

ATTACHMENT 1

OVERALL PLANT ADMIN. PROCEDURE
STEAM GENERATOR WATER CHEMISTRY MONITORING
- UNIT ONE
1000.42 REV. 0



ARKANSAS POWER & LIGHT COMPANY

Arkansas Nuclear One

OVERALL PLANT ADMIN. PROCEDURE

FORM 1000.06A

STEAM GENERATOR WATER CHEMISTRY MONITORING - UNIT ONE
1000.42 REV. 0

UN-Controlled Copy # 62

RECORD OF CHANGES AND REVISIONS

PAGE	REVISION	CHANGE	PAGE	REVISION	CHANGE	PAGE	REVISION	CHANGE
1	0							
2	0							
3	0							
4	0							
5	0							
6	0							
7	0							
8	0							
9	0							
10	0							
11	0							
12	0							
13	0							

APPROVED BY:

J. P. Stanton
(GENERAL MANAGER)

APPROVAL DATE

3/5/82



ARKANSAS POWER & LIGHT COMPANY

Arkansas Nuclear One

TITLE: RECORD OF CHANGES AND REVISIONS

FORM NO. 1000.06A

OVERALL PLANT ADMIN. PROCEDURE

REV. # 8 PC #

STEAM GENERATOR WATER CHEMISTRY MONITORING - UNIT ONE

1000.42 REV. 0

UN - Controlled Copy # 62

PAGE	REV	PC#	PAGE	REV	PC#	PAGE	REV	PC#	PAGE	REV	PC#	PAGE	REV	PC#
1	0													
2	0													
3	0													
4	0													
5	0													
6	0													
7	0	1												
8	0													
9	0													
10	0													
11	0													
12	0													
13	0													

APPROVED BY:

James M. Levine
(General Manager)

APPROVAL DATE

5/18/82

REQUIRED EFFECTIVE DATE:



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE	1 of 13
REVISION	0 DATE 2/18/82
CHANGE	DATE

1.0 PURPOSE

The purpose of this procedure is to identify a secondary water chemistry monitoring program to maximize the availability and operating life of major components such as the steam generators and the turbine.

2.0 SCOPE

The scope of this program is limited to:

- 2.1 Unit One
- 2.2 Identification of a sampling schedule for the minimal critical parameters and control points for these parameters;
- 2.3 Identification of the procedures used to measure the values of the critical parameters;
- 2.4 Identification of sampling procedures and process sampling points,
- 2.5 Procedure for the recording and management of data;
- 2.6 Procedure defining corrective actions for chemistry conditions outside normal ranges; and
- 2.7 A procedure identifying the authority responsible for the interpretation of the data, and the sequence and timing of administrative events required to initiate corrective action.

3.0 REFERENCES

3.1 References Used in Developing this Procedure

- 3.1.1 PWR Secondary Water Chemistry Guidelines Sept. 1981-EPRI
- 3.1.2 Babcock & Wilcox BAW1385 Water Chemistry Manual

3.2 References to be Used in Implementing this Procedure

- 3.2.1 1605.03, "Determination of Ammonia"
- 3.2.2 1605.07B, "Determination of Chloride Specific Ion Electrode Method"
- 3.2.3 1605.10A, "Determination of Cation Conductivity of Water"
- 3.2.4 1605.11A, "Determination of Copper (AA Method)"



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE	2 of 13
REVISION	0 DATE 2/18/82
CHANGE	DATE

- 3.2.5 1605.15, "Determination of Hydrazine - Low Range"
- 3.2.6 1605.15A, "Determination of Hydrazine - High Range"
- 3.2.7 1605.16B, "Determination of Iron (AA Method)"
- 3.2.8 1605.22, "Determination of Dissolved Oxygen"
- 3.2.9 1605.23, "Determination of pH of an Aqueous Solution"
- 3.2.10 1605.25, "Determination of Silica Photometric Method"
- 3.2.11 1605.27, "Determination of Solids Membrane Comparison Method"
- 3.2.12 1606.08, "Atomic Absorption Unit - Startup, Shutdown, and Calibration in the Emission Mode (Sodium Analysis)"
- 3.2.13 1618.05, "Sampling the Steam Generators - Unit 1"
- 3.2.14 1618.04, "Sampling the Condensate"
- 3.2.15 1618.03, "Sampling the Feedwater"
- 3.2.16 1618.02, "Sampling the Condensate Demineralizer System"

4.0 DEFINITIONS

- 4.1 Action Response - Remedial actions to be taken when measured values for parameters are observed and confirmed to be outside normal values. Parameters outside of their normal values represent conditions which could lead to corrosion. The action responses are designed to provide a response in proportion to the severity of the situation encountered.
- 4.2 Corporate Management - Utility management responsible for nuclear power plant operation but with offices which may be remote from the plant site.
- 4.3 Plant Maintenance Staff - Plant personnel responsible for repair and modification of plant equipment.
- 4.4 Sample Sources - Those points in the system from which a sample is drawn for analysis.
- 4.5 Station Management/Operating Staff - On-site management responsible for overall station performance and plant personnel responsible for the day-to-day operation of a nuclear unit.
- 4.6 Trended Chemistry Data - Chemistry data plotted vs time. Provides a rapid visual method of assessing plant chemistry.



PLANT MANUAL SECTION:

OVERALL PLANT

ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:

STEAM GENERATOR WATER

CHEMISTRY MONITORING - UNIT ONE

NO:

1000 42

ARKANSAS NUCLEAR ONE

PAGE 3 of 13

REVISION 0 DATE 2/18/82

CHANGE DATE

5.0 RESPONSIBILITIES

- 5.1 Corporate Management: Establishes the policies and provides the resources to support and enforce the guidelines. The roles of corporate management may include periodic restatement of commitment to the operating policy, maintaining a long-term perspective of the plant operation, maintaining an awareness of the real and potential operating problems as affected by plant chemistry, and assuring periodic review of the operating policy.
- 5.2 Station Management/Operating Staff: Responsibilities include understanding the impact of the chemistry control on major component performance, availability, and expected life; understanding the chemistry control program and the management support for the program; and establishment of corrective action priorities.
- 5.3 Plant Chemistry Staff: Responsibilities include understanding the corporate management goals for the program implementation of the chemistry control program, timely data review to identify problems quickly, initiation of any required corrective actions, and making any necessary changes in the chemistry monitoring requirements to improve the chemistry control program.
- 5.4 Plant Maintenance Staff: Responsibilities include prompt and effective repair of plant equipment required to maintain chemistry specifications.
- 5.5 Planning & Scheduling Staff - Responsibilities include timely issuance of corrective maintenance required to maintain chemistry within specifications.

6.0 SAMPLING AND MONITORING INSTRUCTIONS

- 6.1 A secondary chemistry monitoring program to maximize steam generator availability and operating life shall be carried out on the samples, parameters, and frequencies listed on Attachments 1, 2 and 3 according to the status mode of the unit.
- 6.2 Sampling and analysis of the concerned parameters will be carried out using current approved procedures.
- 6.3 Analysis results shall be recorded on the Daily Clean Lab Water Report for Unit One.
- 6.4 Each parameter concerned with maximizing steam generator availability and operating life should be trended as a means of rapid visual assessment of plant chemistry.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE	4 of 13
REVISION	0 DATE 2/18/82
CHANGE	DATE

- 6.5 Daily Clean Lab Water Reports shall be reviewed, then compared to the normal parameter values listed on Attachments 1, 2, and 3, according to the status mode and sample source. If an out-of-spec condition is noted, request additional verification in the form of a confirmatory grab sample.
- 6.6 Any out-of-spec conditions or deleterious trends shall be promptly reported to the Chemistry and Environmental Supervisor or his assistant and also to the Shift Supervisor. On a back shift, or in the absence of the Chemistry and Environmental Supervisor, the Shift Supervisor shall be promptly alerted of the findings by the Chemist.
- 6.7 The Chemistry and Environmental Supervisor and/or the Shift Supervisor shall proceed with a plan of corrective action to bring the parameter back into a normal value range. Typical corrective actions include:
- 6.7.1 Compare results of confirmatory analyses to readings from continuous monitors.
 - 6.7.2 Increase steam generator blowdown to maximum levels for the removal of specific impurities. (This can be done during certain startup periods only.)
 - 6.7.3 Isolate and identify sources of impurity ingress.
 - 6.7.4 Compare results of various analyses for internal consistency.
 - 6.7.5 Increase sample and analysis frequencies for short-term trending of critical chemistry parameters.
 - 6.7.6 Refer to Attachments 4, 5 and 6 for corrective action of specific parameters.
- 6.8 All values from analyses and instrument readings should be archived for long-term trending and review.
- 7.0 FORMS AND ATTACHMENTS
- 7.1 Attachment 1 - Cold Shutdown/Wet Layup
 - 7.2 Attachment 2 - Startup, Hot Standby, and Steaming at < 15% Full Power
 - 7.3 Attachment 3 - Power Operation > 15% Full Power
 - 7.4 Attachment 4 - Cold Shutdown/Wet Layup Corrective Actions
 - 7.5 Attachment 5 - Startup, Hot Standby, and Steaming at < 15% Full Power Corrective Actions
 - 7.6 Attachment 6 - Power Operations > 15% Full Power Corrective Actions



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:

1000 42

ARKANSAS NUCLEAR ONE

PAGE 5 of 13
REVISION 0 DATE 2/18/82
CHANGE DATE

ATTACHMENT 1

COLD SHUTDOWN/WET LAYUP
(RCS \leq 200°F)

<u>Parameter</u>	<u>Frequency*</u>	<u>Normal Value</u>	<u>Initiate Action</u>	<u>Value Prior to Heatup</u>
<u>Steam Generator Sample</u>				
pH	weekly	9.8-10.5	<9.8, >10.5	8.5-9.3
Hydrazine, ppm	weekly	75-200	<75, >200	3x[O ₂]
Sodium, ppb	weekly	<1000	>1000	<2000
Cation Conductivity µmno/cm	weekly	<10.0	>10.0	<10.0

*Every other day until stable, then weekly.

NOTE: "Value Prior to Heatup" shall be met prior to exceeding 200°F RCS Temperature.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE 6 of 13
REVISION 0 DATE 2/18/82
CHANGE DATE

ATTACHMENT 2

Page 1 of 2

STARTUP, HOT STANDBY, AND STEAMING AT <15% FULL POWER

<u>Parameter</u>	<u>Frequency *</u>	<u>Normal Value</u>	<u>Initiate Action **</u>	<u>Action Response</u>
<u>Feedwater Sample</u>				
pH	3/day	8.5-9.3	<8.5 >9.3	Return to normal value within 100 hours or be in cold shutdown within additional 24 hours.
Hydrazine, ppb	Daily	≥3x [O ₂]	<3x [O ₂]	Return to normal value within 24 hours.
<u>Dissolved Oxygen, ppb</u>				
RCS >200°F <525°F	3/day	<100	≥100	Return to < 100 within 8 hours or be in cold shutdown within additional 24 hours.
RCS > 525°F < 15% F.P.	Daily	<3	≥3	Return to normal value within 8 hours or be in cold shutdown within additional 24 hours.
<u>Cation Conductivity μmho/cm</u>				
RCS > 200°F < 525°F	Continuous	≤1.0	>1.0	Should be <1.0 before feeding OTSG's. After initiated, should be below 0.5 within 24 hrs.
RCS > 525°F < 15% F.P.	Continuous	<0.5	>0.5	Return to ≤ 0.5 within 100 hours or be in cold shutdown within additional 24 hours.
			>1.0	Return to ≤ 1.0 within 24 hours or be in cold shutdown within additional 24 hours.
			>2.0	Return to ≤ 2.0 within 8 hours or be in cold shutdown within additional 24 hours.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE 7 of 13
REVISION 0 DATE 2/18/82
CHANGE PC-1 DATE 5/5/82

ATTACHMENT 2

Page 2 of 2

STARTUP, HOT STANDBY, AND STEAMING AT <15% FULL POWER

<u>Parameter</u>	<u>Frequency *</u>	<u>Normal Value</u>	<u>Initiate Action **</u>	<u>Action Response***</u>
<u>Feedwater Sample</u>				
Silica, ppb	Daily	<20	>20	Should be returned to normal value within 24 hours.
Iron, ppb	Daily	<100	>100	Should be returned to normal value within 8 hours.
<u>Steam Generator Sample</u>				
Sodium, ppb	3/day	<2000	>2000	Return to normal value within 24 hours of reaching $\geq 520^{\circ}\text{F}$ or be in cold shutdown within an additional 24 hours.
Chloride, ppb	3/day	<1000	>1000	Return to normal value within 24 hours of reaching $\geq 520^{\circ}\text{F}$ or be in cold shutdown within an additional 24 hours.
Cation Conductivity $\mu\text{mho/cm}$	3/day	<10.0	>10.0	Return to normal value within 24 hours of reaching $\geq 520^{\circ}\text{F}$ or be in cold shutdown within an additional 24 hours.
Silica, ppb	3/day	<2000	>2000	Return to normal value within 24 hours of reaching $\geq 520^{\circ}\text{F}$ or be in cold shutdown within an additional 24 hours.

* Daily samples will be analyzed for continuous frequency parameters to verify analyzer operation and/or insure that parameter is within normal value if analyzer is out of service.

** Time clock starts when sample results indicate outside normal value.

*** The Steam Generator normal value limits must be in compliance before going above 15% reactor power.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING -

NO:

UNIT ONE

1000 42

ARKANSAS NUCLEAR ONE

PAGE 8 of 13

REVISION 0 DATE 2/13/82

CHANGE DATE

ATTACHMENT 3

Page 1 of 3

POWER OPERATION > 15% FULL POWER

<u>Parameter</u>	<u>Frequency</u>	<u>Normal Value</u>	<u>Initiate Action *</u>	<u>Action Response</u>
<u>Final Feedwater</u>				
pH	Continuous	8.8-9.2	<8.8 >9.2	Return to normal value within 8 hours or be in cold shutdown within additional 24 hours.
Hydrazine, ppb	daily	$\geq 3 \times [O_2]**$	$> 3 \times [O_2]**$	Return to normal value within 24 hours or be in cold shutdown within additional 24 hours.
Dissolved Oxygen, ppb	Continuous	<3	>3	Return to normal value within 8 hours or reduce power to <30% until source is identified and isolated.
Sodium, ppb	Continuous	<3	≥ 3	Return to normal value within 100 hours or be in cold shutdown within additional 24 hours.
			≥ 6	Return to < 6 within 24 hours or be in cold shutdown within additional 24 hours.
			>10	Be in cold shutdown within 24 hours.
Chloride, ppb	Daily***	<5	≥ 5	Return to normal value within 100 hours or be in cold shutdown within additional 24 hours.
			≥ 10	Return to < 10 within 24 hours or be in cold shutdown within additional 24 hours.
			≥ 20	Be in cold shutdown within 24 hours.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING

NO:

UNIT ONE

1000.42

ARKANSAS NUCLEAR ONE

PAGE 9 of 13

REVISION 0 DATE 2/18/82

CHANGE DATE

ATTACHMENT 3

Page 2 of 3

POWER OPERATION > 15% FULL POWER

<u>Parameter</u>	<u>Frequency</u>	<u>Normal Value</u>	<u>Initiate Action *</u>	<u>Action Response</u>
<u>Final Feedwater</u>				
Cation Conductivity µmho/cm	Continuous	<0.2	≥0.2	Return to normal value within 100 hours or be in cold shutdown within additional 24 hours.
			≥0.5	Return to ≤ 0.5 with- in 24 hours or be in cold shutdown within additional 24 hours.
			≥1.0	Be in cold shutdown within 24 hours.
Silica, ppb	Daily	<20	≥20	Return to normal value within 100 hours or be in cold shutdown within additional 24 hours.
			≥35	Return to <35 with- in 24 hours or be in cold shutdown within additional 24 hours.
			≥50	Be in cold shutdown within 24 hours.
Total iron, ppb	Weekly (integrated)	<10	≥10	Should be returned to normal value within 24 hours.
Suspended Solids, ppb	Daily	<10	≥10	Should return to normal range within 24 hours.
Copper, ppb	Weekly	<2	≥2	Should be returned to normal range within 24 hours.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE 10 of 13
REVISION 0 DATE 2/18/82
CHANGE DATE

ATTACHMENT 3

Page 2 of 3

POWER OPERATION > 15% FULL POWER

<u>Parameter</u>	<u>Frequency</u>	<u>Normal Value</u>	<u>Initiate Action *</u>	<u>Action Response</u>
<u>Condensate Pump Discharge Sample</u>				
Dissolved Oxygen, ppb	Continuous	≤10	>10	If >10 ppb for 100 hours, reduce power to 30% until source is identified and isolated.

* All parameters must be below applicable action response level prior to power escalation above 30% full power. Time clock starts when sample results indicate outside normal values.

** Based on oxygen value measured in the condensate sample.

*** Since cation conductivity can detect low levels of chloride, this is not considered to be a required, routine analysis.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000 42

ARKANSAS NUCLEAR ONE

PAGE 11 of 13
REVISION 0 DATE 2/18/82
CHANGE DATE

ATTACHMENT 4

COLD SHUTDOWN/WET LAYUP CORRECTIVE ACTIONS

Steam Generator Sample

Parameter Out of Range

Corrective Action

pH

1. Cross-check with ammonia/hydrazine/cation conductivity values for consistency.
2. If pH is low, add ammonia to correct and mix contents of steam generator.

Sodium

1. Check make-up water purity.
2. Feed and bleed until within range or drain and refill with deoxygenated make-up water of proper purity.

Hydrazine

1. If low, add to range.
2. If high, feed and bleed until within range, or drain and refill with make-up water of proper purity.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING - UNIT ONE

NO:
1000.42

ARKANSAS NUCLEAR ONE

PAGE	12 of 13
REVISION	0 DATE 2/18/82
CHANGE	DATE

ATTACHMENT 5

STARTUP, HOT STANDBY AND STEAMING AT < 15% FULL POWER CORRECTIVE ACTIONS

<u>Parameter Out of Range</u>	<u>Corrective Action</u>
pH	1. Adjust ammonia feed to increase pH if too low. 2. If pH is high, blow down and add deionized, deoxygenated makeup water.
Cation Conductivity	1. Maximum blowdown, and add deionized, de-oxygenated makeup water. Check makeup purity.
Dissolved Oxygen	1. Check hydrazine residual. Add hydrazine if required.
Hydrazine	1. Add hydrazine if residual is low.



PLANT MANUAL SECTION:
OVERALL PLANT
ADMIN. PROCEDURE

PROCEDURE/WORK PLAN TITLE:
STEAM GENERATOR WATER
CHEMISTRY MONITORING

NO:

1000.42

ARKANSAS NUCLEAR ONE

UNIT ONE

PAGE 13 of 13

REVISION 0 DATE 2/18/82

CHANGE DATE

ATTACHMENT 6

POWER OPERATION > 15% FULL POWER CORRECTIVE ACTIONS

Final Feedwater

Parameter Out of Range

Corrective Action

pH

1. Verify correct hydrazine feed.
2. Verify correct ammonia feed.
3. Verify absence of regenerant chemical in-leakage.

Hydrazine

1. Adjust chemical addition.

Oxygen

1. Verify hydrazine residual.
2. Verify absence of significant air inleakage.

Sodium

1. Check condensate polisher sodium leakage.
2. Request routing of MSR drains to condenser.
3. Identify source using other sample points and analytical techniques.

Cation Conductivity,
Chloride, Fluoride,
and Silica

1. Request routing of MSR drains to condenser.
2. Check condensate polisher for anion removal.
3. Identify source using other sample points and analytical techniques.

Iron, Suspended Solids,
Copper

1. Assure pH and oxygen are in specification.

ATTACHMENT 2
PROPOSED LICENSE AMENDMENT
SECONDARY WATER CHEMISTRY MONITORING

(7) Secondary Water Chemistry Monitoring

A secondary water chemistry monitoring program shall be implemented to minimize steam generator tube degradation. This program shall include:

1. Identification of a sampling schedule for the critical parameters and control points for these parameters;
2. Identification of the procedures used to measure the values of the critical parameters;
3. Identification of process sampling points;
4. Procedures for the recording and management of data;
5. Procedures defining corrective actions for off-control point chemistry conditions; and
6. A procedure identifying the authority responsible for the interpretation of the data and the sequence and timing of administrative events required to initiate a corrective action.

- d. This license is effective as of the date of issuance and shall expire at midnight, December 6, 2008.

FOR THE ATOMIC ENERGY COMMISSION

A. Giambusso, Deputy Director

Date of Issuance: May 21 1974