ECC Medium Pressure	4/year
"	% D_2 O	ECC High Pressure	4/year
"	% D_2O	ECC Medium Pressure	4/year

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.5 34320 - Emergency Core Cooling System (Cont'd)

4.5.5 Corrective Actions

Parameter	Condition	Actions
pH	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** lithium concentration. **IF** less than 1.0 mg Li/kg, **ADD** LiOH to give a Li concentration of approximately 1.5 mg Li/kg

NOTE

Volume of Medium Pressure ECC: 17,000 litres.
Volume of High Pressure ECC: 216,000 litres.

Adding 0.09 kg and 1.1 kg of LiOH to MPECC and HPECC respectively will yield a Li concentration of approximately 1.5 mg Li/kg.

Chemical addition for High Pressure ECC is via 3432-V109.

Chemical addition for Medium Pressure ECC is via canister 3432-Y1.

3. **IF** lithium **concentration** is high, **FEED** and **BLEED** system.

Lithium	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** less than 1.0 mg Li/kg or greater than 2.0 mg Li/kg **Refer To** section for pH out of spec.
Hydrazine	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** less than 50 mg N_2H_4/kg, **ADD** hydrazine to bring residual to greater than 70 mg/kg.

NOTE

Addition of 50 litres of 35% hydrazine (catalyzed) will yield a concentration of approximately 80 to 90 mg/kg.

3. **IF** hydrazine is greater than 100 mg/kg, **FEED** and **BLEED** system.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.5 34320 - Emergency Core Cooling System (Cont'd)

4.5.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Chloride	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 1 mg/kg, **REQUEST** system be placed on feed and bleed. 3. **WHEN** chloride is in spec, **CHECK** pH, Li, and hydrazine. **IF** out of spec, **CORRECT** as required.
Suspended Solids	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 1.0 mg/kg, feed and bleed system. 3. **WHEN** suspended solids are in spec, **CHECK** pH, Li and hydrazine. **IF** out of spec, **CORRECT** as required.

4.5.6 Purification Circuit

There is no means of purification for this system.

4.5.7 Abnormal Conditions

None.

4.5.8 Shutdown Chemistry Control

Normal chemical controls are maintained during reactor shutdown. The ECC system remains poised at all times.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.6 34410 - Spent Fuel Bay Cooling And Purification System

4.6.1 Summary

Chemistry control of the Spent Fuel Bay Cooling and Purification System is required to:

- minimize corrosion of metal surfaces.
- minimize the quantity of radioactive materials present in the circuits, thus minimizing radiation fields.
- **MAINTAIN** bay clarity for ease of viewing of underwater bay operations. Purity of the water is maintained via the purification loop which contains H^+/OH- ion exchange resin.

4.6.2 Sample Point and Sample Origin

3441-V142 .....Reception Bay

3441-V143 .....Storage Bay

3441-V140 .....IX1 Outlet

3441-V141 .....IX2 Outlet

4.6.3 Specification

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
*pH	5.5	7.5	5.5	7.5
Conductivity (mS/m)	-	0.2	-	0.15
Chloride (mg/kg)	-	0.1	-	0.05
I-131 Ratio IX in/IX out	5	-	5	-

* pH analysis required only if conductivity is greater than 0.2 mS/m.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.6 34410 - Spent Fuel Bay Cooling And Purification System (Cont'd)

4.6.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pH	Main Storage Bay	Conductivity greater than 0.2 mS/m
"	pH	Reception Bay	Conductivity greater than 0.2 mS/m
"	pH	IX1 Outlet	Conductivity greater than 0.2 mS/m
"	pH	IX2 Outlet	Conductivity greater than 0.2 mS/m
"	Conductivity	Main Storage Bay	1/7 days
"	Conductivity	Reception Bay	1/7 days
"	Conductivity	IX1 Outlet	1/7 days
"	Conductivity	IX2 Outlet	1/7 days
"	Chloride	Main Storage Bay	1/7 days
"	Chloride	Reception Bay	1/7 days
"	Chloride	IX1 Outlet	1/7 days
"	Chloride	IX2 Outlet	1/7 days
"	$\%D_2O$	Reception Bay	1/7 days
"	$\%D_2O$	Main Storage Bay	1/7 days
"	Tritium	Reception Bay	1/28 days
"	Tritium	Main Storage Bay	1/28 days
"	I-131	Reception Bay	1/7 days
"	I-131	Main Storage Bay	1/7 days
"	I-131	IX1 Outlet	1/7 days
"	I-131	IX2 Outlet	1/7 days

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.6 34410 - Spent Fuel Bay Cooling And Purification System (Cont'd)

4.6.5 Corrective Actions

Parameter	Condition	Actions
pH	LOW or HIGH	1. **CONFIRM** analysis. 2. **CHECK** pH, conductivity, and chloride on IX inlet and corresponding IX outlet.* 3. **IF** any of these parameters are out of spec, **REPLACE** resin. **NOTE** that Purification columns can be used to clean up either the Main Storage Bay or the Reception Bay. Normal operating conditions has IX1 purifying the Reception Bay and IX2 purifying the Main Storage Bay.
Conductivity	HIGH	1. **CONFIRM** analysis. 2. **MEASURE** pH. 3. **Refer To** actions for pH out of Spec.
Chloride	HIGH	1. **CONFIRM** analysis. 2. **Refer To** actions for pH out of Spec.
I-131	IX Inlet/IX Outlet less than 5	1. **CONFIRM** analysis. 2. **IF** the ratio of I-131 at IX inlet to IX outlet is less than 5, **REPLACE** resin.

4.6.6 Purification Circuit

There are two filters 3441-FR01, FR02 which are cartridge, disposable types having a pore size of 5 um.

There are two ion exchange columns 3441-IX01, IX02 each containing $1m^3$ of IRN-150 resin or equivalent. This is H^+/OH^- resin capable of removing both cationic and anionic impurities.

Typically the purification half-time is 13.8 hr for the Main Storage Bay and 5.25 hr for the Reception Bay using one IX column in each case.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.6 34410 - Spent Fuel Bay Cooling And Purification System (Cont'd)

4.6.7 Abnormal Conditions

None.

4.6.8 Shutdown Chemistry Control

Normal chemical control is maintained on this system at all times.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.7 34700 - Liquid Injection Shutdown System

4.7.1 Summary

Chemistry control of the Liquid Injection Shutdown System is required to ensure:

- the heavy water used in the system meets specification necessary to maintain the moderator chemistry.
- the gadolinium nitrate used in the system is of the proper chemical purity, concentration and relative isotopic abundance to meet system requirements.

4.7.2 Sample Points and Sample Origin

3471-SS1 .....3471-TK11
3471-Y202 .....3471-TK1, TK2, TK3, TK4, TK5, and TK6 Injection Tanks

4.7.3 Specification

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
$\%D_2O$	99.00	-	99.00	-
pHa	-	6.0	3.0	5.0
Gadolinium (mg/kg)	8420	12000	9000	10500
Gadolinium-157 (Relative % Abundance)	15.5	-	15.5	-
Gadolinium-155 (Relative % Abundance)	14.6	-	14.6	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.7 34700 - Liquid Injection Shutdown System (Cont'd)

4.7.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	$\%D_2O$	TK 11	As Required
"	$\%D_2O$	Injection Tank	1/7 days
"	pHa	TK 11	As Required
"	pHa	Injection Tank	1/7 days
"	Gadolinium	TK 11	As Required
"	Gadolinium	Injection Tank	1/7 days
"	Gadolinium-157* (Isotopic relative abundance)	Each lot number in new shipment	Upon receipt of new shipment of $Gd(NO_3)_3.6H_2O$
	Gadolinium-155* (Isotopic relative abundance)	Each lot number in new shipment	Upon receipt of new shipment of $Gd(NO_3)_3.6H_2O$

* Analysis for these isotopes will be performed by an independent laboratory.

4.7.5 Corrective Actions

Parameter	Condition	Actions
$\%\ D_2O$	LOW	1. **CONFIRM** analysis. 2. **IF** $\%\ D_2O$ is less than 99.00% **INFORM** Shift Supervisor.
pHa	HIGH	1. **CONFIRM** analysis. 2. **ADD** nitric acid to bring pHa within control limits as per OMT-34700.6

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.7 34700 - Liquid Injection Shutdown System (Cont'd)

4.7.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Gadolinium (3471-Y202)	LOW	1. **CONFIRM** analysis. 2. **IF** Gadolinium concentration is less than 9000 mg Gd/kg D_2O, **ADD** Gadolinium Nitrate ($Gd(NO_3)_3.6H_2O$) to bring the Gadolinium concentration to 10000 mg Gd/kg D_2O. **Refer To** OMT-34700.6, Make-up Procedure.
Gadolinium (3471-TK11)	LOW	1. **CONFIRM** analysis. 2. **IF** Gadolinium concentration is less than 9500 mg Gd/kg D_2O, **ADD** Gadolinium Nitrate to bring tank concentration to 9500 mg Gd/kg D_2O or greater. **Refer To** OMT-34700.4.
Gadolinium (3471-Y202)	HIGH	1. **CONFIRM** analysis. 2. **IF** Gadolinium concentration is greater than 12000 mg Gd/kg D_2O, **REMOVE** solution to bring Gadolinium concentration between 9000 and 10500 mg Gd/kg D_2O. **Refer To** OMT-34700.7.
Gadolinium Isotopic (Gd-157)	LOW	1. **IF** the Gd-157 relative abundance is less than 15% **INITIATE** action to procure proper specification material.
Gadolinium Isotopic (Gd-155)	LOW	1. **IF** the Gd-155 relative abundance is less than 14.5% **INITIATE** action to procure proper specification material.

4.7.6 Purification Circuit

There is no purification circuit associated with system.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.7 34700 - Liquid Injection Shutdown System (Cont'd)

4.7.7 Abnormal Conditions

None.

4.7.8 Shut Down Chemistry Control

Normal chemical control is maintained on this system at all times.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.8 34810 - Liquid Zone Control System

4.8.1 Summary

Chemistry control of the Liquid Zone Control System is necessary to maintain a high level of purity in both the demineralized light water circuit and the helium cover gas circuit.

Water Purity is maintained via the purification loop which contains H^+/OH^- ion exchange resin.

The hydrogen concentration in the helium cover gas is maintained below explosive limits by reaction with oxygen in the recombination units.

4.8.2 Sample Point and Sample Origin

3481-V227 .....Main System
3481-V226 .....Purification Outlet
63495-V161, Y132 ....Recombination Unit Inlet
63495-V162, Y132 ....Recombination Unit Outlet

4.8.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Conductivity (mS/m)	-	0.10	-	0.080
*pH	5.5	8.0	5.5	7.5
Chloride (mg/kg)	-	0.100	-	0.050
Fluoride (mg/kg)	-	0.10	-	0.050
Hydrogen (% volume)	-	4.0	-	3.3
Oxygen(% volume)	-	2.0	-	1.65
Nitrogen(% volume)	-	2.0	-	1.65

* pH analysis required only if conductivity is greater than 0.2 mS/m

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.8 34810 - Liquid Zone Control System (Cont'd)

4.8.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Conductivity	IX Inlet and Outlet	1/7 days
"	pH	IX Inlet and Outlet	Conductivity greater than 0.2 mS/m
"	Chloride	IX Inlet and Outlet	1/7 days
"	Fluoride	IX Inlet and Outlet	1/91 days
"	% Hydrogen	RU Inlet	3/7 days
"	% Oxygen	RU Inlet	3/7 days
"	% Nitrogen	RU Inlet	3/7 days
On-line AI (1051)	Conductivity	IX Inlet	Continuous
63495-AE6	% Hydrogen	RU Inlet	2/hour
	% Oxygen	RU Inlet	2/hour
	% Nitrogen	RU Inlet	2/hour
	% Hydrogen	RU Outlet	2/hour
	% Oxygen	RU Outlet	2/hour
	% Nitrogen	RU Outlet	2/hour

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.8 34810 - Liquid Zone Control System (Cont'd)

4.8.5 Corrective Actions

Parameter	Condition	Actions
Conductivity (Main System)	HIGH	1. **CONFIRM** analysis. 2. **IF** conductivity greater than 0.2 mS/m, **MEASURE** pH. 3. **ASSESS** IX performance. **CHECK** Cl at IX Inlet & Outlet and conductivity at IX Outlet. 4. **IF** IX resin is exhausted, **VALVE IN** fresh column and **REPLACE** spent resin.
Conductivity (IX Outlet)	HIGH	1. **CONFIRM** analysis. 2 **IF** resin is exhausted, **VALVE IN** fresh column and **REPLACE** spent resin.
pH (IX Outlet)	HIGH or LOW	**Refer To** ACTIONS for conductivity HIGH Main System.
pH	HIGH or LOW	**Refer To** ACTIONS for conductivity HIGH IX Outlet.
Chloride (Main system)	HIGH	1. **CONFIRM** analysis. 2. **ASSESS** IX performance. **CHECK** conductivity at IX Inlet & Outlet and Cl at IX Outlet. 3. **IF** IX resin is exhausted, valve in fresh column, and **REPLACE** spent resin.
Chloride (IX Outlet)	HIGH	**Refer To** ACTIONS for conductivity HIGH IX Outlet.
Fluoride (Main system)	HIGH	1. **CONFIRM** analysis. 2. **ASSESS** IX performance. **CHECK** Cl at IX Inlet & Outlet and F at IX Outlet.
Fluoride (IX Outlet)	HIGH	**Refer To** ACTIONS for conductivity HIGH IX Outlet.
% Hydrogen (RU Inlet)	greater than 3.3%	1. **INFORM** the CRO. 2. **CONFIRM** by lab analysis. 3. **CHECK** RU operation.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.8 34810 - Liquid Zone Control System (Cont'd)

4.8.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
% Hydrogen (RU Inlet/Outlet)	greater than 4%	1. **IMMEDIATELY INFORM** Shift Supervisor. 2. **CONFIRM** by lab analysis.
(RU Outlet)	greater than 2.0%	**Refer To** ACTIONS for hydrogen greater than 3.3% at RU Inlet.
% Oxygen (RU Inlet)	greater than 1.65%	1. **CONFIRM** by lab analysis. 2. **CHECK** RU performance. 3. **PURGE** system with helium until % oxygen is one-half the hydrogen concentration.
% Oxygen (RU Inlet/Outlet)	greater than 2%	1. **CONFIRM** by lab analysis, **INFORM** SS. 2. **PURGE** system with helium until % oxygen is less than 2%.
% Oxygen (RU Outlet)	greater than 0.25%	**Refer To** ACTION for % oxygen greater than 1.65% at RU Inlet.
% Nitrogen (RU Inlet/Outlet)	greater than 1.65%	1. **CONFIRM** by lab analysis. 2. **CHECK** main system water for nitrates. 3. **PURGE** system with helium until % nitrogen is less than 0.1%.

4.8.6 Purification Circuit

There are two ion exchange columns, each containing 0.2 m^3 of IRN-150 resin or equivalent. This is an H+/0H- type resin capable of removing cationic and anionic impurities.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.8 34810 - Liquid Zone Control System (Cont'd)

4.8.7 Abnormal Conditions

1. Start-up	Lab analysis of cover gas samples are required to confirm correct operation of on-line gas chromatograph
2. On-line GC out of service	a) Lab analysis once per shift with no power changes. b) Lab analysis after each power change of 20% RP

4.8.8 Shutdown Chemistry Control

None.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.9 34980 - Annulus Gas System

4.9.1 Summary

Chemistry control of the Annulus Gas System is required to:

- minimize corrosion of system materials.
- prevent the development of high radiation fields and or high concentrations of undesirable radionuclides.
- detect the in-leakage of D_2O from either the heat transport system or moderator systems.

4.9.2 Sample Points and Sample Origin

3498-V34 (Y1,Y2).....Inlet to Annulus Gas Compressors

4.9.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Dew Point (°C)	-	-10	-30	-10
Deuterium (% Volume)	-	0.100	-	0.050
Oxygen (% Volume)	-	0.500	-	0.500

4.9.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Dew Point Moisture	Compressor Inlet	1/7 days
"	D_2	Compressor Inlet	1/7 days
"	$\%O_2$	Compressor Inlet	1/7 days
	On-line Dew Point (AI 1072 & 3016)	Compressor Inlet	Continuous

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.9 34980 - Annulus Gas System (Cont'd)

4.9.5 Corrective Actions

Parameter	Condition	Actions
Dew Point	HIGH	1. **CONFIRM** analysis. 2. **IF** dew point is greater than -10°C, **PURGE** system with dry carbon dioxide until dew point is less than -30°C. 3. **RE-CHECK** dew point approximately 2 hours after purge is completed.
Deuterium	HIGH	1. **CONFIRM** analysis. 2. **IF** D_2 is greater than 0.050% volume, **PURGE** the system with carbon dioxide until D_2 less than 0.050%
Oxygen	HIGH	1. **CONFIRM** analysis. 2. **IF** % O_2 is greater than 0.5%, **PURGE** with dry carbon dioxide until % O_2 is less than 0.5%.

4.9.6 Purification Circuit

There is no purification circuit associated with this system.

4.9.7 Abnormal Conditions

Not Applicable

4.9.8 Shut Down Chemistry Control

Normally, the annulus gas system is in operation at all times, whether or not the reactor is shutdown. Therefore the normal chemistry controls are in force. If maintenance work is being carried out on the annulus gas system, it will be isolated and depressurized and there will be no chemistry control.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System

Section A - Boiler - Feedwater - Condensate Background

1. Scope

This section of the operating manual provides Point Lepreau Generating Station (PLGS) staff with specifications and recommendations for the optimal chemistry control of the Boiler-Feedwater-Condensate System. Chemistry control specifications are provided in three sections that cover all plant states.

The technical basis for the specifications and actions listed in this section can be found in PLGS Information Reports IR-78210-03 and IR-43240-01.

2. Definitions

The following definitions are provided for assistance in interpretation of the tables used in Section B.

a) Administrative Limits and Action Levels

Administrative Limits - limits or ranges that prescribe off-normal chemistry conditions, but are not considered to be indicative of corrosive conditions in the system. Compliance with these limits are considered to provide a conservative mode of operation with respect to chemistry control.

NOTE

1. Approval of the Chemical Superintendent is required to declare either Action Level II or Action Level III conditions. The decision will be based on an assessment of the particular situation to ensure that it is applicable to the technical basis for these specifications.
2. Note 1 above does not apply in the event of a Condenser Contaminant Ingress. Condenser contaminant ingress is covered in Appendix 1 of this document.

Action Levels - limits or ranges for a parameter outside of which remedial action must be taken to restore chemistry control. Action levels are categorized as follows:

(1) **Action Level I** - corrosive conditions may exist such that long-term operation is not permitted. Action is required to return the parameter below this level within 7 days. If the parameter is not returned to normal within 7 days, Action Level II is instituted. If there is no Action Level II specified for the given parameter, then an engineering justification must be prepared to permit extended operation at full power.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section A - Boiler - Feedwater - Condensate Background (Cont'd)

2. Definitions (Cont'd)

a) Administrative Limits and Action Levels (Cont'd)

(2) **Action Level II** - corrosive conditions are known to exist such that full power operation is not permitted. **INITIATE** action immediately to return the parameter within Action Level I specifications. **IF** the parameter is not returned to normal within 4 days, **CONSIDER** declaration of Action Level III. (**Refer To** previous note.)

(3) **Action Level III** - corrosive conditions are known to exist such that continued operation would result in rapid boiler corrosion. The plant must be shutdown as quickly as safe operation permits to minimize boiler degradation. Depending on the nature of the transient, the Chemistry Department must determine whether a hot or cold shutdown is required. An engineering justification must be prepared to permit return to reactor power operation.

b) Specification Types

Control Parameters - specified range of acceptable operation for parameters with the potential to cause system component degradation. Any indication of operation outside these ranges is expected to generate prompt remedial action as recommended in Section C of this manual.

Diagnostic / Trending Parameters - specified range of acceptable operation with respect to a secondary chemistry parameter for the applicable system. These parameters are considered secondary because they are not expected to cause immediate concern regarding system corrosion. These parameters usually serve as monitoring tools, and are intended to invoke further investigative action.

c) Chemical Measurement Types

On-line - This type of measurement is considered to be the primary measurement when available. An on-line instrument is considered to be available when there are no obvious indications of failure or shutdown, and the instrument has been verified in accordance with the criteria specified in the Chemistry Department Quality Control Manual (78200-QM-1) and associated procedures. All on-line indications may be monitored locally at the instrument, or remotely via the Chemistry Monitoring System.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section A - Boiler - Feedwater - Condensate Background (Cont'd)

2. Definitions (Cont'd)

c) Chemical Measurement Types (Cont'd)

Field - This type of measurement is intended to be done in the field at the location of the sample. These measurements include the use of portable meters and equipment capable of analysis of the process fluid on an "in-line" basis. These types of measurements are considered to be the best alternative to *On-line* measurements.

Lab - These measurements include the collection of a representative sample, and analysis in the chemistry laboratory by either a wet method, or a bench top instrument. This type of measurement is considered to be used either when an *On-line* instrument is unavailable, or if there are no on-line or *Field* measurement capability for the associated parameter and location.

d) Sample Locations and Frequencies

Sample Locations - The locations specified in this manual are considered to be the best locations for obtaining routine samples. Other available locations may be used subject to a review to ensure that the specifications still apply.

Sample Frequencies - All sample frequencies for *On-line* measurements are defined by the particular instrument and process operation. All frequencies specified for Field or Lab measurements are considered to be those required to reasonably monitor the particular process system. For situations where either *Field* measurements or *Lab* measurements are to be used to replace an *On-line* monitor that has become unavailable, an engineering assessment is required to determine an appropriate monitoring frequency.

3. System Operating Modes

The definition of various chemistry control initiatives is significantly affected by the operational state of the system. The definition of applicable operating modes is specified in Section B. In addition, there is a table specifying the chemistry program for each separate operating mode.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications

Definition of System Operating Modes

System Operation mode	Description	Definition
1	Power Operation	Operation at greater than 12% Reactor Power.
2	Heatup / Hot Shutdown	Reactor Power less than12% and PHT System Temperature greater than 95°C.
3	Cold Shutdown / Wet Layup	PHT System Temperature less than 95°C.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.1 - Boiler-Feedwater-Condensate Systems State Mode #1 (Power Operation)

CONTROL PARAMETERS - Boiler Blowdown (upstream of flash tank 3631-TK501)

Parameter (units)	Admin Limit	Control specifications			Method & Location	Sample Frequency (days)	Action Ref (Sect C)
		Action Level I	Action Level II	Action Level III			
Sodium (mg/kg)	< 0.005	> 0.010	> 0.100	> 0.250	On-line BD Comp	Continuous	C.1.1
Chloride (mg/kg)	< 0.005	> 0.020	> 0.100	> 0.250	Lab BO1–BO4	1	C.1.1
Sulfate (mg/kg)	< 0.005	> 0.020	> 0.100	> 0.250	Lab BO1–BO4	1	C.1.1

DIAGNOSTIC / TRENDING PARAMETERS - Boiler Blowdown (upstream of flash tank 3631-TK501)

Parameter (units)	Normal Range	Method & Location	Sample Frequency (days)	Concern and/or required action
Hydrazine (mg/kg)	2 x FW	On-line BO1-BO4	7	**TREND** from on-line data. Ratio of blowdown hydrazine to feedwater hydrazine should be 2.0–3.0; indicative of conditions inside boilers.
Silica (mg/kg)	less than 0.500	Lab BD Comp	1	Make-up water quality from WTP can be improved. **IF** boiler silica levels are significant, **MONITOR** individual boilers for hideout trends.
Organic Acids (mg/kg)	To Be Determined	Lab BD Comp	30	**MONITOR** organic acid formation from morpholine decomposition. Organic acid levels will contribute to background cation conductivity indications.
Bulk Water Equivalent Ratios	Increasing toward 1.0	Lab BO1-BO4	30	Trending parameter to evaluate potential boiler crevice chemistry.
pH	9.2 – 9.5	On-line BD Comp.	Continuous	Trending parameter.
Corrosion Product Morphology (oxidation state)	> 95% reduced	Lab BD Comp	90	**SEND** filters from integrated sample for analysis quarterly, **OR** if change in oxidation state expected. Results are indicative of oxygen control and hydrazine effectiveness.
Cation Conductivity (mS/m)	Trend Not Increasing	On-line BO1-BO4	Continuous	This is the only on-line indicator of anionic impurity increase. **INCREASE** anion sample frequency to assess if the cause is impurities for which there are control specifications.
Phosphate (mg/kg)	< 0.010*	Lab BO1-BO4	1	Trending parameter to evaluate potential boiler crevice chemistry.
Tritium (Bq/kg)	< 1.0 E 6	Lab BO1-BO4	0.5	Possible boiler tube leak. **IF** trend increasing, **INCREASE** sample frequency and **FOLLOW** APOP-09.

* Above normal background.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.1 - Boiler-Feedwater-Condensate Systems State Mode #1 (Power Operation) (Cont'd)

CONTROL PARAMETERS - Feedwater

Parameter (units)	Admin. Limit	Control specifications			Method and Location	Sample Frequency (days)	Action Ref (Sect C)
		Action Level I	Action Level II	Action Level III			
Morpholine (mg/kg)	20 – 30	< 15.0	None	None	Lab HPHTR	0.5	C.1.2
Hydrazine (mg/kg)	0.020 – 0.050	< 0.020	None	None	Lab HPHTR	Continuous	C.1.2
Total Iron (mg/kg)	< 0.005	> 0.010	None	None	Lab HPHTR	30*	C.1.3
Total Copper (mg/kg)	< 0.002	> 0.003	None	None	Lab HPHTR	30*	C.1.4
pH	9.3 – 9.7	< 9.3 or > 9.7	None	None	On-line HPHTR	Continuous	C.1.2
Dissolved Oxygen (mg/kg)	< 0.005	> 0.005	None	None	On-line HPHTR	Continuous	C.1.5

* 30 days is minimum. Expectation is to change the CPT filter every 7 days. Sampling should increase in the event of a pH/N_2H_4/DO_2 transient.

DIAGNOSTIC / TRENDING PARAMETERS - Feedwater

Parameter (units)	Normal Range	Method & Location	Sample Frequency (days)	Concern and/or Required Action
Cation Conductivity (mS/m)	<0.025	On-line HPHTR	Continuous	Only on-line indication of anion contaminants (e.g. Cl, SO_4). **INVESTIGATE** any increasing trend; **CORRELATE** with changes in organic acid levels.
Corrosion Product Morphology (oxidation state)	> 95% reduced	Lab HPHTR	90	**SEND** filters from integrated sample for analysis quarterly, **OR** if change in oxidation state expected. Results are indicative of oxygen control and hydrazine effectiveness. A minimum of 30 days of plant operation should occur before sending samples for this analysis.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.1 - Boiler-Feedwater-Condensate Systems State Mode #1 (Power Operation) (Cont'd)

CONTROL PARAMETERS - Condensate

Parameter (units)	Admin. Limit	Control specifications			Method & Location	Sample Frequency (days)	Action Ref (Sect C)
		Action Level I	Action Level II	Action Level III			
Sodium (mg/kg)	Non-Detectable	> 0.00025	None	None	On-line CEP	Continuous	C.1.6

DIAGNOSTIC / TRENDING PARAMETERS - Condensate

Parameter (units)	Normal Range	Method & Location	Sample Frequency (days)	Concern and/or required action
Corrosion Product Morphology (oxidation state)	> 95% reduced	Lab CEP	90	**SEND** filters from integrated sample for analysis quarterly, **OR** if change in oxidation state expected. Results are indicative of oxygen control and hydrazine effectiveness. A minimum of 30 days of plant operation should occur before sending samples for this analysis.
Cation Conductivity (mS/m)	TBD	On-line CD01 – CD03	Continuous	**TREND** relative cation conductivities for all three condenser hotwells and **IF** one is higher than the others, **INITIATE** condenser leak search procedure.
Sodium (mg/kg)	Non-Detectable	On-line CD01 – CD03	Continuous	**TREND** relative sodium levels for all three condenser hotwells and **IF** one is higher than the others, **INITIATE** condenser leak search procedure.
Ammonia (mg/kg)	TBD	Lab CEP	7	**MONITOR** ammonia levels and **CORRELATE** to system hydrazine levels as baseline indicator of hydrazine thermal decomposition rates.
Specific Conductivity (ms/m)	TBD	On-line LPHTR	Continuous	Conductivity should be correlated to system morpholine and ammonia levels. Decreasing trend indicates make-up requirement for morpholine.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.1 - Boiler-Feedwater-Condensate Systems State Mode #1 (Power Operation) (Cont'd)

DIAGNOSTIC / TRENDING PARAMETERS – Condensate (Cont'd)

Parameter (units)	Normal Range	Method & Location	Sample Frequency (days)	Concern and/or Required Action
Total Iron (mg/kg)	< 0.005	Lab HPHTR Drains, CEP, MS Drains	30*	Higher than normal iron levels indicate poor amine distribution in drains piping. **CHECK** morpholine and hydrazine levels in drains samples and **CONSIDER** program adjustment.
Total Copper (mg/kg)	< 0.002	Lab CEP	30*	Indicates too high ammonia levels in condensers. **CHECK** morpholine and hydrazine levels – **REDUCE** to lower part of range.
Dissolved Oxygen (mg/kg)	< 0.020	On-line CEP	Continuous	Trending parameter for correlation with CPT results. **INSTITUTE** a search for sources of air ingress and **TAKE STEPS** to return DO_2 levels to normal range.

* 30 days is minimum. Expectation is to change the CPT filter every 7 days on CEP. Sampling should increase in the event of a $pH/N_2H_4/DO_2$ transient.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.2 - Boiler-Feedwater-Condensate Systems State Mode #2 (Heat-up/Hot Shutdown)

CONTROL PARAMETERS - Boiler Blowdown (upstream of flash tank 3631-TK501)

Parameter (units)	Admin. Limit	Control specifications		Method & Location	Sample Frequency (days)	Action Ref (Sect C)
		Prior To Increasing RP > 12%	Prior To Increasing RP > 35%			
Sodium (mg/kg)	< 0.010	< 0.250	< 0.100	On-line BLDN Comp	Continuous	C.2.1
Chloride (mg/kg)	< 0.020	< 0.100	< 0.040	Lab BO1–BO4	0.5	C.2.1
Sulfate (mg/kg)	< 0.020	< 0.100	< 0.040	Lab BO1–BO4	0.5	C.2.1
Phosphate * (mg/kg)	< 0.010	< 0.250	< 0.100	Lab BO1–BO4	0.5	C.2.1
Hydrazine (mg/kg)	> 0.080	> 0.010	> 0.010	On-line BLDN Comp	Continuous	C.2.2
pH	9.2 – 9.5	9.2 – 9.5	9.2 – 9.5	On-line BLDN Comp	Continuous	C.2.3
Cation Conductivity (mS/m)	Trend Not Increasing	None	None	On-line BO1–BO4	Continuous	C.2.4

* Phosphate numbers refer to above normal background

DIAGNOSTIC / TRENDING PARAMETERS - Boiler Blowdown (upstream of flash tank 3631-TK501)

Parameter (units)	Normal Range	Method & Location	Sample Frequency (days)	Concern and/or Required Action
Tritium (Bq/kg)	< 1.0 E 6	Lab BO1-BO4	0.5	During plant start-up, all four boilers should be trending toward a common tritium level (which should be within the Normal Range) as the start-up progresses. **IF** this trend is not observed, **INCREASE** sample frequency and **ASSESS** the situation prior to any further power increase.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.2 - Boiler-Feedwater-Condensate Systems State Mode #2 (Heat-up/Hot Shutdown) (Cont'd)

CONTROL PARAMETERS - Feedwater

Parameter (units)	Admin. Limit	Control specifications	Method & Location	Sample Frequency (days)	Action Ref (Sect C)
		Prior To Increasing RP >12%			
Morpholine (mg/kg)	20 – 30	20 - 30	Lab HPHTR	0.5	C.2.5
Chloride (mg/kg)	<0.100	Non-Detectable	Lab HPHTR	0.5	C.2.6
Sodium (mg/kg)	<0.100	Non-Detectable	Lab HPHTR	0.5	C.2.6
Dissolved Oxygen (mg/kg)	< 0.100	< 0.010	On-line HPHTR	Continuous	C.2.7
Hydrazine (mg/kg)	>3 x CEP DO2	> 3 x CEP DO2	On-line HPHTR	Continuous	C.2.5
pH	9.3 – 9.7	9.3 – 9.7	On-line HPHTR	Continuous	C.2.5
Suspended Solids (mg/kg)	<0.100	< 0.100	Lab HPHTR	As Req'd	C.2.6

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section B - Boiler - Feedwater - Condensate System Operating Modes and Specifications (Cont'd)

Table B.3 - Boiler-Feedwater-Condensate Systems State Mode #3 (Cold SD & Wet Layup)

CONTROL PARAMETERS - Boiler Blowdown (upstream of flash tank 3631-TK501)

Parameter (units)	Admin. Limit	Control specifications (Note 1)		Method & Location	Sample Frequency (days)	Action Ref (Sect C)
		Control Limitation	Prior To Increasing PHT Temp. > 95 C			
Sodium (mg/kg)	< 0.100	< 1.0	< 0.100	Lab Wet Layup	7 (Note 2)	C.3.1
Chloride (mg/kg)	< 0.100	< 1.0	< 0.100	Lab Wet Layup	7 (Note 2)	C.3.1
Sulfate (mg/kg)	< 0.100	< 1.0	< 0.100	Lab Wet Layup	7 (Note 2)	C.3.1
Phosphate (mg/kg)	< 0.100	< 1.0	< 0.100	Lab Wet Layup	7 (Note 2)	C.3.1
Hydrazine (mg/kg)	> 75	> 75	> 30	Lab Wet Layup	1	C.3.2
pH	> 9.8	> 9.8	9.2 – 9.5	Field Wet Layup	1	C.3.2
Morpholine (mg/kg)	> 25.0	> 25.0	> 20.0	Lab Wet Layup	1	C.3.2
Dissolved Oxygen (mg/kg) (Note 3)	< 0.100	< 0.500	< 0.100	On-line Wet Layup	1	C.3.3

NOTE

1. The large difference between the cold wet lay-up specifications and the warm-up specifications will require careful planning in the latter stages of the plant outage with respect to boiler drain/fill scheduling.
2. Monitor daily until stable after plant shutdown.
3. DO_2 limits and specifications only applicable when nitrogen blanket has been established.
4. Phosphate concentrations refer to above normal background.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section C - Boiler - Feedwater - Condensate Recommended Actions

Table C.1 - Boiler-Feedwater-Condensate Recommended Actions - Mode #1 (Power Operation)

Action	Parameter Out-of-limits (any one or more)	Corrective action Recommended
C.1.1 (Blowdown)	Sodium Chloride Sulfate	1. **PLACE** condensate polishers in service 2. **INCREASE** blowdown flow to maximum. 3. **IMPLEMENT** search for source (condenser leak, blowdown polisher, WTP make-up, condenser returns) and **ISOLATE** source of ingress. 4. As soon as ingress has been isolated: a) **REMOVE** condensate polishers from service. b) **CHANGE** duty on blowdown polisher columns. 5. **WHEN** Action Level I exited, **RETURN** blowdown flow to normal
C.1.2 (Feedwater)	Morpholine Hydrazine pH	1. **ADJUST** chemical addition pump(s) stroke to bring hydrazine and morpholine within limits. 2. **INCREASE** morpholine sample frequency until control is returned to normal.
C.1.3 (Feedwater)	Total Iron	1. **VERIFY** adequate morpholine and hydrazine concentrations. **INCREASE** to high end of range. 2. **REDUCE** condensate dissolved oxygen levels.
C.1.4 (Feedwater)	Total Copper	**VERIFY** hydrazine concentration acceptable. To reduce ammonia levels, **DECREASE** to low end of range.
C.1.5 (Feedwater)	Dissolved Oxygen	1. **INCREASE** hydrazine concentration to high end of range. 2. **OPTIMIZE** deaerator operation. 3. **IMPLEMENT** condenser air ingress leak search.
C.1.6 (Condensate)	Sodium	1. **PLACE** condensate polishers in service 2. **INCREASE** blowdown flow to maximum. 3. **IMPLEMENT** condenser leak search and **ISOLATE** source of ingress. 4. As soon as ingress has been isolated: a) **REMOVE** condensate polishers from service. b) **CHANGE** duty on blowdown polisher columns. 5. **RETURN** blowdown flow to normal when Action Level I exited.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section C - Boiler - Feedwater - Condensate Recommended Actions (Cont'd)

Table C.2 - Boiler-Feedwater-Condensate Recommended Actions - Mode #2 (Heat-up/Hot SD)

Action	Parameter Out-of-Limits (any one or more)	Corrective Action Recommended
C.2.1 (Blowdown)	Sodium Chloride Sulfate Phosphate	1. **MAXIMIZE** blowdown flow and **HOLD** power level until within specification. 2. **IF** contaminant level is steady or increasing, **REDUCE** power until the source has been determined and isolated.
C.2.2 (Blowdown)	Hydrazine	1. **INCREASE** hydrazine addition rate at the DA outlet location until detectable. 2. **MONITOR** closely and reduce hydrazine input when appropriate to control pH in the condenser.
C.2.3 (Blowdown)	pH	1. **INCREASE** morpholine and/or hydrazine addition rate at the DA outlet. 2. **MONITOR** closely and reduce hydrazine input when appropriate to control pH in the condenser.
C.2.4 (Blowdown)	Cation Conductivity	1. To determine source of CatCon, **CHECK** morpholine concentration and organic acid levels. 2. **CONSIDER** maximizing blowdown flow. 3. **CHANGE** blowdown polisher duty at full power.
C.2.5 (Feedwater)	Morpholine Hydrazine pH	**ADJUST** chemical addition as required to achieve control.
C.2.6 (Feedwater)	Sodium Chloride Suspended Solids	Before increasing reactor power, **MAINTAIN** feedwater re-circulation until a reducing trend is confirmed.
C.2.7 (Feedwater)	Dissolved Oxygen	1. **CHECK** for condenser air ingress. 2. **TARGET** feedwater hydrazine level at 8x CEP DO_2. 3. Before increasing reactor power, **MAINTAIN** feedwater re-circulation until a reducing trend is confirmed.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.10 36110, 36310, 41130, 42110, 43210, 43230, 43240, 45100 - Boiler, Steam, Condensate and Feedwater System (Cont'd)

Section C - Boiler - Feedwater - Condensate Recommended Actions (Cont'd)

Table C.3 - Boiler-Feedwater-Condensate Recommended Actions - Mode #3 (Wet Layup)

Action	Parameter Out-of-Limits (any one or more)	Corrective Action Recommended (Refer To Note)
C.3.1 (Blowdown)	Sodium Chloride Sulfate Phosphate	**FEED/BLEED** or **DRAIN/FILL** boiler inventory to reduce contaminant levels.
C.3.2 (Blowdown)	Morpholine Hydrazine pH	**ADD** morpholine or hydrazine via the wet layup system to maintain specification.
C.3.3 (Feedwater)	Dissolved Oxygen	**IMPLEMENT** nitrogen cover gas procedure.

NOTE

The large difference between the cold wet layup specifications and the warmup specifications will require careful planning in the latter stages of the plant outage with respect to boiler drain/fill scheduling.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.11 38110 - D_2O Supply

4.11.1 Summary

Chemistry control of the D_2O Supply System is required to:

- ensure transfers of D_2O to and from the supply system are of the correct D_2O isotopic, tritium concentration and chemical purity.
- segregate the D_2O for high and low tritium content.

4.11.2 Sample Point and Sample Origin

3811-SS1..... D_2O Supply Tanks
Drum Samples..... Incoming and outgoing shipments of D_2O

4.11.3 Specifications

4.11.3.1 Incoming Shipments of Reactor Grade D_2O

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (% wt)	99.90	-	-	-
Tritium (Bq/kg, Virgin D_2O)	-	3.7E7	-	-
Tritium (Bq/kg, tritiated D_2O)	-	< current PHT conc	-	-
Conductivity (mS/m)	-	0.3	-	-
pH	6.0	8.0	-	-
Turbidity (NTU)	-	5.0	-	-
Organics (mg/kg, by TOC)	-	1.0	-	-
Organics (mg/kg by $KMnO_4$)	-	10	-	-
Chlorides (mg/kg)	-	0.1	-	-
Nitrates (mg/kg)	-	1.0	-	-
Boron (mg/kg)	-	0.1	-	-
Gadolinium (mg/kg)	-	0.1	-	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.11 38110 - D_2O Supply (Cont'd)

4.11.3 Specifications (Cont'd)

4.11.3.2 Transfers from Supply Tanks to PHT System

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (% wt)	Current system isotopic or greater	-	-	-
Tritium (Bq/kg)	-	Current system conc or less	-	-
Conductivity (mS/m)	-	3.6	-	-
pH	6	10.8	-	-
Lithium (mg/kg)	-	1.4	-	-
Chlorides (mg/kg)	-	0.2	-	-
Organics by TOC (mg/kg)	-	1.0	-	-

4.11.3.3 Transfers from Supply Tanks to Moderator System

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (% wt)	Current system isotopic or greater	-	-	-
Tritium (Bq/kg)	Current system concentration or less	-	-	-
Conductivity (mS/m)	-	0.2	-	-
Chlorides (mg/kg)	-	0.2	-	-
*pH	4.5	7.0	-	-
Organics by TOC (mg/kg)	-	1.0	-	-
Boron (mg/kg)		Current system concentration or less		
Gadolinium (mg/kg)		Current system concentration or less		

***NOTE** that pH analysis required only if conductivity is greater than 0.2 mS/m.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.11 38110 - D_2O Supply (Cont'd)

4.11.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	D_2O	Each Drum	Incoming Shipments
"	Tritium	Each Drum	Incoming Shipments
"	Conductivity	Composite of up to six drums	Incoming Shipments
"	*pHa	Composite of up to six drums	Incoming Shipments
"	Organics by TOC	Composite of up to six drums	Incoming Shipments
"	Organics by $KMnO_4$*	Composite of up to six drums	Incoming Shipments
"	Chlorides	Composite of up to six drums	Incoming Shipments
"	Nitrates	Composite of up to six drums	Incoming Shipments
"	Boron	Composite of up to six drums	Incoming Shipments
"	D_2O	3811-TK2, TK3, TK4	Prior to each transfer
"	Tritium	3811-TK2, TK3, TK4	Prior to each transfer
"	Conductivity	3811-TK2, TK3, TK4	Prior to each Transfer
"	*pHa	3811-TK2, TK4	Prior to each transfer
"	Chlorides	3811-TK2, TK3, TK4	Prior to each transfer
"	Organics by TOC	3811-TK2, TK3, TK4	Prior to each transfer
"	Lithium	3811-TK2	Prior to each transfer
"	Boron	3811-TK3, TK4	Prior to each transfer
"	Gadolinium	3811-TK3, TK4	Prior to each transfer

*checked by specific request only or when TOC is unavailable.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.11 38110 - D_2O Supply (Cont'd)

4.11.5 Corrective Actions

Parameter	Condition	Actions
D_2O	LOW	1. **CONFIRM** analysis. 2. If % D_2O is less than 99.75, the water must not be transferred to the supply tanks or process systems. 3. **NOTIFY** Shift Supervisor.
Tritium	HIGH	1. **CONFIRM** analysis. 2. If the tritium concentration is equal to or greater than 1.3x the current concentration in the PHT system, the water should be used in Moderator System and associated auxiliary systems only.
Conductivity	HIGH	1. **CONFIRM** result. 2. **IF** out of spec, **TRANSFER** water to D_2O Clean-up. 3. **NOTIFY** Shift Supervisor.
pH	LOW or HIGH	**Refer To** action for conductivity high.
Turbidity	HIGH	**Refer To** action for conductivity high.
Organics by TOC and by $KMnO_4$	HIGH	**Refer To** action for conductivity high.
Chlorides	HIGH	**Refer To** action for conductivity high.
Boron and Gadolinium Shipments Only	HIGH	**Refer To** action for conductivity high.
Boron, Gadolinium 3811- TK3, TK4	HIGH	1. **CONFIRM** analysis. 2. **IF** out of spec, **NOTIFY** CRO.
Nitrate	HIGH	**Refer To** action for conductivity high.
Lithium 3811- TK2	HIGH	1. **CONFIRM** analysis. 2. **IF** lithium is greater than 1.5 mg/kg, **CHECK** pH. 3. **IF** pH is greater than 10.8, **TRANSFER** water to D_2O Clean-up. 4. **NOTIFY** Shift Supervisor.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.11 38110 - D_2O Supply (Cont'd)

4.11.6 Purification Circuit

There is no purification circuit associated with this system.

4.11.7 Abnormal Conditions

None.

4.11.8 Shutdown Chemistry Control

This system is normally shutdown. It is operated only when transfers to and from the supply tanks are taking place.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.12 38310 - D_2O Vapour Recovery System

4.12.1 Summary

Chemistry monitoring of the D_2O Vapour Recovery System condensate is required to ensure that:

- water is adequately monitored to determine potential corrosive effects on system components.
- water is segregated with respect to D_2O isotopic, organic content and tritium concentration.

4.12.2 Sample Points and Sample Origin

3831-SS1.....3831-TK1 or TK2
3831-SS2.....3831-TK3

4.12.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (wt%) (mg/kg)	0.5	-	-	-
TOC (mg/kg)	-	100	-	-
Tritium (Bq/kg D_2O)	-	1.0 E11	-	7.0 E10
Conductivity (mS/m)	-	-	-	-
pH	-	-	-	-
Chloride (mg/kg)	-	-	-	-
Copper (mg/kg)	-	-	-	-
Ammonia (mg/kg)	-	-	-	-
Turbidity (NTU)	-	-	-	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.12 38310 - D_2O Vapour Recovery System (Cont'd)

4.12.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	D_2O	3831-TK1, TK2, TK3	Prior to each transfer
"	Tritium	3831-TK1, TK2, TK3	Prior to each transfer
"	TOC	3831-TK1, TK2, TK3	Prior to each transfer
"	Copper	3831-TK1 TK2, TK3	Prior to each transfer, or 1/week
"	Ammonia	3831-TK1 3831-TK2, TK3	Prior to each transfer 1/week
"	Conductivity	3831-TK1 3831-TK2, TK3	Prior to each transfer 1/week
"	pH	3831-TK1 3831-TK2, TK3	Prior to each transfer 1/week
"	Chloride	3831-TK1 3831-TK2, TK3	Prior to each transfer 1/week
"	Turbidity	3831-TK1 3831-TK2, TK3	Prior to each transfer 1/week

4.12.5 Corrective Actions

Parameter	Condition	Actions
D_2O	LOW	**ADVISE** Operations to transfer tank contents to Active Drainage.
TOC	HIGH	1. **CONFIRM** analysis. 2. **ADVISE** Operations to drum the tank contents.
Tritium (3831-TK1 or TK2)	greater than 7.0E10	1. **CONFIRM** analysis. 2. **INFORM** Operations that tritium is abnormally high.
Tritium (3831-TK1 or TK2)	greater than 1.0E11	1. **CONFIRM** analysis. 2. **ADVISE** Operations that water must be transferred to moderator D_2O clean-up.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.12 38310 - D_2O Vapour Recovery System (Cont'd)

4.12.6 Purification Circuit

There is no purification available for this system.

4.12.7 Abnormal Conditions

Not applicable for this system.

4.12.8 Shutdown Chemistry Control

There is no specific chemistry control when this system is in shutdown state.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.13 38410 - D_2O Clean-up System

4.13.1 Summary

Chemistry control of the D_2O Clean-up System is required to ensure that:

- water is adequately purified to minimize corrosion and fouling of the upgrader tower packing.
- water is segregated with respect to D_2O isotopic and tritium concentration.

4.13.2 Sample Points and Sample Origin

3261-V23 ..... Outlet of 3841-IX1, IX2, IX3 and Clean-up Tanks 3841-TK1 through TK9.

4.13.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Oil (mg/kg)	-	1.0	-	-
Organics by TOC (mg/kg)	-	1.0	-	-
Organics by $KMnO_4$ (mg/kg)	-	10.0	-	-
Conductivity (mS/m)	-	0.2	-	-
pH	6.5	8.0	-	-
Chloride (mg/kg)	-	0.2	-	-
Nitrate (mg/kg)	-	0.25	-	-
Boron (mg/kg)	-	1.0	-	-
Particulates	-	Visually Clear	-	-
Tritium (Bq/kg)	-	1.3 x current PHT Concentration	-	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.13 38410 - D_2O Clean-up System (Cont'd)

4.13.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	D_2O	3841-TK1 to TK9	Prior to each transfer
"	Tritium	3841-TK1 to TK9	Prior to each transfer
"	Oil	3841-TK7, TK8, TK9	Each product batch
"	Organics by TOC	"	"
"	Organics by $KMnO_4$*	"	"
"	Conductivity	"	"
"	pH	"	"
"	Chloride	"	"
"	Nitrate	"	"
"	Boron	"	"
"	Particulates	"	"
On-line (3261-CT6)	Conductivity	"	"

*Checked by specific request only or when TOC analysis is unavailable.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.13 38410 - D_2O Clean-up System (Cont'd)

4.13.5 Corrective Actions

Parameter	Condition	Actions
pH	HIGH or LOW	1. **CONFIRM** analysis. 2. **CHECK** Conductivity at IX outlet. **IF** greater than 0.3 mS/m, **REPLACE** resin. 3. **REPROCESS** D_2O.
Conductivity	HIGH	1. **CONFIRM** analysis. 2. **CHECK** conductivity at outlet of IX. **IF** out of spec, **REPLACE** resin. 3. **REPROCESS** D_2O.
Chloride	HIGH	1. **CONFIRM** analysis. 2. **CHECK** IX performance, and **IF** exhausted, **REPLACE** resin. 3. **REPROCESS** D_2O.
Nitrate	HIGH	1. **CONFIRM** analysis. 2. **CHECK** IX performance, and **IF** exhausted, **REPLACE** resin. 3. **REPROCESS** D_2O.
Boron	HIGH	1. **CONFIRM** analysis. 2. **CHECK** IX performance, and **IF** exhausted, **REPLACE** resin. 3. **REPROCESS** D_2O.
Organics by TOC & $KMnO_4$	HIGH	1. **CONFIRM** analysis. 2. **CHECK** organic removal of FR1, and **IF** exhausted, **REPLACE** the activated carbon. 3. **REPROCESS** D_2O.
Oil	HIGH	**Refer To** action for organics high.
Particulates	HIGH	1. **CONFIRM** analysis. 2. **CHECK** for possible sources of particulates. 3. **REPROCESS** D_2O.
Tritium	HIGH	1. **CONFIRM** analysis. 2. If tritium concentration is 1.3x the current PHT concentration or greater, D_2O must be used as high tritium D_2O.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.13 38410 - D_2O Clean-up System (Cont'd)

4.13.6 Purification Circuit

The purification circuit for the D_2O Clean-up system consists of one filter in series with three ion exchange columns.

The filter contains 255 litres of activated carbon which removes oil, organic and suspended material. The ion exchange columns contain 200 litres of IRN-150 resin or equivalent that remove ionic impurities and residual oil, organic and suspended material.

4.13.7 Abnormal Conditions

None.

4.13.8 Shutdown Chemistry Control

This is no chemistry control on this system when it is shutdown.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.14 38420 - D_2O Upgrading System

4.14.1 Summary

Chemistry control of the D_2O Upgrader is required to:

- ensure that the feed to the upgrader is added at the correct section for optimum efficiency.
- ensure that the bottom product tank D_2O is reactor grade.
- ensure that the head product isotopic is < 0.2% D_2O.

4.14.2 Sample Points and Sample Origin

3842-SS1.....3842-P08 and P09, Head Product Reject

3842-SS2.....3842-Column 01 Sump

3842-SS3.....3842-Column 02 Sump

3842-SS4.....3842-P02 and P03 Bottom Product Reject

3842-SS5.....3842-P01 Drain Pump Discharge

3842-SS6.....3842-P12 Feed Recirc. Pump Discharge

3842-V033 .....3842-P03 Discharge

3842-V031 .....3842-P02 Discharge

4.14.3 Specifications

4.14.3.1 Column Sumps

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (wt%) Column 1	99.75	-	99.95	-
Copper (mg/kg)	-	0.10	-	0.10

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.14 38420 - D_2O Upgrading System (Cont'd)

4.14.3 Specifications (Cont'd)

4.14.3.2 Bottom Product Tank Prior to Transfer

1. Bottom Product Tank, 3842-TK3, Prior to Transfer to D2O Supply Tank, 3811-TK2

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (wt%)	99.75	-	99.95	-
Copper (mg/kg)	-	0.10	-	0.02
Tritium (Bq/kg)	-	6.00E10	-	-
Conductivity (mS/m)	-	0.20	-	-

2. Bottom Product Tank, 3842-TK3, Prior to Transfer to D2O Supply Tank, 3811-TK3

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (wt%)	99.75	-	99.95	-
Copper (mg/kg)	-	0.10	-	0.02
Tritium (Bq/kg)	-	-	-	-
Conductivity (mS/m)	-	0.20	-	-

3. Bottom Product Tank, 3842-TK3, Prior to Transfer to D2O Supply Tank, 3811-TK4

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (wt%)	99.75	-	99.95	-
Copper (mg/kg)	-	0.10	-	0.02
Tritium (Bq/kg)	-	3.70E11	-	-
Conductivity (mS/m)	-	0.20	-	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.14 38420 - D_2O Upgrading System (Cont'd)

4.14.3 Specifications (Cont'd)

4.14.3.3 Head Product Tank, Head Product Stream, and Sealwater Tank

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (wt%) 3842-TK07	-	0.5	-	-
D_2O (wt%) (Head product stream)	-	0.2	-	-
D_2O (wt%) 3842-TK8	-	5	-	1.0

4.14.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	D_2O	Column 1 Sump	2/Shift
"	Tritium	Column 1 Sump	1/Shift
"	Copper	Column 1&2 Sumps	3/7 days
"	Copper	3842-TK03	Prior to each transfer
"	D_2O	Column 2 Sump	2/Shift
"	D_2O	3842-TK03	Prior to each transfer
"	Tritium	3842-TK03	Prior to each transfer
"	Conductivity	3842-TK03	Prior to each transfer
"	D_2O	3842-TK05, TK06	Before valving to feed evap
"	Tritium	3842-TK05, TK06	Before valving to feed evap
"	D_2O	3842-TK07 transfer	Prior to each transfer
"	D_2O	3842-TK08	1/28 days
On-line (AI 48)	D_2O	Head Product	Continuous Stream

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.14 38420 - D_2O Upgrading System (Cont'd)

4.14.5 Corrective Actions

Parameter	Condition	Actions
D_2O (Column 1)	LOW	1. **CONFIRM** analysis. 2. **IF** isotopic is less than 99.95%, **NOTIFY** Upgrader Operator.
Copper (Columns 1&2) (3842-TK03)	HIGH	1. **CONFIRM** analysis. 2. **RESAMPLE.** 3. **TREND** analysis.
D_2O (3842-TK03)	LOW	1. **CONFIRM** analysis. 2. **IF** isotopic is less than 99.75%, **NOTIFY** the Upgrader Operator to place the upgrader in REFLUX mode.
Tritium (3842-TK03)	HIGH	1. **IF** H^3 is less than 6.00E10 Bq/kg, **CONFIRM** analysis and **TRANSFER** to 3811-TK2. 2. **IF** H^3 is greater than 6.00E10 Bq/kg but less than 3.70E11 Bq/kg, **CONFIRM** analysis and **TRANSFER** to 3811-TK4. 3. **IF** H^3 is greater than 3.70E11 Bq/kg, **CONFIRM** analysis and **TRANSFER** to 3811-TK3.
Conductivity (3842-TK03)	HIGH	1. **CONFIRM** analysis. 2. If conductivity is greater than 0.2 mS/m, water must be reprocessed through D_2O Clean-up.
D_2O (3842-TK07)	HIGH	1. **CONFIRM** analysis. 2. **IF** isotopic is greater than 0.5% D_2O, **TRANSFER** water to D_2O Clean-up. 3. **IF** isotopic is less than 0.5% D_2O, **TRANSFER** water to active drainage.
D_2O (3842-TK08)	HIGH	1. **CONFIRM** analysis. 2. **IF** isotopic is greater than 5% D_2O, **TRANSFER** water to 3842-TK4. 3. **IF** isotopic is greater than 1% D_2O, **INCREASE** sample frequency to 1/day.
D_2O (Head Product)	HIGH	1. **CONFIRM** analysis. 2. **IF** lab analysis and Stream Barringer reading, AI 48, differ by more than 0.02, **CHECK** barringer calibration 3. **NOTIFY** Upgrader Operator.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.14 38420 - D_2O Upgrading System (Cont'd)

4.14.6 Purification Circuit

There is no purification circuit associated with this system.

4.14.7 Abnormal Conditions

None.

4.14.8 Shutdown Chemistry Control

There is no chemistry control on this system while it is shutdown.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.15 41230 - Generator Hydrogen Cooling

4.15.1 Summary

Chemistry control of the Generator Hydrogen Cooling System is required to:

- maintain the hydrogen purity above 96% (by volume) at all times.
- maintain low moisture content.
- ensure that the hydrogen (during degassing) and air (during regassing) are purged with carbon dioxide prior to admitting air or hydrogen to the generator respectively.

The hydrogen gas is maintained dry via a dryer loop which contains activated alumina.

4.15.2 Sample Points and Sample Origin

4123-V069 ..... Hydrogen Drier Inlet

4123-V065 .....Hydrogen Drier Outlet

4123-V025 .....Carbon Dioxide Piping

4123-V026 .....Hydrogen Piping

4.15.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Dewpoint (°C)	-	-18	-	-18
H_2 (% by Volume)	90	-	96	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.15 41230 - Generator Hydrogen Cooling (Cont'd)

4.15.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Dewpoint	Dryer Inlet	1/7 days
"	H_2	Dryer Inlet	1/28 days
"	O_2	Dryer Inlet	1/28 days
"	N_2	Dryer Inlet	1/28 days
"	CO_2	Dryer Inlet	1/28 days
On-line (64123-AT3 Scale #1)	H_2	Generator	Continuous

4.15.5 Corrective Actions

Parameter	Condition	Actions
Dewpoint	HIGH	1. **CONFIRM** analysis. 2. **PURGE** system with fresh H_2. 3. a) **CHECK** dewpoint at H_2 dryer outlet. b) **CHECK** seal oil/lube oil for excessive moisture. c) **CHECK** water cooler for leaks. d) **CHECK** rate of make-up to the Stator Cooling.
H_2	LOW	1. **CONFIRM** analysis. 2. **IF** % H_2 is less than 96%, **PURGE** with fresh H_2 until concentration is greater than 96%.

4.15.6 Purification Circuit

The hydrogen is maintained dry by a hydrogen dryer loop which contains activated alumina beads, 2.5 mm or equivalent.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.15 41230 - Generator Hydrogen Cooling (Cont'd)

4.15.7 Abnormal Conditions

Refer To OM-41230 for the following abnormal conditions:

- Generator operating with H_2 dryer out of service
- Generator operating with a gas to H_2 cooler leak
- Generator operating with excess moisture in hydrogen
- Generator not synchronized
- Generator synchronized moisture source known
- Generator synchronized, moisture source unknown or uncontrolled.

4.15.8 Shutdown Chemistry Control

Normally, this system is not shutdown so normal chemical surveillance is continued even when the reactor is shutdown. If the system has been depressurized and opened, no chemical control is required, except periodic checks for oxygen in air if personnel are working inside the casing.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.16 41240 - Generator Stator Cooling System

4.16.1 Summary

Chemistry control of the Generator Stator Cooling System is required:

- to minimize corrosion of system components
- to prevent the build-up of corrosion and wear products
- to maintain the electrical conductivity of the coolant as low as possible.

Purity of the water is maintained by a purification loop containing H^+/OH^- ion exchange resin.

4.16.2 Sample Points and Sample Origin

4124-V031 .....Main System

4124-V082 .....Outlet of Purification Column

4.16.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
*pH	6.0	8.0	6.0	7.0
Conductivity (mS/m)	-	0.6	-	0.1
Copper (ug/kg)	-	30	-	20
Dissolved Oxygen (ug/kg)	-	50	-	20

*pH analysis only required if conductivity is greater than 0.2 mS/m

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.16 41240 - Generator Stator Cooling System (Cont'd)

4.16.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pH	Main System	Conductivity greater than 0.2 mS/m
"	pH	IX Outlet	Conductivity greater than 0.2 mS/m
"	Conductivity	Main System	1/7 days
"	Conductivity	IX Outlet	1/7 days
"	Copper	Main System	1/7 days
"	Dissolved O_2	Main System	1/7 days
On-line (64124-CT1)	Conductivity	Main System	Continuously

4.16.5 Corrective Actions

Parameter	Condition	Actions
pH	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** pH is less than 6.0 or greater than 8.0, **ASSESS** IX column performance. 3. **IF** resin is exhausted, **VALVE OUT** and **REPLACE**.
Conductivity	HIGH	1. **CONFIRM** analysis. 2. **IF** conductivity is greater than 0.2 mS/m, **MEASURE** pH. 3. **CHECK** conductivity at IX outlet. **IF** out of spec, **VALVE OUT** and **REPLACE** resin.
Copper	HIGH	1. **CONFIRM** analysis. 2. **CHECK** IX Outlet for copper. **IF** 20 ug/kg or greater, **VALVE OUT** and **REPLACE** resin.
Dissolved Oxygen	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 20 ug/kg, **CHECK** for excessive make-up. 3. **NOTIFY** Shift Supervisor and System Specialist.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.16 41240 - Generator Stator Cooling System (Cont'd)

4.16.6 Purification Circuit

The demineralizer (LX01)consists of one column containing IRN-150 H^+/OH^- type resin or equivalent which removes cationic, anionic and suspended impurities.

The Deoxygenator (IX02) consists of one column containing Purolite A310-LC Strong Base Anion in Sulfite Form Resin. The unit is not serviceable in the station and must be returned to the supplier for regeneration or resin replacement. **Refer To** Technical Specification TS-87-41240-1001-Unit 1.

The column (IX02) removes dissolved Oxygen and has a gross capacity to deoxygenate 3000 Imp. Gallons of Oxygen saturated demineralized water. This is sufficient to accommodate two complete system fill and vent operations (1100 IGal each) and one year's operation (200-500 IGal) make-up for leaks & Hydrogen detraining.

4.16.7 Abnormal Conditions

None.

4.16.8 Shutdown Chemistry Control

There is no special chemistry control required during shutdown conditions.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.17 41330 - Turbine Governing Fluid and Supply System

4.17.1 Summary

Chemistry control of the Turbine Governing Fluid and Supply System is required to:

- prevent erosion of the control edges of the servo-valve spools due to electrical resistivity and or high chlorine content of the fluid.
- prevent corrosion of ferrous components of the system.

Governor fluid purity is maintained via a purification loop.

4.17.2 Sample Points and Sample Origin

4133-V36 .....Main system, inlet to 4133-FR10/FR11

4133-V44 .....Main system, inlet to 4133-FR03/FR04

4.17.3 Specifications for In-service Fluid

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Moisture (mg/kg)	-	1500	-	1200
Neutralization Number (mg KOH/g of FRF)	-	0.50	-	0.20
Electrical Resistivity (ohm/cm)	1.0E9	-	1.0E9	-

4.17.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Moisture	Main System	1/28 days
"	Neutralization Number	Main System	1/28 days
"	Electrical Resistivity	Main System	As required and Maintenance Plan No. 93458
"	Mineral Oil	Main System	Maintenance Plan No. 93458

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.17 41330 - Turbine Governing Fluid and Supply System (Cont'd)

4.17.4 Sampling and Sampling Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency Maintenance Plan No.
Lab	Viscosity	Main System	93458
"	Moisture	Main System	93458
"	Acidity	Main System	93458
"	Chlorine	Main System	93458
"	Particle Content	Main System	93458

NOTE that Maintenance Plan No. 93458 runs at 8 week intervals and calls for the analysis to be performed by an independent laboratory.

4.17.5 Corrective Action

Parameter	Condition	Actions
Moisture	HIGH	1. **CONFIRM** analysis. 2. **IF** moisture content is greater than 1500 mg/kg, **REQUEST** Operations start the vacuum dehydration unit heater as per OM-41330, Section 6.1. 3. **MONITOR** 1/shift until a downward trend is established. **REDUCE** to 1/day until less than 1000 mg/kg. 4. **CHECK** neutralization number.
Neutralization Number	HIGH	1. **CONFIRM** analysis. 2. **IF** neut number is greater than 0.20 mg KOH/g of FRF, **INITIATE** a change of ion exchange cartridges within 7 days. 3. **MONITOR** once/2 days until 3 consecutive samples indicate a downward trend. 4. **MONITOR** once/week until neutralization number is less than 0.15 mg KOH/g.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.17 41330 - Turbine Governing Fluid and Supply System (Cont'd)

4.17.5 Corrective Action (Cont'd)

Parameter	Condition	Actions
Electrical Resistivity	LOW	1. **CONFIRM** analysis. 2. **IF** resistivity is less than 1.0E9 ohm/cm: a) **CHECK** moisture b) **CHECK** neut number 3. Within 24 hours of confirmation, **INFUSE** 1 to 5 drums of new FRF to bring resistivity into specification. 4. **IF** unsuccessful, **NOTIFY** System Specialist for further action, **OR** the addition of up to 5 more drums of new FRF.

4.17.6 Purification Circuit

The purification circuit consists of eight ion exchange cartridges, 1 bank of particulate and/or moisture/particulate filters, 2 banks of two low pressure filters each (25 um abs) and 2 banks of five high pressure filters each (3 um abs).

4.17.7 Abnormal Conditions

	Actions
Moisture greater than 2000 mg/kg: (Reportability Limit)	1. **PLACE** vacuum dehydration unit in service. **Refer To** OM-41330. 2. **MONITOR** 1/shift until a downward trend is established. **REDUCE** to 1/day until less than 1500 mg/kg. 3. **MONITOR** neutralization number, taking action as required. 4. **CHECK** electrical resistivity. 5. **ELIMINATE** source of moisture ingress.

4.17.8 Shutdown Chemistry Control

This system is not normally shut down. If it is shut down there is no chemical control required. Samples should be taken and sent for analysis before the system is placed in operation, if possible.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.17 41330 - Turbine Governing Fluid and Supply System (Cont'd)

NOTE

1. The fluid supplier may want to have samples of rejected drums returned prior to accepting our analysis results. Before rejecting a drum or batch, resample and analyse to confirm initial analysis.
2. Under certain emergency conditions, the System Specialist may determine that out of specification new fluid can be used in the system, providing that the fluid quality is of better quality than the in-service system fluid.

4.17.9 Acceptance Specification for New Fluid

Prior to use, all new FRF fluid (as received from the supplier) must be sampled and analyzed for moisture, neutralization number and electrical resistivity. Because the fluid is new and is very expensive, the acceptance standard is much more stringent for the neutralization number specification than for the operating specification of in service fluid. As manufactured, new fluid should easily meet the standards listed below.

Batch Samples

When dealing with more than one drum, with one or more different batch numbers, it is permissible to combine the samples from like batch numbered drums into one sample for one analysis. However, if a batch fails to meet the acceptance criteria, individual samples from each drum in the batch must be taken and analyzed. The supplier of the fluid may request such an analysis prior to giving permission to return the product to his facility.

Contamination Control

The quality of FRF fluid is specified in OP&P Section 4.07. It is essential to maintain strict foreign material exclusion conditions to prevent contaminating the fluid. Drums shall remain protected with bungs in place and FME seals (self adhesive FME labels) installed on the bungs at all times when the mechanical bung seals are off, except when actually withdrawing the sample. If the drums are to remain standing for more than 8 hours or, will be left standing over a shift change before the contents are transferred to the FRF tank 4133-TK01, the drum shall be resealed with mechanical drum seals. The seal shall be initialed and dated.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.17 41330 - Turbine Governing Fluid and Supply System (Cont'd)

4.17.9 Acceptance Specification For New Fluid (Cont'd)

Minimum Quality for New Fluid

Moisture	Neutralization Number	Electrical Resistivity
less than1000 mg/kg	less than 0.1 mg KOH/g	greater than 5.0 X 10^9 ohm/cm

Actions if Limits Exceeded

CONFIRM results by resampling. **INFORM** operations that fluid does not meet new fluid specifications. Operations shall mark, reseal, and return to Stores any new fluid drum which does not meet the specifications. This fluid will eventually be returned to the supplier for replacement. The out-of-specification fluid shall be quarantined to prevent it being used.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.18 41310, 41340, 41350 - Turbine Lube Oil Storage, Generator Seal Oil, and Turbine Lube Oil System

4.18.1 Summary

Chemistry control of the Generator Seal and Turbine Lube Oil is required to:

- minimize corrosion of system components
- minimize erosion of system components.

4.18.2 Sampling Points and Sample Origin

4131-V004 .....Discharge of 4131-P09

4131-V085 .....Drain on PI3 (Discharge of P100)

4131-V086 .....Drain on PI4 (Discharge of P101)

4134-V015 .....Vent on filter FR01

4134-V016 .....Vent on filter FR02

4135-V105 .....Inlet to FR01

4135-V106 .....Inlet to FR02

4135-V107 .....Inlet to FR03

4.18.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Viscosity (centistokes at 40°C)	29.5	37.5	29.5	32.5
Moisture (mg/kg)	-	200	-	100
Neutralization Number (mg KOH/g of oil)	-	0.5	-	0.10

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.18 41310, 41340, 41350 - Turbine Lube Oil Storage, Generator Seal Oil, and Turbine Lube Oil System (Cont'd)

4.18.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Viscosity	Seal Oil	1/28 days
"	Moisture	Seal Oil	1/14 days
"	Neut No.	Seal Oil	1/28 days
"	Viscosity	Lube Oil	1/28 days
"	Moisture	Lube Oil	1/14 days
"	Neut No	Lube Oil	1/28 days
"	Moisture	4131-TK03	Following any transfer into the clean oil tank or Maintenance Plan No. 91359.
"	Particulate	4131-TK03	Following any transfer into the clean oil tank.

4.18.5 Corrective Actions

Parameter	Condition	Actions
Viscosity	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** less than 29.5 cS or greater than 32.5 cS, **CHECK** operation of purifier. For 4131-TK03, **PLACE** on recirc via PFR03 until in spec. 3. **IMMEDIATELY NOTIFY** Shift Supervisor. 4. **CHECK** moisture and neut no.
Moisture	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 200 mg/kg, **CHECK** operation of purifier. For 4131-TK03, **PLACE** on recirc via PFR03 until moisture is in spec. 3. **IMMEDIATELY NOTIFY** Shift Supervisor. 4. **CHECK** neut no and viscosity.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.18 41310, 41340, 41350 - Turbine Lube Oil Storage, Generator Seal Oil, and Turbine Lube Oil System (Cont'd)

4.18.5 Corrective Actions

Parameter	Condition	Actions
Neutralization Number	HIGH	1. **CONFIRM** analysis. 2. **IF** greater than 0.5, **CHECK** operation of purifier. For 4131-TK03, **PLACE** on recirc via PFR03 until neut no. is in spec. 3. **IMMEDIATELY NOTIFY** Shift Supervisor. 4. **CHECK** moisture and viscosity.

4.18.6 Purification Circuit

The Generator Seal Oil System contains two 100% filters as well as two H_2 detraining tanks.

The turbine lube oil storage and lube oil system each contain a centrifugal separation unit that removes water and particulate from the oil.

4.18.7 Abnormal Conditions

	Actions
Water in Turbine Lube Oil:	**Refer To** OM-41350
Operation of Generator without H2 Dryer in service:	**Refer To** OM-41230
Operation with a Gas to Hydrogen cooler leak:	**Refer To** OM-41230
Operation with excess moisture in Hydrogen:	**Refer To** OM-41230

4.18.8 Shutdown Chemistry Control

These systems are not normally shutdown. The generator seal oil and turbine lube oil should meet normal specifications prior to placing turbine in service after a shutdown.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System

4.19.1 Summary

Chemistry control of the Standby Generator and Emergency Power Diesel cooling and lube oil systems is required to:

- minimize the wear of critical engine components.
- prevent build-up of deposits in the lubricating oil.
- maintain a passive corrosion environment in the cooling system.

4.19.2 Sample Points and Sample Origin

5281-V89 .....Shell side of Prelube Unit HX1

5281-V90 .....Shell side of Prelube Unit HX2

5282-V251 .....Discharge of 5282-P101

5282-V252 .....Discharge of 5282-P102

5290-V107 .....Drain Valve on DG1 Radiator

5290-V207 .....Drain Valve on DG2 Radiator

5290-V105 .....Drain Valve on DG1 Oil Sump

5290-V205 .....Drain Valve on DG2 Oil Sump

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System (Cont'd)

4.19.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Viscosity (centistokes at 40°C) 5282-SG1 and 5282-SG2	130	155	135	155
Viscosity (centistokes at 40°C) 5290-DG1 and 5290-DG2	90	155	90	155
Glycol in Oil (mg/kg)	0	500	0	500
Ethylene Glycol Concentration (% weight) (% volume) 5282-SG1 and 5282-SG2	48 45.5	55 52.7	48 45.5	55 52.7
Propylene Glycol Concentration (% weight) (% volume) 5290-DG1 and 5290-DG2	48 47.8	52 51.9	48 47.8	52 51.9
Specific Gravity* (Ethylene Glycol) 5282-SG1 AND 5282-SG2	1.064	1.073	1.064	1.073
Specific Gravity* (Propylene Glycol) 5290-DG1 and 5290-DG2	1.037	1.040	1.037	1.040
Refractive Index* (Ethylene Glycol) 5282-SG1 and 5282-SG2	1.3811	1.3884	1.3811	1.3884
Refractive Index * (Propylene Glycol) 5290-DG1 and 5290-DG2	1.3878	1.3922	1.3878	1.3922
Reserve Alkalinity (ml of 0.1N HCl) (Ethylene Glycol)** 5282-SG1 and 5282-SG2	8.0	-	8.0	-
Reserve Alkalinity (ml of 0.1N HCl) (Propylene Glycol)** 5290-DG1 and 5290-DG2	8.0	-	8.0	-

*These parameters define the proper concentration of glycol. Dowtherm SR-1** and Dowfrost*** manufactured by Dow Chemical.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System (Cont'd)

4.19.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Viscosity	SG1	1/14 days and Maintenance Plan No. 92660
"	Viscosity	SG2	1/14 days and Maintenance Plan No. 92662
"	Viscosity	DG1	1/28 days and Maintenance Plan No. 92664
"	Viscosity	DG2	1/28 days and Maintenance Plan No. 92666
"	Glycol in Oil	SG1	1/14 days
"	Glycol in Oil	SG2	1/14 days
"	Glycol in Oil	DG1	1/year
"	Glycol in Oil	DG2	1/year
"	Glycol Concentration	SG1	2/year
"	Glycol Concentration	SG2	2/year
"	Glycol Concentration	DG1	1/year
"	Glycol Concentration	DG2	1/year
"	Glycol pH	SG1	2/year
"	Glycol pH	SG2	2/year
"	Glycol pH	DG1	1/year
"	Glycol pH	DG2	1/year
"	Reserve Akalinity	SG1	2/year
"	Reserve Akalinity	SG2	2/year
"	Reserve Akalinity	DG1	1/year
"	Reserve Akalinity	DG2	1/year

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System (Cont'd)

4.19.4 Sampling and Sampling Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency Maintenance Plan No.
Lab*	Moisture	SG1	92660
"	Moisture	SG2	92662
"	Moisture	DG1	92664
"	Moisture	DG2	92666
Lab*	Insolubles	SG1	92660
"	Insolubles	SG2	92662
"	Insolubles	DG1	92664
"	Insolubles	DG2	92666
Lab*	Total Base No.	SG1	92660
"	Total Base No.	SG2	92662
"	Total Base No.	DG1	92664
"	Total Base No.	DG2	92666
Lab*	% ASH	SG1	92660
"	% ASH	SG2	92662
"	% ASH	DG1	92664
"	% ASH	DG2	92666
Lab*	Flashpoint	SG1	92660
"	Flashpoint	SG2	92662
"	Flashpoint	DG1	92664
"	Flashpoint	DG2	92666

*Analysis is performed by an independant laboratory

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System (Cont'd)

4.19.5 Corrective Actions

Parameter	Condition	Actions
Viscosity 5282-SG1 & 5282-SG2	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** viscosity is less than 130 centistokes or greater than 155 centistokes, **NOTIFY** Shift Supervisor.
Viscosity 5290-DG1 & 5290-DG2	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** viscosity is less than 90 centistokes **OR** greater than 155 centistokes, **NOTIFY** Shift Supervisor.
Glycol in Oil 5282-SG1 & 5282-SG2 5290-DG1 & 5290-DG2	HIGH	1. **CONFIRM** analysis. 2. **IF** glycol is greater than 50 mg/kg, **NOTIFY** the Shift Supervisor.
Glycol Concentation 5282-SG1 & 5282-SG2	LOW	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. 3. **IF** glycol concentration is less than 48% by wt, **DRAIN** part of system and **ADD** sufficient ethylene glycol to bring system concentration between 48-55% by weight.
Glycol Concentration 5282-SG1 & 5282-SG2	HIGH	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. 3. **IF** glycol concentration is greater than 55% by weight, **DRAIN** part of the system and **REFILL** with demin water to bring system concentration between 48-55% by weight.
Glycol Concentration 5290-DG1 & 5290-DG2	LOW	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. 3. **IF** glycol concentration is less than 48% by wt, **DRAIN** part of the system and **ADD** sufficient propylene glycol to bring system concentration between 48-52% by wt.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System (Cont'd)

4.19.5 Corrective Actions

Parameter	Condition	Actions
Glycol Concentration 5290-DG1 & 5290-DG2	HIGH	1. **CONFIRM** analysis. 2. **NOFITY** Shift Supervisor. 3. **IF** glycol concentration is greater than 52% by wt, **DRAIN** part of the system and **REFILL** with sufficient demin water to bring system concentration between 48-52% by wt.
Reserve Alkalinity 5282-SG1 & 5282-SG2 5290-DG1 & 5290-DG2	LOW	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. 3. **IF** the reserve alkalinity is less than 8.0 ml of 0.1 N HCl, **REPLENISH** inhibitor. **Refer To** Chemistry Procedure, 78200-CP09, Section 5.2.

4.19.6 Purification Circuit

None.

4.19.7 Abnormal Conditions

Lube Oil Contamination by Glycol*

Condition	Actions
Glycol 200-500 mg/kg:	**Refer To** OM-52000
Glycol 500-1000 mg/kg:	**Refer To** OM-52000
Glycol equal to or greater than 1000 mg/kg:	**Refer To** OM-52000

*These conditions and actions apply to 52820 only.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.19 52810, 52820, 52900 - Standby Generator and Emergency Power Diesel Cooling and Lube Oil System (Cont'd)

4.19.7 Abnormal Conditions (Cont'd)

Lube Oil Dilution by Fuel**

Condition	Actions
Viscosity less than 120 centistokes.	**Refer To** OM-52000
Viscosity is 120 to 130 centistokes while engine is shutdown.	**Refer To** OM-52000
Viscosity 120 to 130 centistokes while engine is running.	**Refer To** OM-52000

**Corresponding conditions and actions for 52900 are presently being developed and will be included in the next revision of OM-52900.

4.19.8 Shutdown Chemistry Control

The standby generators are normally shutdown and in hot standby mode. Therefore, normal chemistry conditions apply.

The emergency power system diesels are also normally shutdown and available for service. Therefore normal chemistry conditions apply.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.20 71340 - Recirculated Cooling Water System

4.20.1 Summary

Chemistry control of the Recirculated Cooling Water System is required:

- minimize corrosion of the system materials.
- minimize the transport of insoluble impurities.
- detect leakage of D_2O from reactor systems.

4.20.2 Sample Points and Sample Origin

4510-V100 .....TARCW Heat Exchanger Outlet

4510-V101 .....RCW Main System

4510-V102 .....IACC Pump Discharge

4.20.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
pH - RCW, TARCW, IACC	9.3	9.8	9.3	9.8
Conductivity (mS/m)	0.4	1.5	0.4	1.5
Hydrazine (mg/kg)	0.02	1.0	0.10	1.0
Sodium (mg/kg)	-	0.50	-	0.50
Chloride (mg/kg)	-	3.0	-	0.10
Iron (mg/kg)	-	0.10	-	0.05
Copper (mg/kg) - RCW, TARCW	-	0.05	-	0.02
Suspended Solids (mg/kg)	-	1.0	-	0.50
Dissolved Oxygen (mg/kg) - RCW	-	0.05	-	0.01
D_2O in RCW (mg/kg)	-	160	-	160

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.20 71340 - Recirculated Cooling Water System (Cont'd)

4.20.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pH	RCW	2/7 days
"	pH	TARCW	2/7 days
"	pH	IACC	2/7 day
On-line (67134-CT692) CI 1424	Conductivity	RCW	Continuous
Lab	Conductivity	RCW	2/7 days
"	Conductivity	TARCW	2/7 days
"	Conductivity	IACC	2/7 days
"	Hydrazine	RCW	2/7 days
"	Hydrazine	TARCW	2/7 days
"	Hydrazine	IACC	2/7 days
"	Sodium	RCW	2/7 days
"	Sodium	TARCW	2/7 days
"	Sodium	IACC	2/7 days
"	Chloride	RCW	1/14 days
"	Chloride	TARCW	1/14 days
"	Chloride	IACC	1/14 days
"	Iron	RCW	1/14 days
"	Iron	TARCW	1/14 days
"	Iron	IACC	1/14 days

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.20 71340 - Recirculated Cooling Water System (Cont'd)

4.20.4 Sampling and Sampling Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency
Lab	Copper	RCW	1/14 days
"	Copper	TARCW	1/14 days
"	Suspended Solids	RCW	1/14 days
"	Suspended Solids	TARCW	1/14 days
"	Dissolved Oxygen	RCW	1/7 days
"	Dissolved Hydrogen	TARCW	1/14 days
"	Tritium		1/day
On-line (63862-AT14) CI 0178	D_2O		Continuous

4.20.5 Corrective Actions

Parameter	Condition	Actions
pH - RCW, TARCW	LOW or HIGH	1. **CONFIRM** analysis. 2. a) **IF** pH of RCW is less than 9.3, **ADD** 25 liters of 80% morpholine. b) **IF** pH of TARCW is less than 9.3, **ADD** 2.5 L of 80% morpholine. 3. **RECHECK** pH of system(s) following morpholine addition. 4. **IF** the pH of either RCW or TARCW is greater than 9.8, **PLACE** the respective system on feed and bleed until system pH is less than 9.8.
pH - IACC	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** pH of system is less than 9.3, **ADD** 150 ml of 80% morpholine. 3. If pH greater than 9.8, a feed and bleed may be required from an alternate source other than RCW. 4. **NOTIFY** Shift Supervisor.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.20 71340 - Recirculated Cooling Water System (Cont'd)

4.20.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Conductivity	HIGH	1. **CONFIRM** analysis. 2. **IF** conductivity is greater than 1.5 mS/m, **PLACE** on feed and bleed until conductivity is in spec. **MONITOR** at 2 hour intervals.
Hydrazine	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** hydrazine is less than 0.10 mg/kg in: a) RCW - **ADD** 1 liter of 35% hydrazine b) TARCW - **ADD** 0.10 liter of 35% hydrazine c) IACC - **ADD** 3 mL of 35% hydrazine 3. **CHECK** hydrazine. 4. **IF** hydrazine is greater than 1.0 mg/kg, **PLACE** system(s) on feed and bleed until hydrazine concentration is in spec.
Sodium	HIGH	1. **CONFIRM** analysis. 2. **IF** sodium is greater than 0.50 mg/kg, **PLACE** system on feed and bleed to bring in spec. 3. **CHECK** pH, conductivity and hydrazine. **CORRECT** as indicated.
Chloride	HIGH	1. **CONFIRM** analysis. 2. **IF** chloride is greater than 0.10 mg/kg, **PLACE** on feed and bleed to bring in spec. 3. **CHECK** pH, conductivity and hydrazine. **CORRECT** as indicated.
Iron	HIGH	1. **CONFIRM** analysis. 2. **IF** iron is greater than 0.05 mg/kg, **PLACE** on feed and bleed to bring in spec. 3. **CHECK** pH, conductivity and hydrazine. **CORRECT** as indicated.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.20 71340 - Recirculated Cooling Water System (Cont'd)

4.20.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Copper	HIGH	1. **CONFIRM** analysis. 2. **IF** copper is greater than 0.02 mg/kg, **PLACE** on feed and bleed to bring in spec. 3. **CHECK** pH, conductivity and hydrazine. **CORRECT** as indicated.
Suspended Solids	HIGH	1. **CONFIRM** analysis. 2. **IF** suspended solids are greater than 0.5 mg/kg, **PLACE** on feed and bleed to bring in spec. 3. **CHECK** pH, conductivity and hydrazine. **CORRECT** as indicated.
Dissolved Oxygen	HIGH	1. **CONFIRM** analysis. 2. **IF** dissolved O_2 is greater than 0.01 mg/kg, **CHECK** hydrazine residual. **CORRECT** as indicated.
D_2O	LOW or HIGH	1. **CHECK** grab sample of RCW for tritium. 2. **IF** less than 4.0E4 Bq/kg, **NOTIFY** CRO that results are normal. 3. **IF** greater than 4.0E 04 Bq/kg, a possible HX tube leak may exist. **NOTIFY** CRO.

4.20.6 Purification Circuit

The primary method of purification of the main RCW is by feed and bleed from the Condensate System or via emergency make-up from the Demineralized Water Distribution System.

Provision has been made for the use of a temporary ion exchange column in the Main RCW system to reduce ionic impurities if the need arises.

4.20.7 Abnormal Conditions

Barringers out of service (63862-AT14): Lab analysis of RCW for tritium once per shift.

4.20.8 Shutdown Chemistry Control

If the system is shutdown the same chemical specifications apply as those for normal operation.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems

4.21.1 Summary

Chemistry control of the Domestic Water and Water Treatment Plant systems is required to:

- ensure that the domestic water produced is free of coliform bacteria and potable.
- ensure that the demineralized water produced is of sufficient purity to meet the requirements of the process systems.

4.21.2 Sample Points and Sample Origin

7161-V078 .....Clarifier Inlet

7161-CLR01 M/C .....Clarifier Mixing Chamber

7161-Splitter Box.....Clarifier Outlet/Sandfilter Inlet

7161-FR1 B/W Water Compartment ....Sandfilter#1 Outlet

7161-FR2 B/W Water Compartment ....Sandfilter#2 Outlet

7161-V079 .....Clearwell Pump P101 Discharge

7161-V080 .....Clearwell Pump P102 Discharge

7162-V007 .....7162-IX1 Cation Vessel Outlet

7162-V039 .....7162-IX4 Cation Vessel Outlet

7162-V018 .....7162-IX2 Anion Vessel Outlet

7162-V050 .....7162-IX5 Anion Vessel Outlet

7162-V029 .....7162-IX3 Mixed Bed Outlet

7162-V061 .....7162-IX6 Mixed Bed Outlet

7165-V386 .....7162-TK40 Demineralized Water Tk

7165-V385 .....7162-TK41 Demineralized Water Tk

Lab Demin Water taps .....Laboratory Demin Water Supply

Lab Domestic Water taps.....Laboratory Domestic Water Supply

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Color (APHA units) Clarifier Out	-	15	-	15
Turbidity (NTU) Clarifier Out	-	1.5	-	0.8
pH Clarifier Out	5.5	6.5	5.5	6.2
Turbidity (NTU) Sandfilter Out	-	0.5	-	0.5
Chlorine Residual (mg/kg) Clearwell	0.2	0.5	0.2	0.5
Total Coliform Bacteria (# per 100 ml) Clearwell	-	5	-	5
Faecal Coliform Bacteria (# per 100 ml) Clearwell	-	0	-	0
Conductivity (mS/m) Lab Demin Water	-	0.06	-	0.05
Sodium (mg/kg) 7162-IX1, IX2, IX4, IX5	-	0.30	-	0.10
Sodium (mg/kg) 7162-IX3, IX6	-	0.003	-	0.002
Conductivity (mS/m) 7162-IX2, IX5		0.20		0.20
Conductivity (mS/m) 7162-IX3, IX6		0.02		0.02
Silica (mg/kg) 7162-IX2, IX5		0.100		0.010
Silica (mg/kg) 7162-IX3, IX6		0.010		0.005

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Color	Clarifier Inlet	1/week
"	Color	Clarifier M/C	1/day
"	pH	Clarifier Inlet	1/week
"	pH	Clarifier M/C	1/day
On-line (67161-AT71)	pH	Clarifier Outlet	Continuous
Lab	Conductivity	Clarifier Inlet	1/week
"	Turbidity	Clarifier Inlet	1/week
"	Turbidity	Clarifier Outlet	1/week
On-line (67161-AT21)	Turbidity	Clarifier Outlet	Continuous
Lab	Turbidity	Sandfilter Outlet	1/week
On-line (67161-AT37)	Turbidity	Sandfilter Outlet	Continuous
Lab	Organics (UV)	Clarifier Inlet	1/week
"	Organics (UV)	Clearwell	1/week
"	Chlorine Residual	Clearwell	1/day
"	Silica	Clearwell	1/week
"	Sodium	7162-IX1, IX4	1/Shift*
On-line (67162-AT92)	Sodium	7162-IX1, IX4	Continuous
Lab	Sodium	7162-IX2, IX5	1/Shift*

*Once per shift while demineralizers are in service.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.4 Sampling and Sampling Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency
On-line (67162-AT93)	Sodium	7162-IX3, IX6	Continuous
Lab	Sodium	7162-IX3, IX6	1/Shift*
"	Conductivity	7162-IX2	1/Shift*
On-line (67162-CT84)	Conductivity	7162-IX2	Continuous
Lab	Conductivity	7162-IX5	1/Shift*
On-line (67162-CT69)	Conductivity	7162-IX5	Continuous
Lab	Conductivity	7162-IX3	1/Shift*
On-line (67162-CT89)	Conductivity	7162-IX3	Continuous
Lab	Conductivity	7162-IX6	1/Shift*
On-line (67162-CT73)	Conductivity	7162-IX6	Continuous
On-line (67162-CT59)	Conductivity Inlet	Demin Tank	Continuous
On-line (7162-CT29)	Conductivity	Demin Tank Outlet	Continuous
On-line (7162-CT20)	Conductivity	Demin Water to WTP	Continuous
Lab	Silica	7162-IX2, IX5	1/Shift*
"	Silica	7162-IX3, IX6	1/Shift*
"	Organics (TOC)	Clarifier Inlet	Maintenance Plan No. 94123 (1/4 wks)
"	Organics (TOC)	Clarifier Outlet	Maintenance Plan No. 94123

*Once per shift while demineralizers are in service.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.4 Sampling and Sampling Frequency (Cont'd)

Analysis	Parameter	Sample Origin	Frequency
Lab	Organics (TOC)	Clarifier Outlet	Maintenance Plan No. 94123
"	Organics (TOC)	Sandfilter Outlet	Maintenance Plan No. 94123
"	Organics (TOC)	7162-IX1, IX4 Outlet	Maintenance Plan No. 94123
"	Organics (TOC)	7162-IX2, IX5 Outlet	Maintenance Plan No. 94123
"	Organics (TOC)	7162-IX3, IX6 Outlet	Maintenance Plan No. 94123
"	Organics (TOC)	Lab Demin Water	Maintenance Plan No. 94123
"	Bacteria, Faecal Coliform**	Clearwell	1/14 days
"	Bacteria Total Coliform**	Clearwell	1/14 day
"	Tritium	Domestic Water	1/day
"	Bacteria, Faecal Coliform**	Domestic Water	1/14 day
"	Bacteria, Total Coliform**	Domestic Water	1/14 days
"	Bacteria, Faecal Coliform**	Clarifier Outlet	1/14 days
"	Bacteria, Total Coliform**	Clarifier Outlet	1/14 days

*Once per shift while demineralizers are in service.
**Bacteria, Faecal and Total Coliform analysis is performed by N.B. Dept. of Health.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.5 Corrective Actions

Parameter	Condition	Actions
Color	HIGH	1. **CONFIRM** analysis. 2. **IF** color at Clarifier Outlet is greater than 15 APHA units, **CHECK**: a) Color of raw water. b) Chemical dosage. 3. **PERFORM** jar tests. 4. **OPTIMIZE** chemical concentration. 5. **NOTIFY** Chemical Supervisor.
Turbidity Clarifier Out	HIGH	1. **CONFIRM** analysis. 2. **IF** turbidity at Clarifier Outlet is greater than 1.5 NTU, **CHECK**: a) Sludge blanket level. b) Chemical dosage. c) Turbine speed. 3. **PERFORM** jar tests. 4. **OPTIMIZE** chemical concentration. 5. **NOTIFY** Chemical Supervisor.
pH	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** pH is less than 5.5 or greater than 6.5, **CHECK** chemical dosages. 3. **PERFORM** jar tests. 4. **OPTIMIZE** chemical concentrations. 5. **NOTIFY** Chemical Supervisor.
Turbidity Sandfilter Out	HIGH	1. **CONFIRM** analysis. 2. **IF** turbidity is greater than 0.5 NTU **PLACE** sandfilter on bypass if possible and **CHECK**: a) Clarifier outlet turbidity. b) Chemical dosages. 3. **PERFORM** jar tests. 4. **OPTIMIZE** chemical concentrations. 5. **NOTIFY** Chemical Supervisor.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Chlorine Residual	HIGH	1. **CONFIRM** analysis. 2. **IF** Cl_2 is greater than 0.5 mg/kg, **DECREASE** chlorine timer setting.
Chlorine Residual	LOW	1. **CONFIRM** analysis. 2. **IF** Cl_2 is less than 0.2 mg/kg, **INCREASE** chlorine timer setting.
Total Coliform Bacteria	HIGH	1. **IF** total coliform bacteria count is greater than 5/100 ml, **INCREASE** chlorine residual to 0.5 mg/kg. 2. **CHECK** once per week until three consecutive samples show acceptable results.
Faecal Coliform Bacteria	HIGH	**IF** faecal coliform are detectable, **FOLLOW** same action as for total coliform bacteria count HIGH.
Conductivity Lab Demin Water	HIGH	1. **CONFIRM** analysis. 2. **IF** the conductivity of the lab demin water is greater than 0.06 mS/m, **CHECK** for sodium and silica. If these are in spec, no action required. **IF** either sodium or silica are out of spec, **CHECK** demin storage tanks to locate and isolate the contaminated tank. **IF** only one tank is contaminated, **SWITCH** plant feed to other tank and **DRAIN** the contaminated tank. **REFILL** from demineralizers. **IF** both are contaminated, **IMMEDIATELY DRAIN** one and **REFILL** from demineralizers.
Sodium 7162-IX1, IX2 7162-IX4, IX5	HIGH	1. **CONFIRM** by lab analysis. 2. If sodium is greater than 0.30 mg/kg after rinsing, vessel is exhausted. 3. **REMOVE** from service and **REGENERATE**.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Sodium 7162-IX3, IX6	HIGH	1. **CONFIRM** by lab analysis. 2. If sodium is greater than 0.003 mg/kg after rinsing, vessel is exhausted. 3. **REMOVE** from service and **REGENERATE**.
Conductivity 7162-IX2, IX5	HIGH	1. **CONFIRM** by lab analysis. 2. If conductivity is greater than 0.20 mS/m after rinsing, **CHECK** sodium and silica. **IF** sodium is out of spec, **TAKE** appropriate action for sodium HIGH. If silica is out of spec, vessel is exhausted. **PERFORM** a double regeneration. 3. **IF** sodium and silica are both in spec, **PERFORM** a single regeneration.
Conductivity 7162-IX3, IX6	HIGH	1. **CONFIRM** by lab analysis. 2. If specific conductivity is greater than 0.02 mS/m, vessel is exhausted. 3. **REMOVE** from service and regenerate.
Silica 7162-IX2, IX5	HIGH	1. **CONFIRM** analysis. 2. If silica is greater than 0.20 mg/kg, vessel is exhausted. 3. **REMOVE** from service and **PERFORM** double regeneration.
Silica 7162-IX3, IX6	HIGH	1. **CONFIRM** analysis. 2. If silica is detectable, vessel is exhausted. 3. **REMOVE** from service and **REGENERATE**.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.21 71510, 71610, 71620, 71630, 71640, 71650 - Domestic Water and Water Treatment Plant Systems (Cont'd)

4.21.6 Purification Circuit

The Water Treatment Plant is a purification system so there is no purification circuit as in other process systems where the water is circulated continuously. The two sand filters each contain $5.3m^3$ of 0.6 - 0.8 mm sand and $1.08m^3$ of 6 - 10 mesh gravel.

Each cation unit contains 4.42 m^3 of IR-120+ resin of which $3.96m^3$ is usable.

Each anion contains 4.82 m^3 of IRA-458 resin of which 4.42 m^3 is usable.

Each mixed bed unit contains 0.91 m^3 each of IR-120+ and IRA-402.

4.21.7 Abnormal Conditions

None.

4.21.8 Shutdown Chemistry Control

There is no chemistry control when the Water Treatment Plant is shutdown.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.22 71730, 71740, 71780 - Drainage Systems

4.22.1 Summary

Chemistry control of the drainage systems (i.e. 7173, 7174 RB & SB active drainage respectively, and 71780 TB & Auxilliary Inactive drainage) is required to ensure that the wastes are segregated properly with respect to the levels of gamma radiation, D_2O isotopic, and chemical impurities.

4.22.2 Sample Points and Sample Origin

7173-Sump 1 through 8 ...RB Active Drainage

7174-Sump#1 .....SB Low Active Sump

7174-Sump#2 .....SB Normal Active Sump

7174-Sump#3 .....SB Auxillary Sump

7174-Sump#4 .....SB Emergency Sump

7174-Sump#5 .....SB D_2O Sump

7174-V013 .....7174-TK01 Active Drainage

7178-TK01 .....Lagoon Pumpout Sample Tank

4.22.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (% weight) 7173-SU1 to SU8	-	0.5	-	-
D_2O (% weight) 7174-SU5	-	0.5	-	-
D_2O (% weight) 7174-TK01	-	0.5	-	-
gamma activity (Bq/l) 7173-SU1 to SU8	-	1000	-	-
gamma activity (Bq/l) 7174-SU5	-	1000	-	-

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.22 71730, 71740, 71780 - Drainage Systems (Cont'd)

4.22.3 Specifications (Cont'd)

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
gamma activity (Bq/l) 7174-TK01	-	10000	-	-
pH 7178-TK01	6.0	9.5	-	-
Oil & Grease (mg/kg) 7178-TK01	-	visible	-	-
Suspended Solids (mg/kg) 7178-TK01 7175-Aeration Tank	-	30	-	20

4.22.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	D_2O	7173-SU1 to SU8	Prior to Pumpout
"	D_2O	7174-SU5	Prior to Pumpout
"	D_2O	7174-TK01	Prior to Pumpout
"	gamma activity	7173-SU1 to SU8	Prior to Pumpout
"	gamma activity	7174-SU5	Prior to Pumpout
"	gamma activity	7174-TK01	Prior to Pumpout
"	pH	7178-TK01	1/day
"	oil/grease	7178-TK01	1/day
"	Suspended Solids	7178-TK01	1/day

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.22 71730, 71740, 71780 - Drainage Systems (Cont'd)

4.22.5 Corrective Actions

Parameter	Condition	Actions
D_2O 7173-SU1 to SU8	HIGH	1. **CONFIRM** analysis 2. **IF** D_2O is greater than 0.5%, water must be drummed for upgrading. 3. **IF** D_2O is less than 0.5%, **TRANSFER** to active drainage.
D_2O 7174-SU5	HIGH	1. **CONFIRM** analysis. 2. **FOLLOW** same actions as D_2O HIGH in 7173-SU1 to SU8.
D_2O 7174-TK01	HIGH	1. **CONFIRM** analysis. 2. **FOLLOW** same actions as for D_2O HIGH in 7173-SU1 to SU8.
gamma activity 7173-SU1 to SU8	HIGH	1. **CONFIRM** analysis. 2. **IF** gamma activity is greater than 1000 Bq/l, **TRANSFER** water to 7174-TK01, active waste tank. 3. **IF** gamma activity is less than 1000 Bq/l, **TRANSFER** water to active drainage via SB Low Active SU1.
gamma activity 7174-SU5	HIGH	1. **CONFIRM** analysis. 2. **FOLLOW** same actions as for gamma activity HIGH in 7173-SU1 to SU8.
gamma activity 7174-TK01	HIGH	1. **CONFIRM** analysis. 2. **IF** gamma activity is greater than 10000 Bq/l, **CHECK** filter disk for the presence of resin beads and/or charcoal. 3. **NOTIFY** Shift Supervisor.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.22 71730, 71740, 71780 - Drainage Systems (Cont'd)

4.22.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Suspended Solids 7178-TK01	HIGH	1. **CONFIRM** analysis. 2. **IF** suspended solids are greater than 20 mg/kg, **ADD** 1/4 tank of poly to the neutralizing sump and **PUMP OUT** to the respective lapoon. 3. **NOTIFY** Chemical Supervisor. 4. **IF** suspended solids are greater than 60 mg/l, **NOTIFY** the Shift Supervisor.
Oil/Grease 7178-TK01	HIGH	1. **CONFIRM** analysis 2. **IF** oil/grease is present, **ISOLATE** the lagoon and **PLACE** the alternate in service. 3. **NOTIFY** Shift Supervisor and/or Chemical Supervisor.
pH 7178-TK01	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** pH is less than 5 or greater than 10.5, **ISOLATE** the lagoon and **NEUTRALIZE** following procedure 7178-CP-01 before pumping out.
Sludge Settleability	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** settleability is less than 30% or greater than 50%, **NOTIFY** System Specialist.

4.22.6 Purification Circuit

There is no purification circuit associated with the drainage sumps. There is a 25 micron filter on the discharge of the Active Drainage Tank pump to filter particulates from the water prior to entering the Radioactive Liquid Waste Storage Tanks.

4.22.7 Abnormal Conditions

None.

4.22.8 Shutdown Chemistry Control

Normal chemistry control applies when the sump pumps are shutdown.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.23 71900 - Chilled Water System

4.23.1 Summary

Chemistry control of the Chilled Water System is necessary to ensure proper protection of the system materials against corrosion.

4.23.2 Sample Points and Sample Origin

7190-PI46 Drain.....P104 Suction

7190-PI47 Drain.....P106 Suction

7190-PI48 Drain.....P109 Suction

4.23.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Nitrite (mg/kg)	500	700	500	700
Iron (mg/kg)	-	1	-	1
Copper (mg/kg)	-	1	-	1
Suspended Solids (mg/kg)	-	10	-	10

4.23.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Nitrite	Main System	1/8 weeks*
	Iron	Main System	1/8 weeks*
	Copper	Main System	1/8 weeks*
	Suspended Solids	Main System	1/8 weeks*
	pH	Main System	1/8 weeks*

*1/8 weeks under Maintenance Plan No. 94144

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.23 71900 - Chilled Water System (Cont'd)

4.23.5 Corrective Actions

Parameter	Condition	Actions
Nitrite	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** nitrite is less than 500 mg/kg, **ADD** Dearborn 537 to bring nitrite between 500 and 700 mg/kg. One liter of Dearborn 537 increases system nitrite concentration by 2 mg/kg. 3. **IF** nitrite is greater than 700 mg/kg, **NOTIFY** Chemical Supervisor.
Iron	HIGH	1. **CONFIRM** analysis. 2. **IF** iron is greater than 1.0 mg/kg, **NOTIFY** Chemical Supervisor.
Copper	HIGH	1. **CONFIRM** analysis. 2. **IF** copper is greater than 1.0 mg/kg, **NOTIFY** Chemical Supervisor.
Suspended Solids	HIGH	1. **CONFIRM** analysis. 2. **IF** suspended solids is greater than 10 mg/kg, **NOTIFY** Chemical Supervisor.

4.23.6 Purification System

There is no purification circuit associated with this system. Draining and refilling is the only means of purification.

4.23.7 Abnormal Conditions

None.

4.23.8 Shutdown Chemistry Control

There is no chemistry control when the system is shutdown.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.24 72130, 72140, 73510 - Auxiliary Heating System

4.24.1 Summary

Chemistry control of the Auxiliary Heating System is required to:

- minimize corrosion of system materials.
- reduce the level of dissolved and suspended solids in the system.

4.24.2 Sample Points and Sample Origin

7351-V500 via V002.....Deaerator Outlet (DA)

7351-V501 via V020.....Steam Drum Blowdown (SD)

7351-V501 via V067.....Mud Drum Blowdown (MD)

4.24.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
pH (DA, SD)	9.4	9.7	9.4	9.7
Conductivity (mS/m)	0.600	1.5	0.600	1.5
Hydrazine (mg/kg) (DA)	0.10	0.20	0.10	0.20
Sodium (mg/kg) (SD)	-	0.20	-	0.20
Silica (mg/kg) (MD)	-	5.0	-	5.0
Iron (mg/kg) (DA, SD)	-	0.10	-	0.10
Suspended Solids (mg/kg) (MD)	-	1.0	-	1.0

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.24 72130, 72140, 73510 - Auxiliary Heating System (Cont'd)

4.24.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	pH	DA & SD	1/day*
"	Conductivity	DA & SD	1/day*
"	Hydrazine	DA & SD	1/day*
"	Sodium	SD	2/week*
"	Iron	DA	2/week*
"	Iron	SD	2/week*
"	Silica	MD	2/week*
"	Suspended Solids	MD	2/week*
On-line (AI 0563)	Conductivity	7213-TK1	Continuous
On-line (AI 0565)	Conductivity	7213-TK2	Continuous

*While auxiliary boiler is in service.

4.24.5 Corrective Actions

Parameter	Condition	Actions
pH - DA, SD	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** pH is less than 9.4 or greater than 9.7, **INCREASE** or **DECREASE** morpholine addition respectively. **Refer To** 73510-CP-01.
Conductivity - DA	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** conductivity is less than 0.6 or greater than 1.5 mS/m **INCREASE** or **DECREASE** morpholine addition respectively.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.24 72130, 72140, 73510 - Auxiliary Heating System (Cont'd)

4.24.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Conductivity - SD	HIGH	1. **CONFIRM** analysis. 2. **IF** conductivity is greater than 1.5 mS/m, **CHECK** DA conductivity. 3. **IF** in spec, **INCREASE** SD blowdown rate.
Hydrazine - DA	LOW or HIGH	1. **CONFIRM** analysis. 2. **IF** the hydrazine is less than 0.1 or greater than 0.2 mg/kg, **INCREASE** or decrease hydrazine addition respectively. **Refer To** 73510-CP-01.
Sodium - SD	HIGH	1. **CONFIRM** analysis. 2. **IF** sodium is greater than 0.2 mg/kg: a) **CHECK** DA for sodium. b) **INCREASE** SD blowdown rate.
Silica - MD	HIGH	1. **CONFIRM** analysis. 2. **IF** silica is greater than 5.0 mg/kg: a) **CHECK** DA for silica. b) **INCREASE** SD blowdown rate until silica concentration is in spec. c) **INCREASE** mud drum blowdown frequency until silica is in spec.
Iron - DA & SD	HIGH	1. **CONFIRM** analysis. 2. **CHECK** other parameters. **CORRECT** any out of spec condition.
Suspended Solids - MD	HIGH	1. **CONFIRM** analysis. 2. **IF** suspended solids are greater than 1.0 mg/kg in the mud drum: a) **INCREASE** SD blowdown rate until suspended solids are in spec. b) **INCREASE** mud drum blowdown frequency until suspended solids are in spec.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.24 72130, 72140, 73510 - Auxiliary Heating System (Cont'd)

4.24.6 Purification Circuit

There is no purification circuit associated with this system.

4.24.7 Abnormal Conditions

None.

4.24.8 Shutdown Chemistry Control

If the system is to be shutdown for periods longer than 1 week, a wet lay-up is employed. The specifications for wet lay-up are:

pH	9.5 - 10.0
hydrazine	80 - 120 mg/kg
Conductivity	1.0 - 2.5 mS/m

Refer To 73510-CP-01 for sampling requirements and corrective actions.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.25 73010, 73210, 73410, 73810 - Hot Water and Glycol Heating Systems

4.25.1 Summary

Chemistry control of the Hot Water and Glycol Heating Systems is required to ensure:

- proper protection of the system components against corrosion.
- sufficiently low freezing point protection for the glycol/water mixture.

4.25.2 Sample Points and Sample Origin

Drain on 67301-PI22.....7301-P101 Discharge

Drain on 67301-PI23.....7301-P102 Discharge

Drain on 67301-PI24.....7301-P103 Discharge

Drain on 67321-PIS2 .....7301-P107 Discharge

Drain on 67321-PIS4 .....7321-P104 Discharge

Drain on 67321-PIS5 .....7321-P105 Discharge

Drain on 67321-PIS6 .....7321-P106 Discharge

4.25.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
Nitrite (mg/kg) H/W Heating	500	700	500	700
Iron (mg/kg) H/W Heating		1.0		1.0
Copper (mg/kg) H/W Heating		1.0		1.0
Suspended Solids (mg/kg) H/W Heating		10		10
Glycol Concentration (% weight)	50	70	50	70
Glycol Specific Gravity*	1.066	1.091	1.066	1.091
Glycol Refractive Index*	1.3833	1.4032	1.3833	1.4032
pH Glycol Heating	9.0	9.6	9.0	9.6
Reserve Alkalinity (ml of 0.1 N HCl) Glycol Heating	8.0		8.0	

*These parameters define the proper glycol concentration.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.25 73010, 73210, 73410, 73810 - Hot Water and Glycol Heating Systems (Cont'd)

4.25.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	Nitrite	Hot Water Heating	1/8 weeks*
"	Iron	Hot Water Heating	1/8 weeks*
"	Copper	Hot Water Heating	1/8 weeks*
"	Suspended Solids	Hot Water Heating	1/8 weeks*
"	Glycol Concentration	Glycol Heating	1/8 weeks*
"	pH	Glycol Heating	1/8 weeks*
"	Reserve Alkalinity	Glycol Heating	1/8 weeks*

*Performed via Maintenance Plan No. 94144.

4.25.5 Corrective Actions

Parameter	Condition	Actions
Nitrite H/W Heating	LOW	1. **CONFIRM** analysis. 2. **IF** nitrite is less than500 mg/kg, **ADD** Dearborn 537 via the hot water fill tank until nitrite concentration is between 500 and 700 mg/kg. **NOTE** that one liter of Dearborn 537 increases system nitrite concentration by approximately 2 mg/kg.
Nitrite H/W Heating	HIGH	1. **CONFIRM** analysis. 2. **IF** nitrite concentration is greater than 700 mg/kg, **NOTIFY** Chemical Supervisor.
Iron H/W Heating	HIGH	1. **CONFIRM** analysis. 2. **IF** iron is greater than 1.0 mg/kg, **CHECK** nitrite concentration. 3. **NOTIFY** Chemical Supervisor.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.25 73010, 73210, 73410, 73810 - Hot Water and Glycol Heating Systems (Cont'd)

4.25.5 Corrective Actions (Cont'd)

Parameter	Condition	Actions
Copper H/W Heating	HIGH	1. **CONFIRM** analysis. 2. **IF** copper is greater than 1.0 mg/kg, **CHECK** nitrite concentration. 3. **NOTIFY** Chemical Supervisor.
Suspended Solids H/W Heating	HIGH	1. **CONFIRM** analysis. 2. **IF** suspended solids are greater than 10 mg/kg, system requires draining, flushing and refilling. 3. **NOTIFY** System Specialist.
Glycol Concentration	LOW	1. **CONFIRM** analysis. 2. **IF** glycol concentration is less than 50%, **DRAIN** part of system and **REFILL** with Dowtherm SR1 to bring systems glycol concentration between 50 and 70%. **NOTE** that 200 litres of Dowtherm SR1 will increase system glycol concentration by approximately 2-3% by wt.
Glycol Concentration	HIGH	1. **CONFIRM** analysis. 2. **IF** glycol concentration is greater than 70%, **DRAIN** part of system and **REFILL** with demin water to bring system glycol concentration between 50 and 70%.
pH (Glycol Heating)	LOW	1. **CONFIRM** analysis. 2. **IF** pH is less than 9.0 **CHECK** glycol concentration. 3. **IF** glycol is in spec, **PARTIALLY DRAIN** system and **REFILL** with fresh glycol to bring pH in spec.
pH (Glycol Heating)	HIGH	1. **CONFIRM** analysis. 2. **IF** pH is greater than 9.6, **CHECK** for leak from auxiliary steam system at heat exchangers. 3. **NOTIFY** Chemical Supervisor.
Reserve Alkalinity	LOW	1. **CONFIRM** analysis. 2. **IF** reserve alkalinity is less than 8.0 ml of 0.1 N HCl, replenish inhibitor. **Refer To** Chemistry Procedure, 78200-CP09, Section 5.2.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.25 73010, 73210, 73410, 73810 - Hot Water and Glycol Heating Systems (Cont'd)

4.25.6 Purification Circuit

There are no purification circuits associated with these systems. Draining and refilling is the only means of purification.

4.25.7 Abnormal Conditions

None.

4.25.8 Shutdown Chemistry Control

There is no chemistry control when these systems are shutdown. The systems must be circulated to ensure proper sampling and mixing of chemicals.

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.26 79210 - Radioactive Liquid Waste Management System

4.26.1 Summary

Chemistry control of the radioactive liquid waste management system is required to ensure that the effluent discharged has an acceptable chemical, radiation and D_2O content.

4.26.2 Sample Points and Sample Origin

7921-V69 .....Discharge of 7921-P01

7921-V73 .....Discharge of 7921-P02

7921-V78 .....Discharge of 7921-P03

4.26.3 Specifications

Parameter	Low Specification	High Specification	Lower Control Limit	Upper Control Limit
D_2O (% by wt)	-	1.5	-	1.5
Total gamma activity (% DEL)*	-	1.0E-4	-	1.0E-4
Total gamma and tritium activity (% DEL)*	-	0.1	-	0.1
Total gamma and tritium activity (cummulative % DEL)*	-	1.0	-	1.0

*Derived emission limits for liquid effluents as set forth in Licensing Document RD-01364-L1 (monthly limit).

4.26.4 Sampling and Sampling Frequency

Analysis	Parameter	Sample Origin	Frequency
Lab	D_2O	7921-TK1 to TK5	Prior to each pumpout
"	Total gamma and tritium activity	7921-TK1 to TK5	Prior to each pumpout

4.0 SYSTEM SPECIFICATIONS AND CORRECTIVE ACTIONS (Cont'd)

4.26 79210 - Radioactive Liquid Waste Management System (Cont'd)

4.26.5 Corrective Action

Parameter	Condition	Actions
% D_2O	HIGH	1. **CONFIRM** analysis. 2. If % D_2O is 1.5 or greater, water must be upgraded.
Total gamma	HIGH	1. **CONFIRM** analysis. 2. **IF** gamma activity is greater than 1E-04% DEL, **CHECK** sample for solids activity. **Refer To** Chemistry Procedure 7921-CP-01. 3. **IF** solids activity exceeds 1.0E4 Bq/l, **NOTIFY** Shift Supervisor. Health Physics approval will be required to discharge.
Total gamma and Tritium activity	HIGH	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. Health Physics approval will be required for discharge.
Total gamma and Tritium activity (cummulative for current month)	HIGH	1. **CONFIRM** analysis. 2. **NOTIFY** Shift Supervisor. Health Physics approval will be required for discharge.

4.26.6 Purification Circuit

This system has no purification circuit of its own. When the water requires purification, it is done using the Spent Fuel Bay Purification circuit. **Refer To** OM-34410 Spent Fuel Bay Cooling and Purification System Section 5.5.2.

4.26.7 Abnormal Conditions

When the liquid effluent monitor is unavailable, retain the tank sample for detailed analysis by Health Physics.

4.26.8 Shutdown Chemistry Control

There is no chemistry control on this system when it is shutdown. The circulating pump must be running before sampling takes place.

5.0 APPENDICES

Appendix 1 - Actions upon Detection of a Condenser Leak

5.1 Purpose

The purpose of this procedure is:

1. To identify specific provisions which have been made to deal with contaminant ingress into the condensers and cautions relating to that event.

2. To identify "Entry Conditions" which when recognized by the Control Room Operator, demands use of this procedure.

3. To identify the specific actions required by the Control Room Operator and Chemical Maintainer during Condenser Contaminant Ingress conditions.

5.2 Specific Provisions and Cautions

1. This procedure addresses impurity ingress into the condensers. Low impurity concentrations in the condensers can result in extremely corrosive conditions in local areas in steam generators. The actions specified in this procedure are intended to limit damage while regaining good chemistry control to insure long-term integrity of the steam generators.

2. Upon initial detection of condenser contaminant ingress, it is very important that the condensate polishers are promptly placed in service and morpholine addition established. Communication between the CRO and Chemical Maintainer must be maintained at all times.

3. It is important that plant shutdown criteria specified in this procedure are adhered to as continued operation at these concentrations can result in rapid corrosion of steam generator tubes.

4. Low concentrations of impurities present in the condensers can very quickly result in boiler impurity concentrations requiring plant shut down. **Refer To** the following Table, which gives times to reach plant shut down conditions with various condenser tube leaks, chloride and sodium concentrations.

5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

5.2 Specific Provisions and Cautions (Cont'd)

Table

Condenser Leak Rate (ml/min)	CEP Equilibrium Sodium Concentration (ug/kg)		DA Equilibrium Sodium Concentration (ug/kg)		Boiler Equilibrium Sodium Concentration (ug/kg)		Time to Reach Plant Shutdown Boiler Specifications (minutes)	
	Sodium	Chloride	Sodium	Chloride	Sodium	Chloride	Sodium	Chloride
5	1.2	2.2	0.9	1.7	147	269	N/A	234
20	4.7	8.6	3.7	6.8	588	1080	61	37
50	11.8	21.6	9.3	17.0	1470	2700	30	22
100	23.6	43.1	18.6	34.0	2940	5390	21	17
150	35.4	64.7	27.9	51.1	4420	8080	18	15

Source: Underhill, W.T. "Condensate Polisher Operational Strategy"; PLGS Information Report No. IR-43240-01 Rev. 0, July 2000

5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

5.3 Entry Conditions and Actions Logic

- Impurity ingress into the condensers requiring corrective action is indicated by receipt of the specific Entry Conditions given on the next page.
- Diamonds, identified as Governing Conditions, have precedence over all subsequent actions listed on that page. (Current activities must be postponed/abandoned until the Governing Condition has been addressed).
- Where more than one Governing Condition is present on a page, the first listed has precedence over the second, etc.
- Logic Diamonds (questions) require the use of on-line instrumentation.
- Continuing Actions (bold bordered logic rectangles) identify tasks that require continued monitoring and/or continuing action applied on a priority basis, in parallel with subsequent activities.
- During execution of this procedure, procedure steps are to be "Highlighted" or checked as completed on the procedure copy used.

5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

5.4 Entry Conditions

CRITERIA 1.

Sodium ***or*** Cation Conductivity in alarm on one or more Condensers.
AND
Sodium ***or*** Cation Conductivity in alarm on the CEP Discharge.

	CD01	CD02	CD03
Condenser Indications (Any of)	WII-6 CI 1873 AI 2764 AI 2766	WII-6 CI 1873 AI 0551 AI 0564	WII-6 CI 1873 AI 2765 AI 2767
	AND		
CEP (Either of)	AI 1014 AI 1015		

OR

CRITERIA 2.

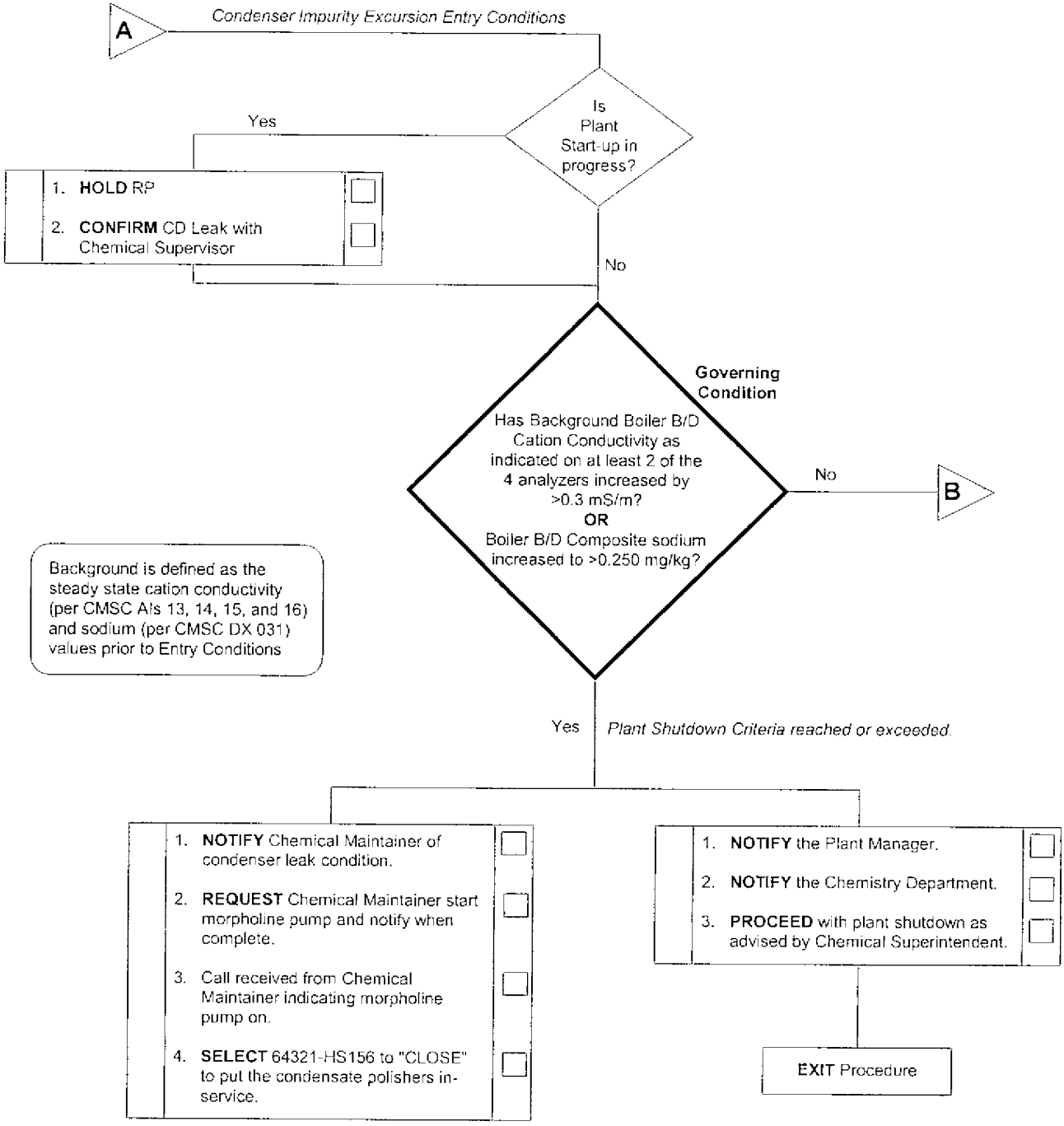
Any single alarm and trending indicates we are approaching a CRITERIA 1. Situation as monitored by the Chemistry Department.

A

5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

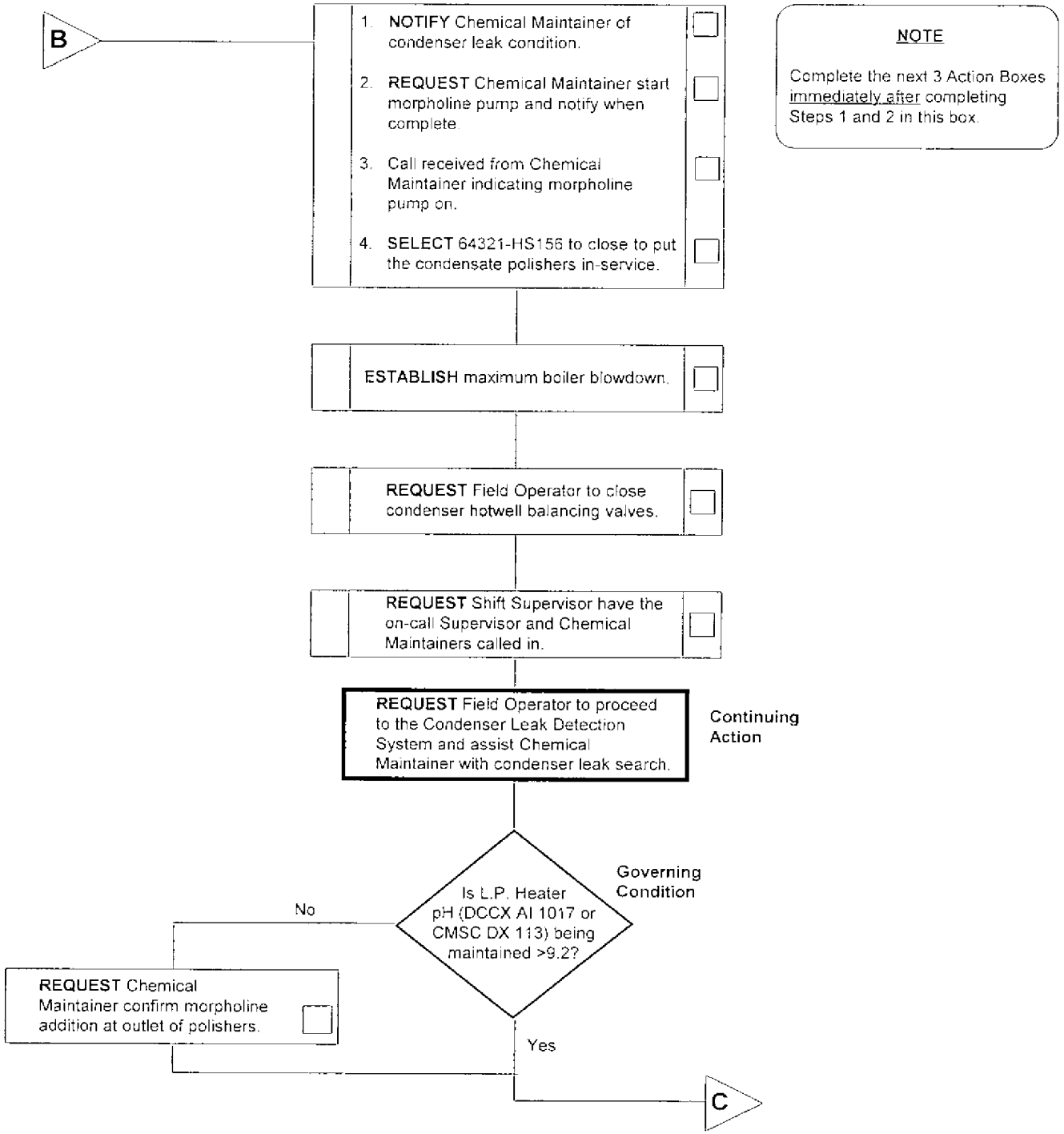
5.5 Initial Assessment



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

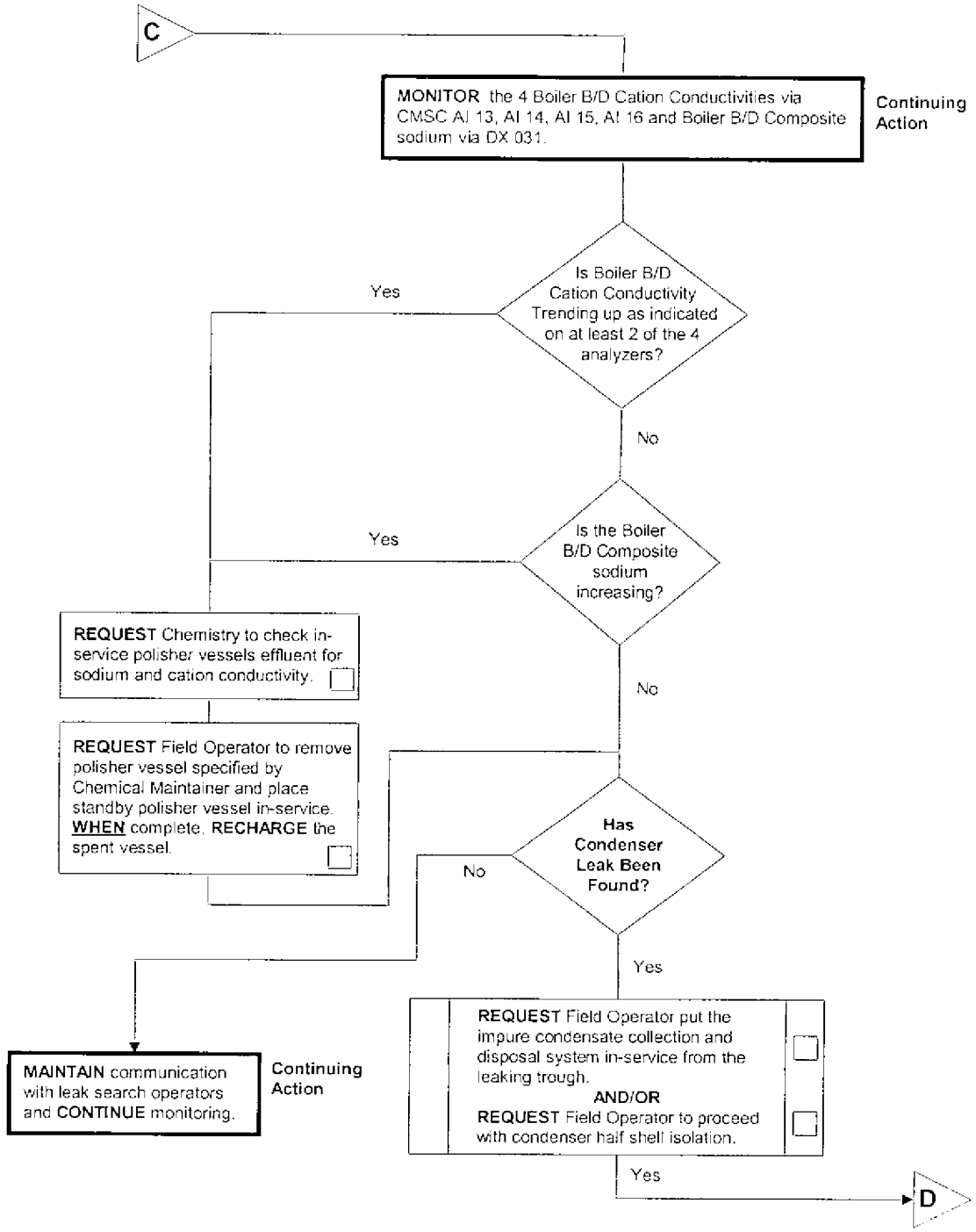
5.6 Control Room Operator Actions



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

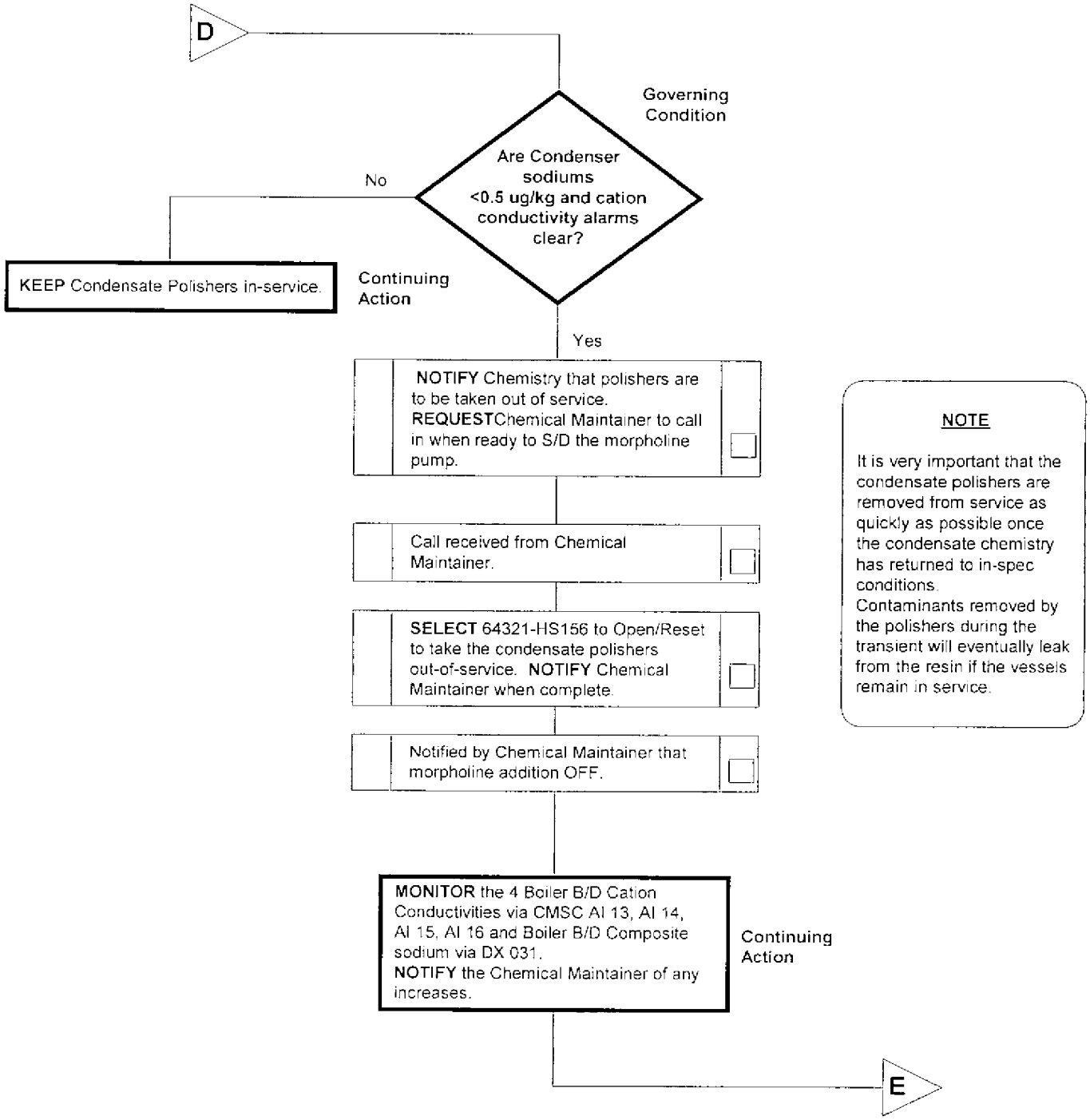
5.6 Control Room Operator Actions (Cont'd)



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

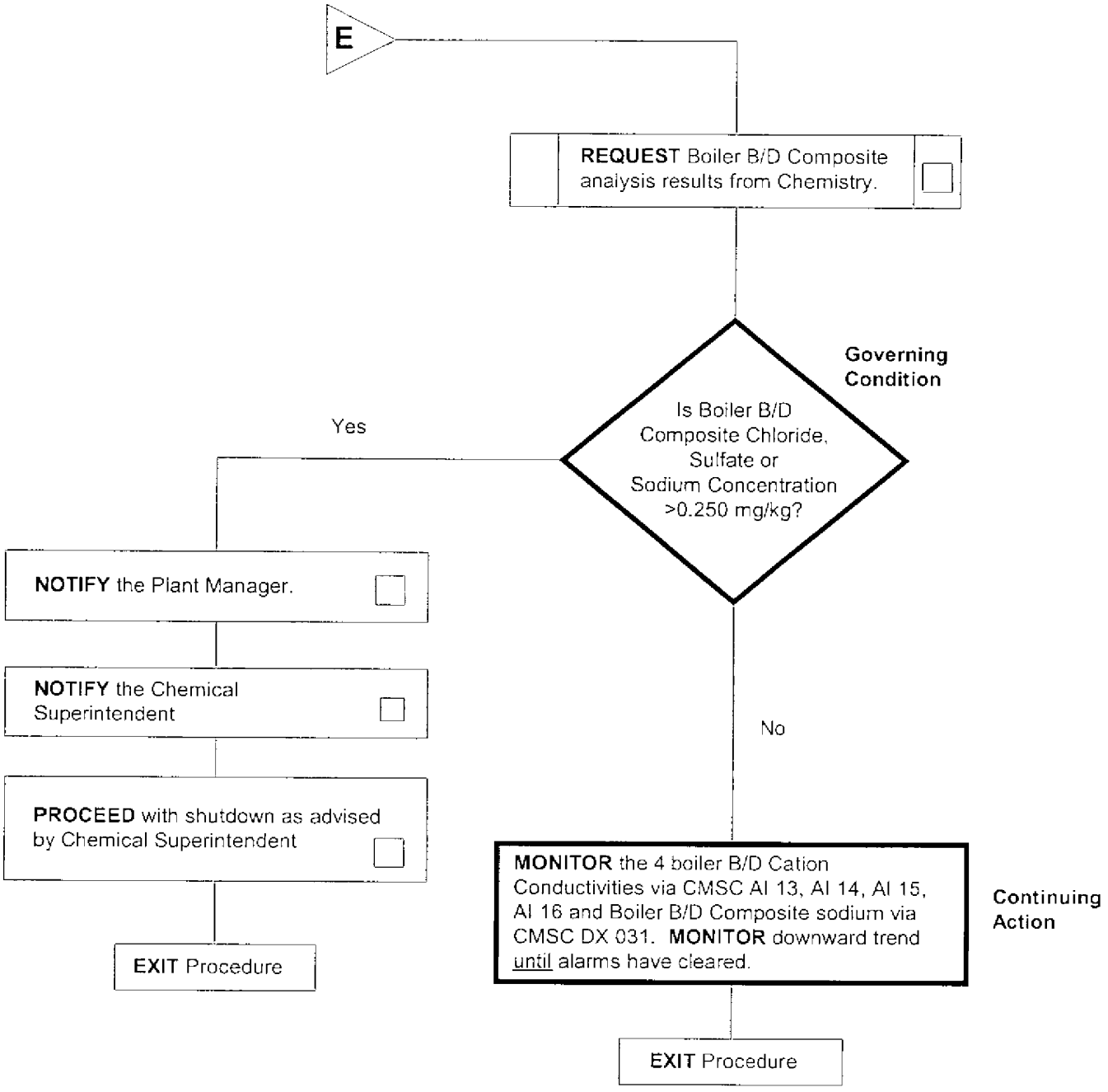
5.6 Control Room Operator Actions (Cont'd)



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

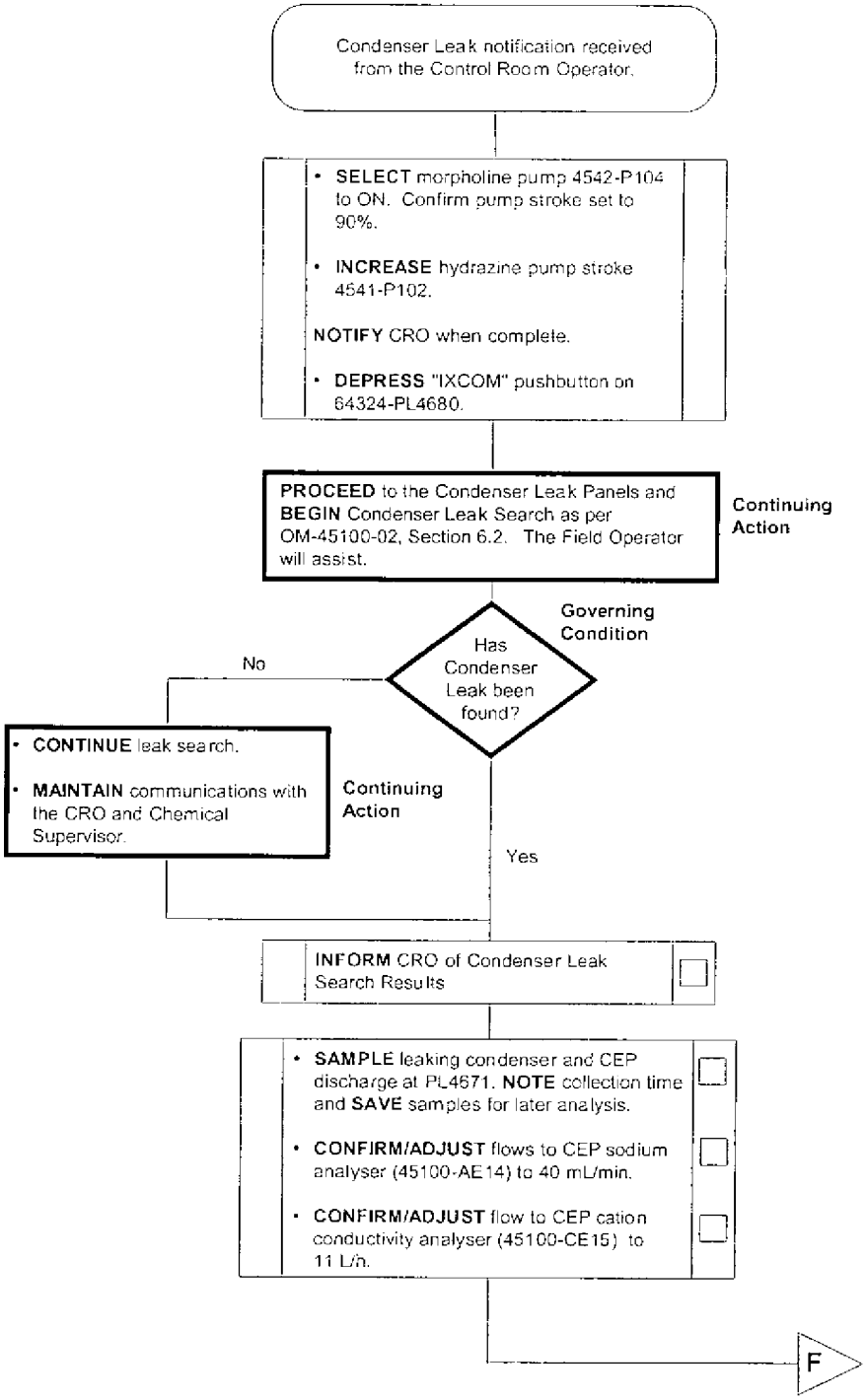
5.6 Control Room Operator Actions (Cont'd)



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

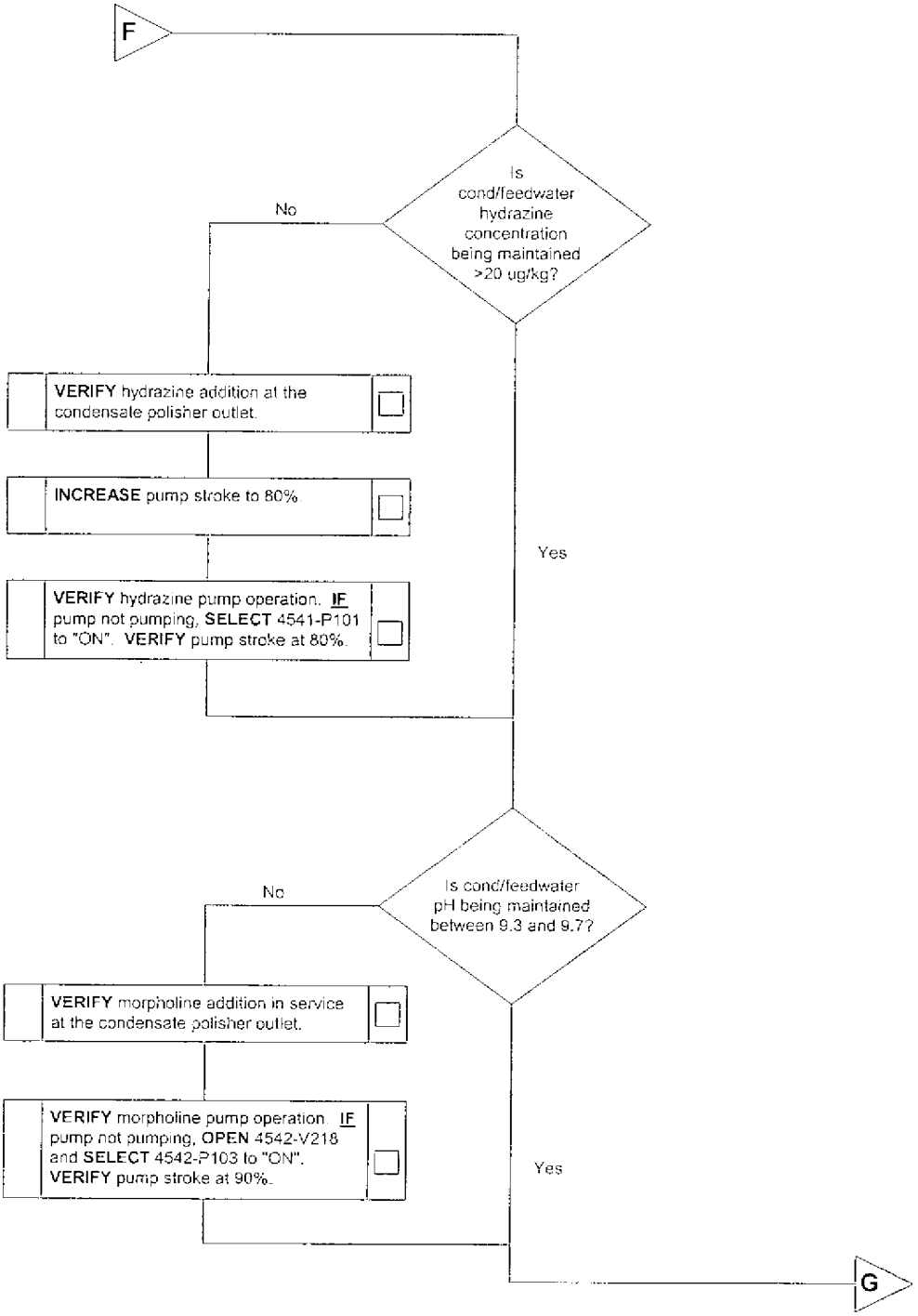
5.7 Chemical Maintainer Actions



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

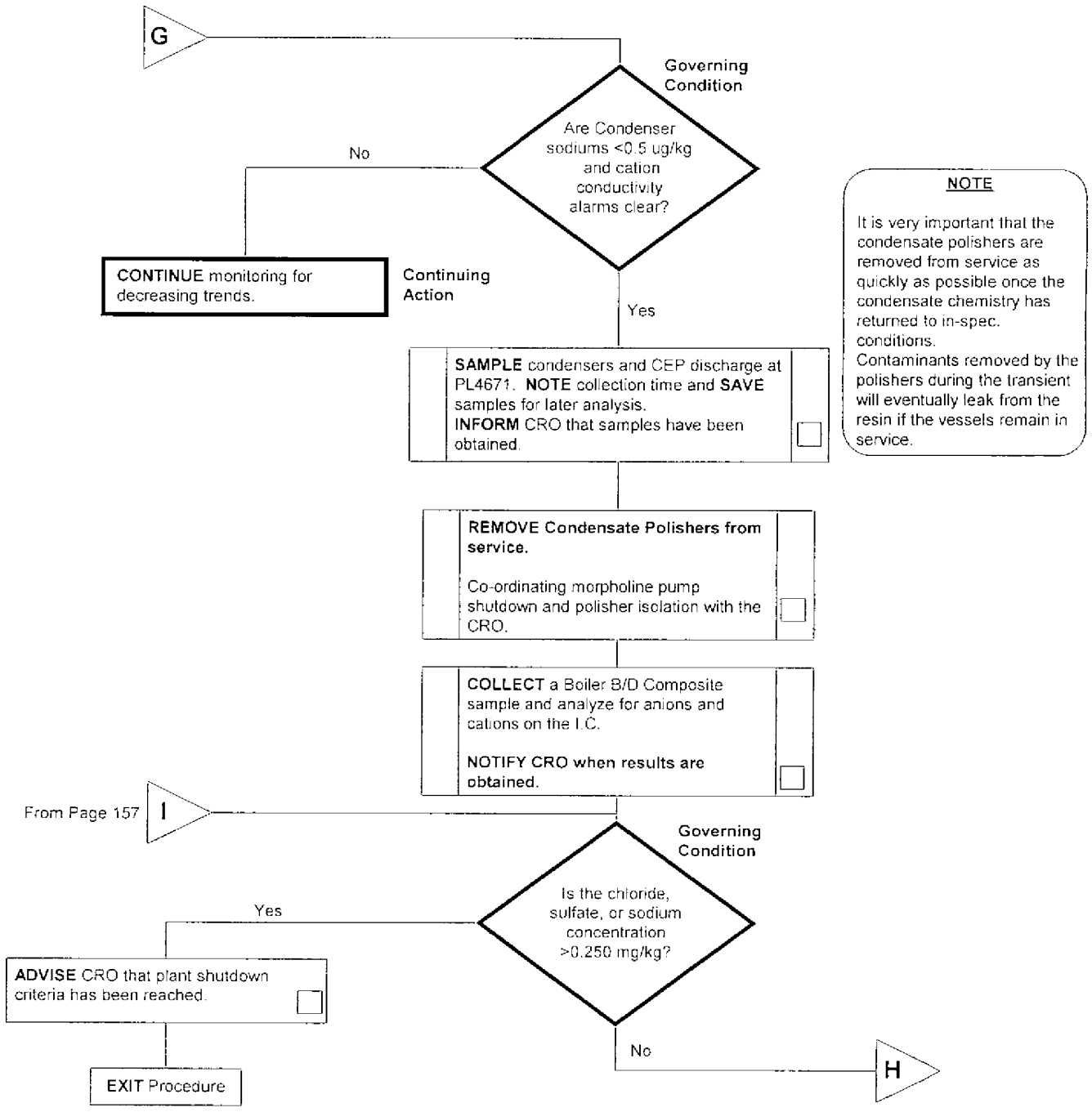
5.7 Chemical Maintainer Actions (Cont'd)



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

5.7 Chemical Maintainer Actions (Cont'd)



5.0 APPENDICES (Cont'd)

Appendix 1 - Actions upon Detection of a Condenser Leak (Cont'd)

5.7 Chemical Maintainer Actions (Cont'd)