

ARKANSAS POWER & LIGHT COMPANY
Arkansas Nuclear One

TITLE: TRANSMITTAL

FORM NO. 1013.02H

REV. # 12 PC #

Arkansas Nuclear One
Russellville, Arkansas
Date 3-14-84

MEMORANDUM

TO: 76 - NRC

FROM: ANO DOCUMENT CONTROL

SUBJECT: ANO MASTER PLANT MANUAL UPDATE

PROCEDURE NUMBER 1617.98 REV. # 0 PC # TC #

PROCEDURE TITLE ORION MODEL 1610 BORON / pH ANALYZER SITE

ACCEPTANCE TEST

PROCEDURE NUMBER _____ REV. # _____ PC # _____ TC # _____

PROCEDURE TITLE

PROCEDURE NUMBER _____ REV. # _____ PC # _____ TC # _____

PROCEDURE TITLE

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PROCEDURE (S)

PAGE (S)

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☒ PROCEDURE (S) SHOULD BE PLACED IN YOUR SET OF THE PLANT MANUAL.

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ARKANSAS POWER & LIGHT COMPANY

Arkansas Nuclear One

TITLE: RECORD OF CHANGES AND REVISIONS

FORM NO. 1000.06A

GERM/GAIM SYSTEM

REV. # 12 PC #

Safety Related YES ☒ NO ☐

ORION MODEL 1610 BORON/pH ANALYZER SITE ACCEPTANCE TEST
1617.098 REV. 0

UN-Controlled Copy # 76

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APPROVED BY:

APPROVAL DATE

James M. Levine
(General Manager)

3/14/84
REQUIRED EFFECTIVE DATE:



PLANT MANUAL SECTION:

GERM/GAIM SYSTEM

PROCEDURE/WORK PLAN TITLE:

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1.0 PURPOSE

The purpose of this work plan is to test the capability and reliability of the Orion Model 1610 Boron/pH Analyzer.

2.0 SCOPE

This work plan is applicable to both Unit One and Unit Two.

3.0 REFERENCES

3.1 References used in the development of this work plan.

3.1.1 Orion Model 1610 Boron/pH Analyzer Instruction Manual

3.1.2 NUREG 0737

3.2 References used in conjunction with this work plan.

3.2.1 1617.009 "Panel 2C357 Valve Alignment"

3.2.2 1617.011 "Inline Monitoring Of pH And Boron Concentration in Reactor Coolant"

3.3 References used which interface with this work plan.

None

4.0 DEFINITIONS

None

5.0 PRECAUTIONS AND LIMITATIONS

None

6.0 PREREQUISITES

6.1 The analyzers shall have set unattended for at least seven days immediately prior to commencing PHASE I of the SAT.

6.2 The analyzers shall have successfully completed PHASE I of the SAT prior to commencing PHASE II of the SAT.

7.0 SETPOINTS

None

8.0 INSTRUCTIONS

8.1 PHASE I - Phase I of the SAT shall not be conducted unless the pre-



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requisite in step 6.1 has been satisfied. PHASE I will take approximately two weeks to complete and shall be performed on Monday through Friday of weeks one and two. Both analyzers shall be tested concurrently. See Attachment 2 for the listing of the random order the standards will be analyzed in. The results of the analyses shall be recorded on Form 1617.098A. When PHASE I is completed the results shall be tabulated on Form 1617.098B and compared to the acceptance criteria in section 9.0 if acceptable initiate PHASE II of the SAT, otherwise the SAT shall be terminated at the end of PHASE I with the results recorded as unsatisfactory. The analyzer printouts should be maintained as a part of the SAT data.

NOTE: Upon commencement of this test inclusive of step 6.1 no adjustments to the Sensing Panel or Reagent Panel components or solutions may be made with the exception of removing the temporary sample pumps upon the completion of PHASE I and the reconnection of the analyzers into the PASS system start the start of PHASE II of this test.

- 8.1.1 Each days testing should be initiated by placing the sample pump suction lines into the first standard solutions to be analyzed for the day (see Attachment 2) then place the analyzers into the INTERMITTENT mode of operation on a 45 minute time cycle using procedure 1617.011.
- 8.1.2 As each standard solution completes its analysis cycle record the information on Form 1617.098A, then place the sample pump suction line into the next standard solution for analysis (see Attachment 2).
- 8.1.3 Repeat step 8.1.2 until the last standard solutions for the day have been analyzed then terminate the analyzer's INTERMITTENT mode of operation using procedure 1617.011.
- 8.1.4 When all the analyses for PHASE I have been completed tabulate the results on Form 1617.098B and compare them with the acceptance criteria in section 9.0. The Radiochemistry Supervisor or his designee should mark the appropriate box on Form 1617.098B and then sign the form.
- 8.1.5 If PHASE I was signed off as Satisfactory proceed to PHASE II of the SAT otherwise the SAT is complete at this point with the results being Unsatisfactory.
- 8.2 PHASE II - PHASE II of the SAT shall consist of a test of the analyzer's operation under normal in-line conditions (ie Reactor in Mode I with RCS total gas $\geq 20\text{cc/kg}$). PHASE II will be conducted over an approximate two week period on Monday, Wednesday, and Friday of each week. At least five analyses on each analyzer should be performed on each of the above mentioned days. Prior to initially starting PHASE II remove the temporary sample pumps and reinstate the analyzers into the in-line system (see Procedure 1617.011).



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- 8.2.1 Prior to commencing each days testing contact the Operations Department to determine if any evolutions that could change the chemistry status in the RCS are planned during the days testing period. If no evolutions are scheduled then the Radiochemistry department shall sample the RCS to determine the Boron and pH values in the system. When this is completed the in-line analyzer testing may be commenced by lining the system up to sample the RCS using Procedure 1617.009 and then placing the analyzers in the INTERMITTENT mode of operation on a 45 minute time cycle using procedure 1617.011.
- 8.2.2 When at least five sets of analyses have been completed for the day then terminate the in-line analyses using Procedure 1617.011 and secure sample flow using Procedure 1617.009.
- 8.2.3 The Radiochemistry department should then sample the RCS and analyze the samples for Boron and pH. All results for the day should then be recorded on Form 1617.098C.
- 8.2.4 When the minimum of six days of analyses have been completed the results should be tabulated on Form 1617.098D and then compared to the acceptance criteria in section 9.0. The Radiochemistry Supervisor or his designee should mark the appropriate box on Form 1617.098D and then sign the form.

9.0 ACCEPTANCE CRITERIA

9.1 Range - Boron: 100 - 6000 ppm; pH: 2 - 12

9.2 Accuracy - Boron: (>1000 - 6000 ppm) REL. STD. DEV. of % ERRORS \leq 5
Boron: (100 - 1000 ppm) REL. STD. DEV. of % ERRORS \leq 10
pH: (2 - 12) REL. STD. DEV. \leq 0.3

The relative standard deviation shall be calculated in the following manner.

$$\text{REL. STD. DEV.} = \sqrt{\frac{R_1^2 + R_2^2 + \dots + R_N^2}{N}}$$

Where: R = result of the analyzer from the true concentration expressed as a percent for Boron or pH units for pH.

N = number of analyses being evaluated.

NOTE: During PHASE I of the Acceptance Test the intended concentration will be assumed "true" unless both analyzers have a relative standard deviation of the % ERRORS > 10 if the standard's concentration is \leq 1000 ppm or REL. STD. DEV. > 5 if the standard's concentration is > 1000 ppm and the errors are in the same



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direction. If this condition occurs the on-site lab will analyze the standard in question and if the results show the analyzed concentration to be $> \pm 5\%$ from the intended concentration the results for that standard will be voided, a fresh sample prepared and the test for that standard repeated. During PHASE II of the Acceptance Test if the initial concentration step 8.2.1 is $> 5\%$ from the final concentration step 8.2.3, the plant condition wasn't stable enough to conduct the test. The results for that day will be voided and the test extended for an additional testing day per step 8.2.

10.0 ATTACHMENTS AND FORMS

10.1 Attachment 1 - PHASE I CHEMICAL STANDARD SHEET: Orion Boron/pH Analyzer

10.2 Attachment 2 - PHASE I Listing of Random Sequence for Standard Analysis: Orion Boron/pH

10.3 Form 1617.098A - PHASE I DATA SHEET: Orion Boron/pH Analyzer

10.4 Form 1617.098B - PHASE I DATA SUMMARY SHEET: Orion Boron/pH Analyzer

10.5 Form 1617.098C - PHASE II DATA SHEET: Orion Boron/pH Analyzer

10.6 Form 1617.098D - PHASE II DATA SUMMARY SHEET: Orion Boron/pH Analyzer



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ATTACHMENT 1

PHASE I CHEMICAL STANDARD SHEET: Orion Boron/pH Analyzer

STD. NUMBER	BORON (ppm)	PH	CHLORIDE (ppm)	IODINE (ppm)
1	100	*	.1	--
2	200	*	.2	--
3	300	*	.3	--
4	400	*	.4	--
5	500	*	.5	--
6	600	*	.6	--
7	700	*	.7	--
8	800	*	.8	--
9	900	*	.9	--
10	1000	*	1.0	--
11	1250	7.0**	2.0	5
12	1500	7.0**	4.0	5
13	1750	7.0**	6.0	5
14	2000	7.0**	8.0	5
15	2250	7.0**	10.0	5
16	2500	*	12.0	10
17	2750	*	14.0	10
18	3000	*	16.0	10
19	3500	*	18.0	10
20	4000	*	20.0	10

* to be determined at time of sample preparation

** NaOH added to solution to yield a pH of 7.0



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ATTACHMENT 2

PHASE I Listing of Random Standard Sequence Analysis: Orion Boron/pH Analyzer

UNIT I				UNIT 2			
Week 1: Mon, Wed, Fri	Week 1: Tue, Thur	Week 1: Mon, Wed, Fri	Week 1: Tue, Thur	Week 2: Mon, Wed, Fri	Week 2: Tue, Thur	Week 2: Mon, Wed, Fri	Week 2: Tue, Thur
17	8	15	16				
1	6	5	2				
11	18	19	14				
3	10	9	20				
7	12	13	4				
13	4	7	12				
9	20	3	10				
19	14	11	18				
5	2	1	6				
15	16	17	8				





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TITLE: PHASE I DATA SUMMARY SHEET

FORM NO. 1617.098B

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PHASE I DATA SUMMARY SHEET: Orion Boron/pH Analyzer

STANDARD BORON ppm	STANDARD DEVIATION OF % ERROR			STANDARD pH	STANDARD DEVIATION OF ΔpH		
	Unit 1	Unit 2	Overall		Unit 1	Unit 2	Overall
100							
200							
300							
400							
500							
600							
700							
800							
900							
1000							
1250							
1500							
1750							
2000							
2250							
2500							
2750							
3000							
3500							
4000							
Overall							

- ☐ Satisfactory
☐ Unsatisfactory

Radiochemistry Supervisor

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TITLE: PHASE II DATA SHEET

FORM NO. 1617.098C

REV. # 0 PC #

PHASE II DATA SHEET: Orion Boron/pH Analyzer Unit _____ Date _____

[illegible]

Performed by _____

Reviewed by _____



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GERM/GAIM SYSTEM

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TITLE: PHASE II DATA SUMMARY SHEET

FORM NO. 1617.098D

REV. # 0 PC #

PHASE II DATA SUMMARY SHEET: Orion Boron/pH Analyzer

STANDARD DEVIATION OF BORON % ERROR

UNIT 1	UNIT 2	OVERALL

STANDARD DEVIATION OF ΔpH

UNIT 1	UNIT 2	OVERALL

☐ Satisfactory☐ Unsatisfactory_____
Radiochemistry Supervisor