TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

CHEMISTRY MANUAL

CHAPTER 4.01

VISUAL INSPECTIONS AND CORROSION MONITORING

Revision 3

Unit 0

QUALITY RELATED

PREPARED BY: J. Keith Riggle
(Type Name)

SPONSORING ORGANIZATION: Chemistry

APPROVED BY: [signature] DATE: 8/24/94

EFFECTIVE DATE: 9/9/94

LEVEL OF USE: INFORMATION

REVISION LOG

REVISION OR CHANGE NUMBER	EFFECTIVE DATE	AFFECTED PAGE NUMBERS	DESCRIPTION OF REVISION/CHANGE
Rev 0	11/15/92	All	New Instruction. This Instruction superseded the parts of TI-90 regarding visual inspections of raw water systems.
Rev 1	3/29/93	All	Provide for more definitive acceptance criteria and better describe actions to be taken based on data trends.
Rev 2	8/30/93	All	Changed VERIFY to ENSURE to allow actions to be taken as necessary to establish proper configurations. Add notes in Section 6.0 to allow flexibility of performing steps out of order. Changed final signoff on Appendixes A, B, C, E, F from Responsible Engineer to Chemistry Supervisor. Revised portions of Section 6.6 to reflect current wording in TI-27, Part III. Added Appendix E to document fiberscopic inspections. Renumbered Appendixes to place them in order of use. Correct minor errors.
Rev 3	7/7/94	4, 21	• Add a reference to the Betz vendor manual in Section 2.2. • Source note WBPER 940298 R1 on use of vendor manuals.

1.0 INTRODUCTION

Visual inspections and corrosion monitoring techniques are used to verify the effectiveness of chemical treatment regimes and to make improvements where possible. Having access to several years worth of periodic visual inspection reports on the same equipment is useful in determining if changes are slowly occurring over time. Visual inspections can point out problems in localized portions of systems which may require additional attention such as targeted chemical injection. Corrosion monitoring techniques include the use of weight loss coupons, linear polarization probes, test heat exchangers, pH, temperature, and flow instrumentation. Data from these various techniques and instruments are used in conjunction with visual inspections to develop an overall assessment of system condition with respect to corrosion.

1.1 Purpose

This Instruction describes in detail the requirements for visual inspections and corrosion monitoring of raw water systems.

1.2 Scope

This Instructions defines, instructs, and documents actions necessary to meet the requirements for visual inspections and corrosion monitoring of raw water systems.

1.3 Frequency and Conditions

A. As found visual inspections for corrosion, fouling, and Asiatic clams are required to be performed and documented by Technical Instruction (TI)-27 Part III every time a cleanness class D system is opened.

B. Visual inspections of heat exchangers are performed and documented by this Instruction when opened by maintenance for periodic maintenance or on an as requested basis.

C. Weight loss corrosion coupons are replaced on approximately 30 and 60 day intervals as required by this Instruction. Special test coupons may remain in place for different durations on an as needed basis.

D. In line instrumentation such as corrosion rate meters, pH, temperature, and flow remain in service on a continuous basis excluding down time for maintenance and routine calibration.

E. Condenser Circulating Water (CCW) conduits should be inspected approximately every three years (schedule to coincide with refueling outages).

F. Self-cleaning strainers in the raw water system should be inspected when opened for maintenance.

1.4 **Definitions**

CORRATOR - Trade name of an instantaneous corrosion rate instrument using linear polarization resistance methodology.

SULFATE REDUCING BACTERIA (SRB) - Anaerobic bacteria which is commonly associated with accelerated corrosion of stainless steel heat affected zones and carbon steel.

TOTAL AEROBIC BACTERIA - Aerobic bacteria which is capable of becoming the precursor to SRB attack by providing a nutrient source and creating anaerobic conditions on pipe walls.

WEIGHT LOSS COUPONS - Stamped coupons of a chosen metallurgy which are pre-weighed and placed into a flowing system for a known length of time. The coupons are then removed, cleaned, and reweighed. An estimate of the corrosion rate is calculated by the following equation:

$$MPY = \frac{(534*W)}{DAT}$$

Where: 534 = Unit Conversion Factor
W = Weight loss, mg
D = Density of coupon, g/cm^3
A = Area of coupon, Sq in
T = Exposure time, hr
MPY = mils/year

2.0 **REFERENCES**

2.1 **Performance References**

A. SSP-2.09, "Records Management."

2.2 **Developmental References**

A. WBN CM Chapter 4.0, "Corrosion Control."

B. TI-27 Part III, "Cleaning and Cleanness of Fluid Systems and Components."

C. G-97A - Corrosion Control, Part A: General, Localized, and Galvanic Corrosion.

D. Nuclear Power Safety and Health Manual (NPSHM), Section VI-B.

E. WBN-VM 2808, Contract 91NNA-75954A, "Betz Industrial Vendor Manual for Injection Equipment, COSMOS, and Chemical Injection Control."[3]

2.3 Commitments

A. TVA response to NRC Generic Letter (GL) 89-13, Service Water System Problems Affecting Safety Related Equipment, memorandum L44 900126 804 dated January 26, 1990.

B. TVA response to NRC Office of Inspection and Enforcement Bulletin (IEB) 81-03, "Flow Blockage of Cooling Water to Safety System Components by Corbicula Sp. (Asiatic Clams)," memorandums T50 880906 937 dated September 9, 1988; A27 810722 023 dated July 21, 1981; and A27 830321 019 dated March 21, 1983.

3.0 PRECAUTIONS AND LIMITATIONS

A. Performance of some component inspections requires entry into confined spaces. NPSHM VI-B contains information and controls for entry into confined spaces.

4.0 PREREQUISITE ACTIONS

4.1 Preliminary Actions

None

5.0 ACCEPTANCE CRITERIA

A. Accumulation of corrosion product deposition should decrease noticeably after injecting pyrophosphate and copolymer for approximately 1 year.

B. The trend of clam infestation in the raw water systems should remain the same or decrease.

C. The following are target values for corrosion rates based on industry practice and are guidelines only.

1. Carbon steel corrosion rates should be <5 mils/year (mpy).

2. Copper and copper alloys should have corrosion rates which are <0.2 mpy.

3. 304 and 316 stainless steels should have corrosion rates which are $\leq$1 mpy.

6.0 PERFORMANCE

NOTE Sections 6.1 through 6.7 may be performed in any order and are performed only when appropriate.

6.1 Heat Exchanger Inspection

A select number of heat exchangers which are cooled by the raw water systems shall be inspected by a representative of the Chemistry Group for the presence of Asiatic clams/Zebra mussels, and slime to determine the effectiveness of the chemical treatment program. To determine the effectiveness of the chemical treatment program, it is essential that all inspections be performed before component cleaning.

Unless operational problems require a heat exchanger to be removed from service for maintenance, heat exchangers chosen for inspection should be from those scheduled for preventive maintenance or eddy current testing.

Individual steps in this section may be performed in any order.

[1] **COMPLETE** Appendix A for each heat exchanger inspection.

[2] **RECORD** a brief description of the work being performed on the heat exchanger and any Work Request (WR) numbers or Preventive Maintenance (PM) numbers under Work Description on Appendix A.

[3] **INSPECT** the heat exchanger for the presence of MIC, Asiatic clams, Zebra mussels, slime, silt, or any debris which could impair flow through the heat exchanger tubes. Operational problems, structural damage, and an estimate of the percentage of plugged tubes should also be noted under observations on Appendix A.

[4] **COMPARE** the condition and observations from the current inspection to the previous inspection if possible, and

RECORD the results on Appendix A.

[5] **COMMENT** on the effectiveness of the chemical treatment program to minimize MIC, clam/mussel infestation, and prevent slime buildup in the raw water systems, and

RECORD comments on Appendix A.

[6] **RECORD** any program recommendations on Appendix A.

6.1 Heat Exchanger Inspection (continued)

[7] **ROUTE** the completed Appendix A to the responsible Chemistry Supervisor.

NOTE 1 Photographs should be taken of the heat exchanger's As-Found condition and retained in the Chemistry Group files.

NOTE 2 Representative samples of material found to be impeding flow in the heat exchanger should be collected and preserved in a suitable medium for future analysis if required.

6.2 Condenser Circulating Water (CCW) System

The CCW system is capable of being chemically treated separately from the RCW, RSW, ERCW, and HPFP systems with its own pumping equipment; however, at present there are no plans to use this option. If equipment inspections indicate a problem with MIC, Asiatic clams, Zebra mussels, or slime deposits, then the need to chemically treat the CCW system will be reevaluated.

An inspection of the CCW conduits should be performed approximately every three years (to coincide with refueling outages) by the Mechanical Maintenance Group or System Engineering. Steps in this section may be completed in any order by Maintenance, System Engineering, or Chemistry as appropriate.

[1] **DETERMINE** if there is evidence of structural fatigue or damage.

[2] **DETERMINE** if there is any failure of construction joint water seals.

[3] **ASSESS** the level of clam/mussel infestation (Chemistry Group).

[4] **COMPLETE** Appendix B to document CCW conduit inspections.

[5] **ROUTE** the completed Appendix B to the Responsible Chemistry Supervisor.

6.3 Continuous Flow Self-Cleaning Strainers

Continuous flow self-cleaning strainers in the raw water systems should be inspected for damage and proper operation when taken out of service for maintenance. Steps in this section may be completed by Maintenance, System Engineering, or Chemistry as appropriate.

[1] **COMPLETE** Appendix C to document strainer inspections.

[2] **ROUTE** the completed Appendix C to the Responsible Chemistry Supervisor.

6.4 Weight Loss Corrosion Coupons

Various types of weight loss corrosion coupons are placed in side stream coupon racks to assist in determining the effectiveness of the chemical treatment program. The coupon racks are portable and are attached to the raw water systems at various locations throughout the plant. One coupon rack is located at the IPS on a sample stream of untreated river water. The remaining coupon racks which are mounted on raw water systems are used to collect data after chemically treating the water. Data is evaluated and used to determine relative corrosion rates of different metals with and without chemical treatment.

Coupons are routinely installed/replaced on an approximate 30 and 60 day schedule. Coupons are preweighed and catalogued when received by the vendor. Once coupons have been removed, they are returned to the vendor representative for analysis and reporting of results.

NOTE A vendor who is responsible for administering the corrosion coupon program may perform all steps in this section of the procedure.

6.4.1 Installing Weight Loss Corrosion Coupons

[1] **RECORD** the responsible vendor who is handling the coupons, coupon material, coupon identification number, desired duration of exposure time, date of coupon installation, and location on Appendix D.

NOTE The coupon identification number is stamped on new coupons and can be obtained from the vendor representative.

[2] **CLOSE** the raw water sample isolation valve supplying the coupon rack.

[3] **REMOVE** the coupon holder from the desired coupon rack.

[4] **FASTEN** the coupon to the holder using a teflon screw and nut.

CAUTION **Avoid touching the coupon with bare skin to prevent initial corrosion from bodily contamination.**

[5] **INSTALL** the coupon holder into the desired coupon rack.

[6] **IDENTIFY** the type of coupon metallurgy by hanging a marker tag on the end of the coupon holder.

[7] **OPEN** the raw water isolation valve to the desired coupon rack, and

ADJUST the flow to approximately 5 gpm by timing the rate at which a suitably sized container fills.

6.4.2 Removing Weight Loss Corrosion Coupons

[1] **CLOSE** the raw water isolation valve to the desired coupon rack at the scheduled frequency.

[2] **REMOVE** the desired coupon holder from the coupon rack.

[3] **REMOVE** the teflon screw and nut from the coupon holder, and

PLACE the coupon into either the original container or a clean plastic zip lock bag.

CAUTION **Avoid touching the coupon with bare skin to prevent damage from bodily contamination.**

[4] **RECORD** on Appendix D the date of coupon removal.

[5] **ROUTE** Appendix D to the Responsible Engineer for completion.

[6] **INSTALL** a new coupon in accordance with Step 6.4.1 if necessary.

6.4.3 Managing Results From Weight Loss Corrosion Coupons

[1] **RECORD** on Appendix D the weight loss of the coupon, the actual coupon exposure time, special observations or notes about the condition of the coupon, and the corrosion rate in mpy.

[2] **COMPARE** results from weight loss coupons to average results from corrators for the same time periods to ensure comparable results are obtained.

[3] **RECORD** corrosion rates obtained from corrators on Appendix D.

[4] IF differences greater than ± 20% exist, **THEN**

INVESTIGATE the operation of the corrators, and

REPLACE tips as necessary.

[3] IF the anomalies are still present, then work with the vendor, and

DETERMINE the reason for the differences.

[4] **DOCUMENT** problems, corrective actions, and if possible, results on Appendix D.

6.5 COSMOS Process Monitoring Corrosion Monitoring Station

COSMOS is a corrosion monitoring tool which employs the use of a thermally adjustable test heat exchanger, flow, pH, conductivity, corrators, and temperature instrumentation. These instruments are located inside of a "wet" cabinet. Probes from the wet cabinet are connected to a "dry" cabinet which contains the electrical portion of the system. The dry cabinet uses an IBM compatible computer to store up to 30 days worth of data. The data can be downloaded to a 5.25" floppy computer disk and used with LOTUS software to develop trend plots. The COSMOS unit is installed at the IPS and monitors untreated river water. Additional corrosion monitoring equipment is installed in the hypochlorite building and monitors either treated RCW or ERCW after circulating through the plant. The Responsible Chemical Engineer and/or responsible vendor will maintain COSMOS equipment by performing the following steps:

NOTE Individual steps may be performed out of order.

[1] **ENSURE** 115VAC power is connected to the COSMOS unit before placing it in service.

[2] **ENSURE** electrical connections between COSMOS cabinets are complete and tight.

[3] **ENSURE** all COSMOS instrument probes are installed and tight before pressurizing with water.

[4] **CONNECT** the sample stream to the inlet of the COSMOS wet cabinet, and

ROUTE the discharge hose to a drain.

NOTE COSMOS requires a sample stream of at least 5 gpm.

[5] **OPEN** the COSMOS discharge isolation valve, **THEN**

OPEN the supply isolation valve until a flow of approximately 5 gpm is achieved.

[6] **PLACE** the hot tester voltage control knob in the zero position.

[7] **PLACE** the COSMOS power switch in the ON position.

NOTE The switch will light and the instruments will begin reading. The computer will show that it is in the RUN MODE on its LCD display.

[8] **COLLECT** a sample of the discharge and analyze it for pH, conductivity, and temperature at a frequency designated by the Responsible Chemical Engineer.

[9] **COMPARE** the results from the grab sample to the COSMOS analyzer outputs.

6.5 COSMOS Process Monitoring Corrosion Monitoring Station (continued)

[10] IF the results differ by more than 10%, THEN

FOLLOW the instructions in the vendor manual or contact the vendor to recalibrate the instruments.

[11] PLACE the CORROSION SELECT switch in the AUTO position unless otherwise directed by the Responsible Chemical Engineer.

[12] SET the CORROSION RATE METER CYCLE time to 20 minutes, the range to 50, and the SAMPLE/INSTANTANEOUS/POLAR switch to SAMPLE.

[13] VERIFY that the corrator probe cables on the back of the meter are connected so that ANODIC is readable.

[14] ADJUST the hot tester voltage knob according to Responsible Chemical Engineer recommendations. This will increase the temperature of the test heat exchanger tube to simulate actual in plant conditions.

[15] INSTALL a preformatted, 5.25" floppy computer disk and PRESS the DISK DRIVE ALARM/MASTER RESET button to initiate operation of the computer disk drive. Data will be stored into the memory at a frequency prescribed by the Responsible Chemical Engineer.

[16] PRESS the PLC MEMORY DUMP button to download the data in memory to the floppy disk. This operation should be performed approximately once every 30 days by the Responsible Chemical Engineer.

6.6 As Found Visual Inspections Of Raw Water Systems

Visual inspections of raw water systems are performed in accordance with TI-27 Part III, by maintenance personnel when components are opened. Documentation of the inspections include information such as component identification, descriptions of materials of construction, presence of corrosion deposits, presence of clams, estimated pipe restrictions, etc.[1] Chemistry is contacted for further evaluation if pipe restrictions are estimated to be severe enough to adversely affect system operation or if clams are observed. Completed copies of the TI-27 Part III sheets are attached to the work document for record storage.

Chemistry also performs fiberoptic visual inspections on selected components which are documented on video tape. The video tapes are retained in the chemistry files and are used to determine where future inspections will be performed. It is desirable to inspect the same location several times during the year to look for changes in system conditions.

6.6 As Found Visual Inspections Of Raw Water Systems (continued)

[1] **INITIATE** WR as necessary to breach systems selected for inspection, and

RECORD WR number on Appendix E.

[2] **COMPLETE** Appendix E to document fiberoptic inspections.

NOTE Information such as severity of silt deposition, size and number of nodules, shape of nodules, smell, etc., should be included.

[3] **ROUTE** the completed Appendix E to the Responsible Chemistry Supervisor.

6.7 Data Assessment

Data obtained from visual inspections, side stream corrosion coupons, and chemical analysis will be evaluated and appropriate actions taken as necessary.

Assessing the accumulation of corrosion product deposition is an intuitive determination which can be made in part, by utilizing results from visual inspections. Estimations of effectiveness of nodule reductions can also be accomplished by comparison of untreated (supply) to treated (return) water chemistry (i.e., turbitity and iron).

[1] **IF** improvements in system condition are not acceptable, then chemical concentrations and flow through pipes should be evaluated for possible changes.

[2] **TREND** the instances of clam findings in a manner to correlate the number of findings with the number of inspections.

[3] **IF** the trend for clam findings is increasing, then the biocide treatment program should be re-evaluated to review the chemical residual concentrations, flushing procedures, and operating procedures to determine where changes to the program need to be made.

[4] **IF** target corrosion rates are not consistently achieved, then the chemical treatment program should be reviewed to determine if the chemical concentrations should be changed.

7.0 POST PERFORMANCE ACTIVITY

7.1 Asiatic Clam Findings

[1] IF Asiatic clams/Zebra mussels are observed while performing heat exchanger inspections, system flushes, or component inspections, **THEN**

COMPLETE Appendix F to document performance of an investigation to determine the extent of infestation.[2]

[2] **ROUTE** the completed Appendix F to the Responsible Chemistry Supervisor and a copy to the Responsible System Engineer.

8.0 RECORDS

8.1 QA Records

Appendixes A through F are QA records and are processed in accordance with SSP-2.09.

8.2 Non QA Records

None

APPENDIX A
Page 1 of 1

HEAT EXCHANGER INSPECTION REPORT

Heat Exchanger _____ Unit _____

Inspector(s) _____

1. Work description (include work instruction or package number):_____
_____
_____

2. Observations: _____
_____
_____
_____
_____
_____
_____
_____
_____

3. Comparison with previous inspection: _____
_____
_____
_____
_____
_____
_____
_____
_____

4. Effectiveness of chlorination program: _____
_____
_____
_____
_____

5. Recommendations: _____
_____
_____
_____
_____

_____/_____
Prepared By Date

_____/_____
Chemistry Supervisor Date

QA Record

1132Q

APPENDIX B
Page 1 of 1

CCW CONDUIT INSPECTION REPORT

Unit _____ Date of Inspection _____

Inspector(s) _____

1. Observations

a. Signs of structural fatigue or fractures in lining - description and relative location (System Engineer/Chemistry):_____

b. Signs of structural fatigue or failure of construction joint water seals - description and relative location (System Engineer/Chemisty):

c. Asiatic Clams/Zebra Mussels present (Chemistry):

1. Exposed _____, Embedded in silt _____
2. Alive _____, Dead (OPEN with flesh present) _____, Empty shells _____
3. Distribution in system is: even _____, concentrated in some areas _____ - describe areas and relative locations:_____

2. Comparison with previous inspections: _____

3. Recommendations: _____

_____ / _____
Prepared By Date

_____ / _____
Chemistry Supervisor Date

QA Record

APPENDIX C
Page 1 of 1

CONTINUOUS FLOW SELF-CLEANING STRAINER REPORT

Unit _____ Date of Inspection _____

Strainer Identification _____

Inspector(s) _____

1. Work description: _____

2. Observations: _____

3. Comparison with previous inspection: _____

4. Effectiveness of biocide treatment program: _____

5. Recommendations: _____

_____ / _____
Inspected By Date

_____ / _____
Chemistry Supervisor Date

QA Record

1132Q

APPENDIX D
Page 1 of 1

WEIGHT LOSS CORROSION COUPON LOG

Responsible Vendor:_____

Coupon Material:_____

Coupon Identification #:_____

Desired Duration Of Coupon Exposure:_____ days

Date Of Installation:_____

Date Of Removal:_____

Actual Exposure Duration:_____ days

Location: _____

Weight Loss:_____ grams

Coupon Corrosion Rate:_____ mpy

Corrator Corrosion Rate:_____ mpy

$$\% \text{ difference} = \frac{(\text{corrator corr. rate} - \text{coupon corr. rate})}{\text{coupon corr. rate}} * 100 = \_\_\_\_\_\%$$

Observations:_____

_____

_____

_____/_____
Completed By Date

_____/_____
Chemistry Supervisor Date

QA Record

APPENDIX E
Page 1 of 1

FIBEROPTIC VISUAL INSPECTIONS

1. Work Request Number for breach of system:_____

2. Date of Inspection: _____

3. System and component identification/location:_____

_____

_____

4. Detailed Observations (silt, nodules, smell, relative restruction, etc.):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Comments_____

_____

_____

_____ /_____
Inspected By Date

_____ /_____
Chemistry Supervisor Date

QA Record

1132Q_____

APPENDIX F
Page 1 of 2

SYSTEM CONDITION INVESTIGATION

1. Identification of system being investigated: _____

2. Approximate location of Asiatic clam/Zebra mussel infestation in the system:

_____

_____

_____

_____

_____

_____

3. Approximate number and size of Asiatic clams/Zebra mussels observed in system:

_____

_____

_____

_____

4. Date Asiatic clams/Zebra mussels discovered in the system. _____

5. **DESCRIBE** the work activities taking place on the system which led to the discovery of infestation.

_____

_____

_____

_____

_____

QA Record

APPENDIX F
Page 2 of 2

6. **DESCRIBE** any recommended corrective actions required to return the system to an acceptable condition. **LIST** any Work Requests (WRs) or other work instructions that will be used to implement the corrective actions.

7. **DESCRIBE** activities required to verify that corrective actions were satisfactory.

_____ / _____
Completed By Date

_____ / _____
Chemistry Supervisor Date

QA Record

SOURCE NOTES

Page 1 of 1

SOURCE NOTE	SOURCE DOCUMENT	SUMMARY
1	TVA response to NRC Generic Letter (GL) 89-13	Raw Water Fouling
2	TVA response to NRC Office of Inspection and Enforcement Bulletin (IEB) 81-03	Asiatic Clam Control
3	WBPER 940298 R1	Vendor Manuals

Historical Record Copy

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

CHEMISTRY MANUAL

CHAPTER 4.02

STARTUP AND NORMAL OPERATION OF THE PYROPHOSPHATE, ZINC, AND COPOLYMER EQUIPMENT

Revision 5

Unit 0

QUALITY RELATED

PREPARED BY: J. Keith Riggle
(Type Name)

SPONSORING ORGANIZATION: Chemistry

APPROVED BY: [signature] DATE: 8/24/94

EFFECTIVE DATE: 9/9/94

LEVEL OF USE: REFERENCE

REVISION LOG

REVISION OR CHANGE NUMBER	EFFECTIVE DATE	AFFECTED PAGE NUMBERS	DESCRIPTION OF REVISION/CHANGE
Rev 0	10/12/92	All	New instruction.
Rev 1	3/29/93	All	Provide for more definitive acceptance criteria and better describe actions to be taken based on data trends. Provide action statement for obtaining ERCW/RCW samples following initiation of chemical addition.
Rev 2	10/23/93	All	Revised to permit operation of the dilution water line with 0-FCV-050-0748, 0749 replaced by manual valves. Added Appendix E to record dilution water flow.
Rev 3	3/22/94	3,4,5,6,12,13	Revise Section 1.3 to clarify what is meant by "continuous injection." Add a reference for the November Betz monthly report. Correct minor errors. Add precaution "H" to define the minimum chemical ratios needed to prevent precipitation of zinc phosphate. Add Precaution "I" to define dilution water requirements. Revise the scope of the procedure to include inspection and troubleshooting of the chemical addition equipment. Remove actions for personnel safety from the precautions section and reference the MSDS. Revise Section 5.0 to define target chemical concentrations in the plant. Revise Section 7.0 to perform annual assessments of program effectiveness.
Rev 4	6/21/94	5, 19	• This revision is required by QA in order to close WBPER930332.
Rev 5	9/9/94	4, 19	• Add sourcenote for WBPER940298, R1, regarding the use of vendor manuals. • Change VTD to VM in reference to Betz vendor manuals.

1.0 INTRODUCTION

A raw water chemical treatment program designed to remove existing corrosion products and reduce future corrosion rates has been installed at Watts Bar Nuclear Plant (WBN). The program elements include continuously injecting a pyrophosphate solution into all raw water systems at WBN to sequester iron from existing mounds of corrosion products thus facilitating removal of deposits by the water normally flowing through the systems. Zinc sulfate will be injected into the raw water systems on a continuous basis to provide a mild steel corrosion inhibitor. The purpose of adding a zinc sulfate solution is to reduce the corrosion rates of mild steel. A copolymer will also be injected into the raw water systems on a continuous basis to act as a dispersant to keep solids in suspension, thus reducing accumulations of silt and rust.

Three flow controllers, located in the Intake Pumping Station (IPS), are used to determine which raw water pumps are in service and to provide an estimate of the flow leaving each IPS pit. Data from the flow controllers is sent to the Pacesetter computer controllers located in the Raw Water Corrosion Monitoring building located in front of the IPS. The Pacesetter computer controllers automatically adjust the individual chemical drawdown pumps based on the flow leaving the IPS. Automatic flow control valves (FCV) are located on the chemical injection lines to the IPS and are controlled by signals sent from the flow controllers. If the FCVs become inoperable, then they can be replaced with manual throttle valves and the system allowed to remain in service. There is one Pacesetter computer controller and drawdown pump module for each of the three chemical tanks. All chemical tanks, pumps, and controls are installed at the IPS. The pyrophosphate and zinc sulfate are each contained in separate 6,000 gallon tanks and the copolymer is contained in a 4,000 gallon tank.

1.1 Purpose

This instruction explains the actions necessary to operate the pyrophosphate, zinc sulfate, and copolymer injection equipment.

1.2 Scope

This instruction delineates the actions necessary to operate, inspect, and troubleshoot the pyrophosphate, zinc sulfate, and copolymer portion of the raw water chemical treatment skid. Bulk chemical receipt instructions are given for each of the above chemicals.

1.3 Frequency and Conditions

A. Pyrophosphate, zinc sulfate, and copolymer injection will be performed on a continuous, year round basis. Exceptions for maintenance, troubleshooting, and addition of other chemicals are allowed on a case-by-case basis. Outages which last greater than 14 consecutive days will be evaluated for impact on the goals of the raw water corrosion control program and documentation retained in the Chemistry Group Files.

B. The frequency for routine sample analysis to verify chemical concentrations throughout the plant will be determined by the Chemistry Supervisor.

2.0 REFERENCES

2.1 Performance References

A. WBN ECM Chapter 3, "National Pollutant Discharge Elimination System (NPDES) Permit."

B. SSP-2.09, "Records Management."

2.2 Developmental References

A. WBN CM Chapter 4.0, "Corrosion Control."

B. Manual WBN-VM-2807, Revision 0, Contract 91NNA-75954A, "Betz Pacesetter Model C Configuration Software Instruction and Operating Manual."[3]

C. Manual WB-VM-2808, Revision 0, Contract 91NNA-7595A, "Betz Industrial Vendor Manual for Injection Equipment, COSMOS, and Chemical Injection Control."[3]

D. Memorandum (L75 910513 800) to P. Simmons from M. P. Schmierbach dated May 8, 1991.

E. November Monthly Report for Raw Water Treatment Program from Betz Industrial to David Voeller, dated December 10, 1993.

2.3 Commitments

None

3.0 PRECAUTIONS AND LIMITATIONS

A. Chemicals used by this instruction are irritating to the skin, eyes, and upper respiratory tract.

B. The MSDS for pyrophosphate is listed as "Betz Inhibitor 30K-30656" and contains the necessary safety precautions.

3.0 PRECAUTIONS AND LIMITATIONS (continued)

C. The MSDS for zinc sulfate is listed as "Powerline Inhibitor (TVA-07)" and contains the necessary safety precautions.

D. The MSDS for copolymer is listed as "Powerline TVA-06" and contains the necessary safety precautions.

E. The letter of agreement with the state of Tennessee indicates that the release of pyrophosphate (Betz 30K) at the diffuser discharge is expected not to exceed 0.2 ppm as total P.

F. The letter of agreement with the state of Tennessee indicates that the release of zinc sulfate (Betz TVA-07) is anticipated to be maintained at 0.2 ppm zinc.

G. The letter of agreement with the state of Tennessee indicates that the release of copolymer (Betz TVA-06) is anticipated to be kept at 0.2 ppm as active product.

H. The following chemical ratios[1,2] are needed as a minimum to prevent precipitation of zinc phosphate:

1. 1:1 ratio of copolymer:zinc sulfate
2. 1:2 ratio of copolymer:pyrophosphate

I. The minimum acceptable dilution water flowrate is 50 gpm.

4.0 PREREQUISITE ACTIONS

4.1 Preliminary Actions

[1] **ENSURE** dilution water is flowing prior to energizing chemical injection pumps.

NOTE The minimum acceptable flow is 50 gpm (total).

[2] **ENSURE** an adequate supply of pyrophosphate, zinc sulfate, and copolymer is in the storage tanks prior to initiating chemical injection.

NOTE Each tank has an externally mounted level gauge.

[3] **VERIFY** that the safety shower/eyewash is operable or a portable eyewash unit is available and fully charged.

[4] **REQUEST** the Responsible Engineer to determine the desired in-plant concentrations and estimated ending date of pyrophosphate, zinc, and copolymer, **AND**

RECORD the concentrations on Appendix A.

4.1 Preliminary Actions (Continued)

[5] **PLACE** Appendix A beside the pacesetter computer controllers inside of the IPS corrosion monitoring building.

[6] **COMPLETE** a new Appendix A sheet after reaching the estimated ending date or if changes are needed prior to the estimated ending date.

[7] **ROUTE** expired Appendix A forms to the Responsible Engineer for data management and filing.

4.2 Approvals and Notifications

[1] **NOTIFY** the Shift Operations Supervisor (SOS) prior to placing the chemical injection system in service.

5.0 ACCEPTANCE CRITERIA

Concentrations for phosphate, zinc, and copolymer in the plant systems are determined by the Responsible Engineer and injection rates are documented on Appendix A.

Target concentrations to be maintained throughout the plant are summarized below:

Pyrophosphate: 0.2 - 0.3 ppm as Total P
Zinc Sulfate : 0.15 - 0.25 ppm as Zinc

6.0 PERFORMANCE

6.1 Equipment Startup and Normal Operation

[1] **VERIFY** power is ON, **AND**

PRESS the DISPLAY button on flow controllers 0-FC-050-0707, 0708, and 0709 to obtain a digital readout of water flow out of the IPS.

NOTE The Pit A essential raw cooling water (ERCW) flow controller is located in the IPS Pit A ERCW strainer room. The Pit B ERCW flow controller is located in the IPS Pit B ERCW strainer room. The raw cooling water (RCW) flow controller/flow totalizer is located in the electrical equipment room downstairs in the IPS (RCW sample points are also located in this room).

6.1 Equipment Startup and Normal Operation (Continued)

[2] **OBSERVE** the illuminated PUMP STATUS lights on flow controllers 0-FC-050-0707, 0708, and 0709 to determine which IPS pumps are in service.

NOTE 0-FC-050-0707 indicates IPS pit B ERCW and high pressure fire protection (HPFP) pump status.
0-FC-050-0708 indicates IPS pit A ERCW and HPFP pump status.
0-FC-050-0709 indicates IPS pit A and pit B RCW pump status and total IPS flow.

[3] **RECORD** the date, time, and number of ERCW, RCW, or HPFP pumps in service for each IPS pit on Appendix B.

[4] **RECORD** the total IPS flow from flow controller 0-FC-050-709 on Appendix B.

[5] **OBSERVE** the alarm status lights on flow controllers 0-FC-050-0707,0708, and 0709, **AND**

IF any alarm status light is on, **THEN**

CONTACT the Responsible Engineer or Chemistry Supervisor immediately.

NOTE The Responsible Engineer or Chemistry Supervisor will try to determine the cause of the alarm and take the appropriate corrective actions. Corrective actions may include terminating power, initiating work requests, or contacting the Betz representative.

[6] **PLACE** the dilution water supply line in service by OPENING the following valves:

IPS pit A throttle valve (see note below)	0-050-0748
IPS pit B throttle valve (see note below)	0-050-0749
Dilution water supply throttle valve	0-THV-050-0722
IPS pit A supply isolation valve	0-ISV-050-0746
IPS pit B supply isolation valve	0-ISV-050-0747
IPS pit A, line 1A-A throttle valve	0-THV-050-0752
IPS pit A, line 2A-A throttle valve	0-THV-050-0764
IPS pit B, line 1B-B throttle valve	0-THV-050-0753
IPS pit B, line 2B-B throttle valve	0-THV-050-0742

NOTE Manual operation of these valves is only applicable if the normal FCVs have been replaced with manual valves.

6.1 Equipment Startup and Normal Operation (continued)

[7] **OPEN** the following chemical tank level gauge root valves:

Tank A: 0-RTV-050-0810A, 0-RTV-050-0811A, 0-RTV-050-811B
Tank B: 0-RTV-050-0815A, 0-RTV-050-0816A, 0-RTV-050-816B
Tank C: 0-RTV-050-0820A, 0-RTV-050-0821A, 0-RTV-050-821B

[8] **OBSERVE** the level in each chemical tank to verify a sufficient quantity of chemical is available prior to initiating chemical injection.

[9] **OPEN** chemical tank A isolation valves 0-ISV-050-0727, 0-ISV-050-0814, and pump discharge isolation valve 0-ISV-050-0728 to prepare for pyrophosphate injection.

[10] **OPEN** chemical tank B isolation valves 0-ISV-050-0732, 0-ISV-050-0819, and pump discharge isolation valve 0-ISV-050-0734 to prepare for zinc sulfate injection.

[11] **OPEN** chemical tank C isolation valves 0-ISV-050-0736, 0-ISV-050-0824, and pump discharge isolation valve 0-ISV-050-0738 to prepare for copolymer injection.

[12] **OPEN** the front door to each drawdown pump module located on the southwest end of tanks A, B, and C, **AND**

VERIFY that the knob on the front of the solenoid valve is aligned in the vertical position.

[13] **CLOSE** the front door to each drawdown pump module after verifying solenoid valve position.

[14] **TURN** on power to the desired Pacesetter computer control module located inside of the IPS corrosion monitoring building. The pump stroke light will begin to flash if the primary signal is being received.

NOTE There is one Pacesetter computer control module for each tank A, B, and C. Normal pacesetter operation is in automatic CPU control. Detailed instructions for placing the pacesetters in automatic or manual control are given in the approved vendor manual.

[15] **IF** the pump stroke light does not flash when the Pacesetter computer control module is turned on, **THEN**

CONTACT the Responsible Engineer immediately.

NOTE The Responsible Engineer or Chemistry Supervisor will try to determine the cause for the problem and take the appropriate corrective actions. Corrective actions may include terminating power, initiating work requests, or contacting the Betz representative.

6.1 Equipment Startup and Normal Operation (continued)

[16] IF a pacesetter requires a different set concentration, THEN

PRESS the "Advance Display" button, followed by pressing ENTER.

[17] ADJUST the setpoint by rotating the knob on the front of each pacesetter clockwise to increase or counter clockwise to decrease to achieve the desired concentration entered on Appendix A.

[18] PRESS "ESC" on the front of the pacesetter to return to the normal display screen.

[19] RECORD the date, time, and pacesetter average concentration on Appendix C.

[20] REPEAT Steps [14] through [19] to place the remaining chemical tanks/pumps in service.

[21] COLLECT a sample of either U-1 or U-2 ERCW and/or RCW at the Hypochlorite Building after the Pacesetter pumps have been in service at least one hour. Samples should be collected from the sample valves listed below:

U-1 ERCW: 1-ISV-050-0765	U-2 ERCW: 2-ISV-050-0760
U-1 RCW : 1-ISV-050-0762	U-2 RCW : 2-ISV-050-0762

[22] ANALYZE the samples for total phosphorus and zinc, AND

RECORD the results on Appendix C.

[23] CONTINUE routine sampling at a frequency determined by the Chemistry Supervisor.

[24] ROUTE completed Appendix C forms to the Chemistry Supervisor for review and processing.

6.2 Equipment Shutdown

[1] TURN off power to the desired Pacesetter computer by placing the red "ON/OFF" switch in the OFF position.

6.3 Receiving Bulk Chemicals

[1] VERIFY chemical dike drain valves 0-DRV-050-0826 and 0827 are CLOSED.

6.3 Receiving Bulk Chemicals (Continued)

[2] **VERIFY** the following level gauge root valves are OPEN:

Tank A: 0-RTV-050-0810A, 0-RTV-050-0811A
Tank B: 0-RTV-050-0815A, 0-RTV-050-0816A
Tank C: 0-RTV-050-0820A, 0-RTV-050-0821A

[3] **VERIFY** the level guages are clean enough to easily read.

[4] **READ** the initial tank level, **AND**

RECORD the results on Appendix D for the tank read.

[5] **VERIFY** that the tanker is connected to the correct chemical storage tank.

Tank A: pyrophosphate (Betz 30K)
Tank B: zinc sulfate (TVA 07)
Tank C: copolymer (TVA 06)

[6] **OPEN** the following chemical fill line isolation valves for the tank being filled:

Tank A: 0-ISV-050-0813 and 0-ISV-050-0812
Tank B: 0-ISV-050-0818 and 0-ISV-050-0817
Tank C: 0-ISV-050-0823 and 0-ISV-050-0822

[7] **INITIATE** tanker off-loading to chemical tanks.

[8] **CLOSE** the appropriate chemical fill line isolation valves after the tank has been filled:

Tank A: 0-ISV-050-0813 and 0-ISV-050-0812
Tank B: 0-ISV-050-0818 and 0-ISV-050-0817
Tank C: 0-ISV-050-0823 and 0-ISV-050-0822

[9] **RECORD** the date and final tank level on Appendix D.

[10] **ROUTE** completed Appendix D forms to the Responsible Engineer for review and filing.

6.4 **Walkdown Inspection Criteria/Troubleshooting Problems**

NOTE Detailed troubleshooting guidelines are given in the Betz Industrial vendor manual for contract #91NNA-75954A.

[1] **PERFORM** a system walkdown daily to verify satisfactory operation and identify problems as they occur.

[2] **OBSERVE** IPS flow controllers 0-FC-050-0707, 0708, and 0709 to verify that pumps status lights are working, flow is displayed, and alarm status lights are off.

6.4 Walkdown Inspection Criteria/Troubleshooting Problems (Continued)

[3] IF the flow controllers are displaying an alarm condition or any other problem, THEN

CONTACT the Responsible Engineer.

[4] OPEN the door to each chemical pump box and look inside for signs of leakage, THEN

CLOSE the door, AND

CONTACT the Responsible Engineer if leaks are observed.

[5] OBSERVE each pacesetter controller for the following conditions:

CPU Light

[a] IF the amber CPU light is ON, THEN

VERIFY that the drawdown correction lights indicate a less than 20% correction factor.

[b] IF the correction factor is greater than 20%, THEN

TURN the pacesetter OFF.

[c] MAKE an appropriate entry in the chemical log journal, AND

NOTIFY the Responsible Engineer.

Pacesetter Alarms

[a] IF the pacesetter display showns "Pump Alarm" or "*DDA?", THEN

PUSH the "reset" button on the electrical outlet recepticle in the back of the corresponding pump box outside.

[b] TURN the pacesetter OFF then back ON, AND

WAIT 5 minutes.

[c] IF the condition persists, THEN

TURN the pacesetter OFF.

6.4 Walkdown Inspection Criteria/Troubleshooting Problems (Continued)

[d] **MAKE** an appropriate entry in the chemical log journal, **AND**

NOTIFY the Responsible Engineer.

[6] **TOUCH** the top metal portion of 0-FCV-050-0748, 0749 located inside of the IPS chemical corrosion control building.

[7] **IF** the motor feels hot or is vibrating, the valve is in a bind, **THEN**

PLACE breaker #2 in the OFF position.

NOTE Breaker #2 is located in lighting panel 0-LAC-233-100 inside of the chemical corrosion control building at the IPS.

[8] **PLACE** the breaker back in the ON position to reenergize the valve.

[9] **IF** the valve is still binding, **THEN**

PLACE the breaker in the OFF position, **AND**

CONTACT the Responsible Engineer.

[10] **IF** the actions in Step [9] result in no dilution water in service to either IPS pit, **THEN**

TURN all three pacesetter controllers OFF.

[11] **RECORD** appropriate entries in the chemical log journal, **AND**

CONTACT the Responsible Engineer.

[12] **OBSERVE** the flow reading on the blue COSMOS cabinet.

[13] **IF** the display is showing 0 gpm, **THEN**

PUSH the "start" button (0-HS-50-802) on 0-JB-299-5881 which is located outside near the safety shower.

NOTE This should restart the river sample pump.

[14] **OBSERVE** the COSMOS flow reading again to determine if the sample pump is working properly.

6.4 **Walkdown Inspection Criteria/Troubleshooting Problems** (Continued)

[15] **IF** the flow is still not obtained, **THEN**

PUSH the "Stop" button (0-HS-50-802) on 0-JB-299-5881, **AND**

NOTIFY the Responsible Engineer.

[16] **RECORD** dilution water flow rates on Appendix E.

7.0 **POST PERFORMANCE ACTIVITY**

A. If walkdown inspections require notification of the Responsible Engineer to troubleshoot problems, then the Responsible Engineer or Chemistry Supervisor will try to determine the exact cause for the problem and take appropriate corrective actions. Corrective actions may include terminating power, initiating work requests, or contacting the Betz representative for additional assistance.

B. Annual assessments should be performed to document the effectiveness of the chemical treatment program on MIC, corrosion rates, fouling, etc. Programmatic changes should be recommended as necessary based on the results of each assessment.

8.0 **RECORDS**

8.1 **QA Records**

Appendix C is a QA record and is processed in accordance with SSP-2.09.

8.2 **Non QA Records**

Appendixes A, B, D, and E are Non-QA records.

APPENDIX A
Page 1 of 1

APPROVED CHEMICAL INJECTION RATES

Betz 30K (Pyrophosphate): _____ ppm

Betz TVA-07 (Zinc Sulfate): _____ ppm

Betz TVA-06 (Copolymer): _____ ppm

Beginning Date: _____

Estimated Ending Date: _____

Actual Ending Date : _____

Comments: _____

_____

_____

_____

_____

_____ / _____
Responsible Engineer Date

APPENDIX B
Page 1 of 1

IPS PUMP STATUS LOG

DATE	TIME	IPS PIT A			IPS PIT B			TOTAL FLOW	INITIALS
		NUMBER ERCW PUMPS I/S 0-FC-050-0708	NUMBER RCW PUMPS I/S 0-FC-050-0709	NUMBER HPFP PUMPS I/S 0-FC-050-0708	NUMBER ERCW PUMPS I/S 0-FC-050-0707	NUMBER RCW PUMPS I/S 0-FC-050-709	NUMBER HPFP PUMPS I/S 0-FC-050-0707	0-FC-050-709	

Responsible Engineer / Date

CHEMICAL CONCENTRATION LOG

DATE	TIME	PACESETTER AVERAGE CONCENTRATIONS 30K (PPM)	TVA-07 (PPM)	TVA-06 (PPM)	SAMPLE IDENTIFICATION	ERCW CONCENTRATIONS UNIT 1 OR 2	TOTAL P (PPM)	ZINC (PPM)	SAMPLE IDENTIFICATION	RCW CONCENTRATIONS UNIT 1 OR 2	TOTAL P (PPM)	ZINC (PPM)	INITIALS

/
Chemistry Supervisor Date

QA Record

APPENDIX D
Page 1 of 1

CHEMICAL RECEIPT LOG

DATE	TANK A PYROPHOSPHATE (BETZ 30K) (GAL) INITIAL	FINAL	TANK B ZINC SULFATE (BETZ TVA 07) (GAL) INITIAL	FINAL	TANK C COPOLYMER (BETZ TVA 06) (GAL) INITIAL	FINAL	ANALYST INITIALS

/
Responsible Engineer Date

APPENDIX E
Page 1 of 1

DILUTION WATER FLOW

DATE	0-FMT-050-0723 GPM	0-FMT-050-0750 GPM	0-FMT-050-0751 GPM	0-FMT-050-0754 GPM	0-FMT-050-0730 GPM	0-FMT-050-0755 GPM	0-FMT-050-0756 GPM

SOURCE NOTES

Page 1 of 1

NOTE	SOURCE DOCUMENT	SUMMARY
1	Betz letter to R. N. Cutcher from J. Fulgham dated November 30, 1993, (conclusion) (T50 940606 992)	Deposition in Chemical Dilution Water Line
2	WBPER930332, Revision 1	Chemical ratios.
3	WBPER940298, Revision 1	Vendor manuals.

Historical Record Copy

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

CHEMISTRY MANUAL

CHAPTER 4.03

COPPER-TROL INJECTION FOR REDUCTION OF COPPER CORROSION RATES

Revision 2

Unit 0

QUALITY RELATED

PREPARED BY: Charles L. Stewart
(Type Name)

SPONSORING ORGANIZATION: Chemistry

APPROVED BY: [signature] DATE: 9/14/94

EFFECTIVE DATE: 9/23/94

LEVEL OF USE: INFORMATION

REVISION LOG

REVISION OR CHANGE NUMBER	EFFECTIVE DATE	AFFECTED PAGE NUMBERS	DESCRIPTION OF REVISION/CHANGE
Rev 0	11/15/92	All	New instruction.
CN-1	02/08/94	All	Revise to replace "55-gallon drum" to allow use of other containers as necessary. Revise to prime the chemical addition pump with water instead of Copper-Trol.
Rev 1	3/30/94	All	Incorporate CN-1. Revise to add more detailed provisions for chemical addition at alternate locations. This was a corrective action for WBPER930307. Add Appendix B to document steps taken to add CU-1 at alternate locations.
Rev 2	9/23/94	All	Include diffuser sampling, make IPS sampling optional, address handling of equipment upon completion of injection at alternate locations, address identification of sample locations used to verify chemical concentrations obtained.

1.0 INTRODUCTION

Butyl Benzotriazole (Copper-Trol) is a corrosion inhibitor which is periodically injected into the raw water systems to reduce copper corrosion rates. Most of the heat exchangers cooled by the raw water systems are constructed with copper or copper alloy tubes. Copper-Trol is shipped in portable 55-gallon drums. The primary point of chemical injection will be at the intake pumping station (IPS). When injecting Copper-Trol at the IPS, Copper-Trol containers will be located inside of the corrosion control chemical containment dike near the designated injection pump and plumbing. Copper-Trol may be injected on a targeted basis at locations other than the IPS at the Chemistry Supervisor's discretion.1 Under these circumstances only applicable portions of this Instruction should be used.

1.1 Purpose

This Instruction describes the necessary actions to operate the permanently installed Copper-Trol injection equipment and provides guidance for additions at alternate locations.1

1.2 Scope

This Instruction provides the necessary requirements and actions for injecting Copper-Trol into the various raw water systems.

1.3 Frequency and Conditions

Copper-Trol will be injected into the copper bearing raw water systems on an as needed basis. Results from corrosion monitoring instruments will be used to determine the need for copper corrosion inhibitors.

2.0 REFERENCES

2.1 Performance References

A. CM Chapter 4.01, "Visual Inspections and Corrosion Monitoring."

B. CM Chapter 4.02, "Startup and Normal Operation of the Pyrophosphate, Zinc, and Copolymer Equipment."

C. CM Chapter 4.04, "BCDMH Injection for Control of Clams, Slime, and MIC."

D. CM Chapter 8.0, "Laboratory Operations."

2.2 Developmental References

A. CM Chapter 4.0, "Corrosion Control."

B. ECM Chapter 3, "National Pollutant Discharge Elimination System (NPDES) Permit."

C. Memorandum (L75 910513 800) from M. P. Schmierbach to P. Simmons dated May 8, 1991.

2.3 Commitments

None

3.0 PRECAUTIONS AND LIMITATIONS

A. The letter of agreement with the state of Tennessee limits the release of Copper-Trol to <5.0 ppm as active product.

[1] **ENSURE** the Bromo Chloro Dimethyl Hydantoin (BCDMH), pyrophosphate (Betz 30K), zinc sulfate (Betz TVA-07), and copolymer (Betz TVA-06) injection pumps are OFF and ISOLATED.

[2] **VERIFY** that both diffuser discharge valves 0-FCV-027-100, 101, are CLOSED and all flow is routed to the yard holding pond (YHP) prior to initiating chemical feed.

[3] **REFER** to the material safety data sheet for Copper-Trol for applicable safety requirements. Copper-Trol is a caustic chemical.

4.0 PREQUISITE ACTIONS

4.1 Preliminary Actions

NOTE Steps in this section may be performed in any sequence.

[1] **VERIFY** that the BCDMH skid is not in service prior to energizing the chemical injection pump.

[2] **VERIFY** that the safety shower/eyewash is operable or a portable eyewash unit is available and fully charged.

[3] **IDENTIFY** any necessary sample points (other than IPS), **AND**

RECORD on Appendix A.

[4] **RECORD** the total quantity of Copper-Trol to be pumped on Appendix A.

NOTE A Chemistry Supervisor or designee is responsible for determining the quantity to be used.

4.1 Preliminary Actions (Continued)

[5] **ENSURE** an adequate quantity of Copper-Trol is at the addition point prior to performing any steps in the performance section of this Instruction.

[6] **VERIFY** the Copper-Trol containers are properly labeled and stored.

[7] **REQUEST** a Chemistry Supervisor or designee to determine the desired chemical concentration/pumping duration, **AND**

RECORD the concentration/duration on Appendix A.

[8] **REQUEST** a Chemistry Supervisor or designee to determine, **AND**

RECORD on Appendix A the required pump stroke (stroke may be varied during pumping if determined necessary to achieve correct flow).

NOTE Step [9] is only applicable when using the permanently installed addition system.

[9] **VERIFY** the dilution water line is in service prior to initiating chemical feed.

4.2 Approvals and Notifications

[1] **NOTIFY** the Shift Operations Supervisor (SOS) prior to placing the Copper-Trol injection equipment in service.

[2] **REQUEST** Operations to close the diffuser discharge valves (0-FCV-27-100, 101), **AND**

ROUTE cooling tower blowdown flow to the YHP for the duration of chemical injection.

5.0 ACCEPTANCE CRITERIA

A. The concentration of Copper-Trol at the injection point should be in accordance with the approved value on a completed Appendix A.

B. The duration of chemical injection should be in accordance with the approved value on a completed Appendix A.

C. Corrosion rates as monitored in CM Chapter 4.01 for copper and 90-10 Copper-Nickel alloys should be maintained <0.2 mils/year (mpy).

6.0 PERFORMANCE

6.1 Equipment Startup and Normal Operation at the IPS Using the Permanently Installed System

NOTE If IPS sample is to be taken, personnel should be stationed at the IPS to collect samples in accordance with Section 6.4 prior to initiating chemical addition.

[1] IF the pyrophosphate, zinc sulfate, copolymer, or BCDMH injection equipment is in service, **THEN**

TERMINATE its operation according to the equipment shutdown section in CM Chapters 4.02 and 4.04 respectively.

[2] **VERIFY** power is ON, **AND**

OBTAIN a digital readout of water flow into the IPS from flow controllers 0-FC-050-0707, 0708, and 0709.

NOTE The Pit A essential raw cooling water (ERCW) flow controller is located in the IPS Pit A ERCW strainer room. The Pit B ERCW flow controller is located in the IPS Pit B ERCW strainer room. The raw cooling water (RCW) flow controller/flow totalizer is located in the electrical equipment room downstairs in the IPS (RCW sample points are also located in this room).

[3] **OBSERVE** the illuminated PUMP STATUS lights on flow controllers 0-FC-050-0707, 0708, and 0709 to determine which IPS pumps are in service.

NOTE 0-FC-050-0707 indicates IPS pit B ERCW and high pressure fire protection (HPFP) pump status.
0-FC-050-0708 indicates IPS pit A ERCW and HPFP pump status.
0-FC-050-0709 indicates IPS pit A and pit B RCW pump status and total IPS flow.

[4] **OBSERVE** the alarm status lights on flow controllers 0-FC-050-0707,0708, and 0709, **AND**

IF any alarm status light is on, **THEN**

CONTACT the responsible individual immediately.

[5] **RECORD** on Appendix A the date and total IPS flow.

[6] **VERIFY** that both Diffuser Discharge Valves 0-ISV-027-100, and 101 are CLOSED and all flow is routed to the YHP.

6.1 Equipment Startup and Normal Operation at the IPS Using the Permanently Installed System (continued)

[7] INITIAL on Appendix A signifying that the diffuser discharge valves are CLOSED and all flow is routed to the YHP.

[8] CLOSE 0-ISV-050-0805.

[9] OPEN the following valves to initiate dilution water flow:

Dilution water supply throttle valve	0-THV-050-0722
IPS pit A supply isolation valve	0-ISV-050-0746
IPS pit B supply isolation valve	0-ISV-050-0747
IPS pit A, line 1A-A throttle valve	0-THV-050-0752
IPS pit A, line 2A-A throttle valve	0-THV-050-0764
IPS pit B, line 1B-B throttle valve	0-THV-050-0753
IPS pit B, line 2B-B throttle valve	0-THV-050-0742

[10] VERIFY dilution water flow, AND

INITIAL on Appendix A.

[11] PRIME the pump by loosening the pump vent plugs, AND

POUR water into the suction hose until the water begins to flow, AND

TAKE appropriate actions to clean up any solution that spills onto the floor.

CAUTION **The pump will be damaged if not properly vented.**

[12] TIGHTEN the pump vent plugs after venting the air out of the pumping chamber.

[13] SET the pump stroke according to the settings obtained from a Chemistry Supervisor or designee.

[14] CONNECT the Copper-Trol pump suction line to the first Copper-Trol chemical drum.

[15] VERIFY the following valve alignment prior to energizing the Copper-Trol chemical injection pump:

Copper-Trol pmp suction isolation valve	0-ISV-050-0743	Open
Copper-Trol pmp discharge isolation valve	0-ISV-050-0825	Open
Copper-Trol pmp discharge isolation valve	0-ISV-050-0826	Open
Drain line isolation valve	0-ISV-050-0807	Closed
Copper-Trol discharge header isolation valve	0-ISV-050-0745	Open

6.1 Equipment Startup and Normal Operation at the IPS Using the Permanently Installed System (continued)

[16] ENERGIZE the pump, AND

RECORD pump start time on Appendix A.

[17] PUMP the contents of the containers into the IPS, THEN

TURN the pump OFF, AND

CLOSE the pump suction line isolation valve 0-ISV-050-0743.

CAUTION Do not let the pump operate without an adequate supply of Copper-Trol. Operating the pump with a dry pumping chamber will damage the pump.

[18] RECORD on Appendix A the time at which the contents of the containers were pumped into the raw water systems (pump finish time).

[19] ROUTE the completed Appendix A to the responsible individual for review and filing.

6.2 Chemical Injection at Alternate Locations[1]

NOTE The pump vent pipe next to each ERCW and RCW pump at the IPS is an excellent location for targeting ERCW and RCW systems for treatment.

[1] CONTACT the Chemistry Supervisor or designee to determine the required quantity of Copper-Trol required for the specific application.

_____gallons

[2] OBTAIN the required amount of Copper-Trol in suitable containers, AND

LABEL the containers appropriately.

[3] TRANSPORT the containers to the desired location.

[4] OBTAIN necessary equipment such as portable pumps, hoses, extension cords, ground fault circuit interrupters, etc., to facilitate chemical addition.

[5] DOCUMENT on Appendix B a description of the alternate feed point and other activities necessary to adequately document performance of this Instruction.

6.2 Chemical Injection at Alternate Locations[1] (Continued)

[6] **INJECT** the Copper-Trol corrosion inhibitor as directed by the Chemistry Supervisor or designee.

[7] **PERFORM** applicable sample collection/monitoring per section 6.4 and any additional sampling requested by Chemistry Supervisor or designee.

[8] **RINSE** the portable containers, hoses, and pump with water.

[9] **RETURN** all equipment to its appropriate storage location.

[10] **REQUEST** Operations to resume normal operation of the diffuser discharge valves (0-FCV-27-100, 101) in approximately 4 hours, **AND**

INITIAL on Appendix A signifying that the request was made.

6.3 Equipment Shutdown (Permanently Installed System)

[1] **DEENERGIZE** the pump.

[2] **CLOSE** the pump suction isolation valve 0-ISV-050-0743.

[3] **CONNECT** a flexible hose to the dilution water service fitting at valve 0-ISV-050-0805.

[4] **OPEN** Valve 0-ISV-050-0805, **AND**

FILL the empty Copper-Trol containers with water.

[5] **CLOSE** 0-ISV-050-0805.

[6] **OPEN** the pump suction isolation valve 0-ISV-050-0743.

[7] **ENERGIZE** the pump, **AND**

EMPTY the contents of the containers to rinse out the pump and piping.

[8] **DEENERGIZE** the pump, **AND**

CLOSE the pump suction isolation valve 0-ISV-050-0743.

[9] **IF** necessary, **THEN**

REMOVE the flexible hose, **AND**

STORE it inside of the IPS corrosion monitoring building.

6.3 Equipment Shutdown (Permanently Installed System) (Continued)

[10] **REMOVE** the flexible pump suction line from the empty Copper-Trol containers.

[11] **REQUEST** Operations to resume normal operation of the diffuser discharge valves (0-FCV-27-100, 101) in approximately 4 hours, **AND**

INITIAL on Appendix A signifying that the request was made.

6.4 Sampling

NOTE Sample collection at the IPS is Chemistry Supervisor or his designee's option.

[1] **OBTAIN** the following equipment as necessary prior to initiating chemical addition:

- At least 24 plastic samples bottles (at least 150 ml each)
- 2 radios
- 1 portable pH meter or litmus paper (pH will vary from approximately 7 to 9)

NOTE Step [2] through [4] are optional at Chemistry Supervisor or his designee's discression.

[2] **PROCEED** to the IPS, **AND**

COLLECT a sample from RCW or ERCW as appropriate before chemical addition is initiated.

[3] **MONITOR** the pH of the sample stream, **AND**

COLLECT samples at approximately 3 minutes intervals once the pH begins to increase.

[4] **CONTINUE** collecting samples until the pH reaches a peak and returns to within 0.5 SU of the initial pre-addition values.

[5] **WAIT** approximately 30 minutes after chemical addition was initiated, **AND**

STATION person to collect samples at location(s) designated on Appendix A.

[6] **MONITOR** the pH of the sample stream, **AND**

COLLECT a sample before the pH begins to increase.

6.4 Sampling (Continued)

[7] **CONTINUE** monitoring the pH, **AND**

BEGIN collecting samples at approximately 3-minute intervals once the pH begins to increase.

[8] **CONTINUE** collecting samples until the pH returns to within approximately 0.5 SU of the initial value.

[9] **TAKE** duplicate samples at the diffuser for copper-trol analysis within one hour from time the diffuser discharge valves are open.

[10] **ANALYZE** the samples for tolytriazole, **AND**

RECORD the results on a Request for Analysis sheet in CM Chapter 8.0.

[11] **RECORD** diffuser sample results on Appendix A.

7.0 POST PERFORMANCE ACTIVITY

[1] IF necessary, **THEN**

REPLACE the bung plugs in empty Copper-Trol drums to prevent inadvertent filling from rain water, **OR**

REMOVE portable containers, **AND**

STORE them inside the Corrosion Control Building.

[2] IF necessary, **THEN**

COLLECT empty Copper-Trol drums, **AND**

LOCATE them together inside of the chemical containment dike at the IPS.

[3] IF necessary, **THEN**

NOTIFY the Responsible Environmental Engineer that the drums are ready for disposal.

8.0 RECORDS

8.1 QA Records

None

8.2 Non-QA Records

Appendixes A and B are Non-QA records.

APPENDIX A
Page 1 of 1

COPPER-TROL USAGE LOG

Date: _____

Sample location(s): _____

Total quantity to be pumped: _____

Desired concentration at injection point: _____ ppm

Estimated pumping duration: _____ minutes

Required pump stroke: _____

Total IPS flow (from 0-FC-050-0709): _____ gpm

Diffuser Discharge Valves verified closed: _____
Initials

Dilution water flow verified: _____
Initials

Pump start time	
Pump finish time	

Operations notified to return diffuser discharge valves to normal operation:
_____
Initials

COPPER-TROL CONCENTRATION		SAMPLE DATE	SAMPLE TIME	CU-1 (ppm)	ANALYST INITIALS
Diffuser Discharge Samples	#1				
	#2				

Reviewed By: _____ / _____
Date

APPENDIX B
Page 1 of 1

COMMENT LOG FOR ALTERNATE CHEMICAL ADDITION LOCATIONS[1]

Reviewed By: _____ / _____
Date

SOURCE NOTES
Page 1 of 1

SOURCE NOTE	SOURCE DOCUMENT	SUMMARY
1	WBPER930307	

Historical Record Copy

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

CHEMISTRY MANUAL

CHAPTER 4.04

BCDMH INJECTION FOR CONTROL OF CLAMS, SLIME, AND MIC

Revision 4

Unit 0

QUALITY RELATED

PREPARED BY: Keith Riggle
(Type Name)

SPONSORING ORGANIZATION: Chemistry

APPROVED BY: [signature] DATE: 8/24/94

EFFECTIVE DATE: 9/9/94

LEVEL OF USE: REFERENCE

REVISION LOG

REVISION OR CHANGE NUMBER	EFFECTIVE DATE	AFFECTED PAGE NUMBERS	DESCRIPTION OF REVISION/CHANGE
Rev 0	02/22/90	All	New Instruction. This Instruction superseded parts of TI-90.
Rev 1	10/22/93	All	Major revision to allow operation of the BCDMH feed equipment during off normal conditions (i.e., loss of power). Swap Appendix C and D to place in order of use. Add precaution regarding potential for explosion if product is left in a drained tank. Correct minor errors. Add corrective actions from II-W-93-018.
Rev 2	1/26/94	4,28	Minor revision to add General Engineering Specification G-71, "Detection and Control of Asiatic Clams (Corbicula Species)," to Section 2.2. This revision completes a corrective action for WBPER930161. Update references to environmental procedures.
CN-1	7/25/94	9	Change the position of valves 0-25-622 and 0-50-780 to permit temporary operation of the brominator. Add valve 0-50-805 to supply a temporary source of water to the brominator while HO# 094 0635 is in place.
Rev 3	8/15/94	All	• Minor revision to incorporate CN-1 to provide a means of supplying a temporary source of water to the brominator. • Return valves 0-ISV-25-622 and 0-50-780 to their normal configuration. • Renumber steps in Section 6.1. • Correct minor typographical errors. • Change "O-Ring" to "gasket" in Sections 6.6 and 6.7 to match current configuration. • Change "50 inches" to "60 inches" of freeboard in Section 4.1.
Rev 4		4, 28	• Added reference to Betz vendor manual. " Source note WBPER 940298 R1.
CN-1	11/8/94	5,12,14,16,28	• Added source note to document steps which satisfy corrective actions in WBPER930307. These steps were in place prior to PER initiation.

1.0 INTRODUCTION

1.1 Purpose

This Instruction implements the necessary controls to minimize the effects of microbiologically induced corrosion (MIC), Asiatic Clam infestation, and minimize the accumulation of slime in critical plant systems which contain raw water.

1.2 Scope

This Instruction defines group responsibilities and the actions to be taken to control MIC, Asiatic Clams, and slime in systems containing raw water. This instruction also delineates the necessary steps required to inject bromo chloro dimethyl hydantoin (BCDMH) into the plant raw systems. Addition of this chemical will result in residual concentrations of bromine and chlorine which are typically reported as total residual oxidant (TRO).

1.3 Frequency and Conditions

A. Biocide injection at the Intake Pumping Station (IPS) to control MIC and slime shall be implemented approximately four hours each day throughout the year.

B. Samples of river water will be collected periodically during the clam spawning season by the TVA aquatic Biology Department to monitor the concentration of Asiatic Clam larvae entering WBN. Continuous injection of BCDMH for at least three weeks after the peak clam dissemination periods shall be performed twice each year for Asiatic Clam control unless a nonoxidizing biocide is used in its place.[1,2]

C. High Pressure Fire Protection (HPFP) system hose stations and hydrants shall be flushed with biocide at least twice during the year.[1,2] A TRO concentration of $\geq$0.1 ppm should be obtained at each flush point if BCDMH is being added during the flush. If a non-oxidizing biocide is being added during the flush, then the limits specified in CM Chpater 4.05 should be used.

D. If System 50 biocide injection is out of service for more than 14 consecutive days, **THEN** the Responsible Chemical Engineer shall perform the following:[1]

   [a] **COMPLETE** Appendix A to document the problem and actions taken to return the system to normal.

   [b] **PERFORM** Appendix B after biocide injection has been returned to service to flush the deadleg piping.

E. If System 50 biocide injection is out of service for less than 14 consecutive days, then reestablish normal biocide injection as soon as the system has been repaired.

2.0 REFERENCES

2.1 Performance References

A. CM Chapter 3.01, "System Chemistry Specifications."

B. CM Chapter 11 series.

2.2 Developmental References

A. CM Chapter, 4.05, "Non-Oxidizing Biocide Injection for Control of Asiatic Clams, Zebra Mussels, and MIC."

B. ECI-1.0, "NPDES Liquid Effluent Release Requirements."

C. WBN ECM Chapter 3, "National Pollutant Discharge Elimination System (NPDES) Permit."

D. G-71, "Detection and Control of Asiatic Clams (Corbicula Species)."[5]

E. MSDS, "Hazardous Chemicals."

F. Nuclear Power Safety and Health Manual (NPSHM), "Emergency Showers and Eye Baths."

G. SSP-2.09, "Records Management."

H. SSP-12.15, "Fire Protection Program."

I. WBN-VM 2703, Contract 90NNQ-75880A, "Betz Industrial Solid Halogen Feeder Installation and Operation Manual."[6]

2.3 Commitments

A. TVA response to NRC Office of Inspection and Enforcement Bulletin (IEB) 81-03, "Flow Blockage of Cooling Water to Safety System Components by Corbicula Sp. (Asiatic Clams)," memorandums T50 880906 937 dated September 9, 1988; A27 810722 023 dated July 21, 1981; and A27 830321 019 dated March 21, 1983.

B. TVA response to NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety Related Equipment," memorandum L44 900126 804 dated January 26, 1990.

3.0 PRECAUTIONS AND LIMITATIONS

A. BCDMH is the biocide currently in use at WBN to control MIC, Asiatic Clams, and slime deposition. BCDMH is a skin irritant, and contact with the eyes may cause severe damage. BCDMH may become corrosive if it comes in contact with moist skin. Inhalation of dust will cause irritation to the upper respiratory tract. If significant dust exposure is anticipated (i.e.,

3.0 PRECAUTIONS AND LIMITATIONS (Continued)

loading chemical tank), then use of a full face respirator with organic vapor, acid gases, and dust/mist cartridges for respiratory protection is required. Use of gauntlet type neoprene gloves and a chemical resistant apron are also recommended. Emergency eyewash/showers or an ample supply of water shall be available to flush chemicals from the body.

B. The fan inside the biocide shed should be in service (I/S) continuously to reduce the potential for hazardous fumes.

C. The NPDES Permit limits the release of total residual chlorine (TRC) at the diffuser discharge piping to $\leq$0.1 ppm.[3]

NOTE Environmental monitoring requirements are specified in the ESIs.

D. TRO concentrations in excess of 0.5 ppm may damage the Makeup Water Treatment Plant resin.

E. Shutdown of all raw water system pumps in the same pit at the IPS shall be preceded by shutdown of BCDMH injection to that pit to prevent back flow of treated water from an IPS pit to the Tennessee River.

F. Startup of raw water system pumps at the IPS shall precede startup of BCDMH injection to that pit to prevent back flow of treated water from an IPS pit to the Tennessee River.

G. Before decreasing the number of raw water system pumps in operation at the IPS, the Chemistry Lab shall be notified by Operations to decrease the BCDMH injection flowrate.

H. If the Condenser Circulating Water (CCW) system is out of service and essential raw cooling water (ERCW) is discharging through the cooling tower blowdown to the diffuser discharge piping, then chemical feed shall be terminated. This is an administrative requirement designed to prevent exceeding the NPDES limit of 0.1 ppm TRC at the diffuser discharge. The Chemistry Control Manager can waive this restriction if circumstances are such that compliance with the NPDES permit will not be jeapordized.

I. Exothermic chemical reactions and explosions are possible if the BCDMH product is left moist and uncovered in the feed tank. The product must remain submerged in water at all times.[4,7] CN-1

J. Use of the brominator's eductor suction for alternate chemical feed is to be avoided to prevent introduction of an noncompatible chemical with BCDMH.[4,7] CN-1

4.0 PREREQUISITE ACTIONS

NOTE Individual steps within Sections 4.1 and 4.2 may be performed out of order.

4.1 Preliminary Actions

[1] **ENSURE** an adequate supply of BCDMH (<60 inches of freeboard space should be present) is in feed tank prior to placing equipment in service.

[a] **REFER** to Appendix C, **AND**

DETERMINE the approximate freeboard space by reviewing the previous entries.

[b] **IF** the freeboard has not been recorded on Appendix C within approximately 14 days or if flow through the brominator has been increasing to maintain adequate chemical residuals, **THEN**

PERFORM Section 6.6 to check the tank level.

NOTE A notebook containing in progess Appendix C forms is maintained in the biocide shed.

[2] **VERIFY** that if CCW is out of service and the diffuser discharge valves are open, ERCW is routed to the YHP prior to initiating chemical feed. The Chemistry Control Manager may waive this restriction if circumstances are such that compliance with the NPDES permit will not be jeapordized.

4.2 Approvals and Notifications

[1] **ENSURE** the Shift Operations Supervisor (SOS) is notified before placing the chemical feed system in service and has been instructed to contact Chemistry prior to shutting down or starting up pumps at the IPS during chemical treatment.

[2] **IF** ERCW is routed to the cooling tower basin while CCW is out of service and cooling tower blowdown is discharging to the river through the diffuser, **THEN**

REQUEST Operations to route ERCW to the YHP unless otherwise directed by the Chemistry Control Manager.

5.0 ACCEPTANCE CRITERIA

A. TRO concentrations in the plant should be maintained $\geq$ 0.1 and $\leq$ 0.3 ppm for at least four hours each day. An administrative lower limit of 0.2 ppm is intended to prevent the TRO concentration from going below the lower limit of 0.1 ppm.

B. The TRO concentration at the diffuser discharge shall be maintained $\leq$ 0.1 ppm.[3]

6.0 PERFORMANCE

NOTE Subsections may be performed out of order; however, individual steps must be performed in order.

6.1 Normal Startup of BCDMH Feed Equipment

NOTE 1 The raw water systems consist of four different systems.

- Raw Cooling Water (RCW)
- Essential Raw Cooling Water (ERCW)
- Raw Service Water (RSW)
- High Pressure Fire Protection (HPFP)

NOTE 2 The Operations Group is responsible for valve alignments necessary to provide a source of raw service water to the biocide shed up to the BCDMH Skid Inlet Pressure Control Valve (0-PREG-050-699). Operations is also responsible for contacting Chemistry prior to making IPS pump alignment changes during periods of chemical treatment.

NOTE 3 The Chemistry Group is responsible for valve alignments necessary for injecting BCDMH into the raw water systems and adjusting the chemical flow rates.

NOTE 4 Normal operation of the BCDMH feed equipment will be in the manual mode. Automatic operation shall only be initiated at the direction of the Responsible Chemical Engineer.

[1] ENSURE the satisfactory completion of the Preliminary Actions outlined in Section 4.1.

WARNING 1 **BCDMH is the biocide currently in use at WBN to control MIC, Asiatic Clams, and slime deposition. BCDMH is a skin irritant, and contact with the eyes may cause severe damage. BCDMH may become corrosive if it comes in contact with moist skin. Inhalation of dust will cause irritation to the upper respiratory tract. If significant dust exposure is anticipated (i.e., loading chemical tank), then use of a full face respirator with organic vapor, acid gases, and dust/mist cartridges for respiratory protection is required. Use of gauntlet type neoprene gloves, and a chemical resistant apron are also recommended. Emergency eyewash/showers or an ample supply of water shall be available to flush chemicals from the body.**

WARNING 2 **If work must be performed in the vicinity of a leaking chemical component, eye protection (preferably face shields), neoprene gloves, and protective clothing must be worn.**

6.1 Normal Startup of BCDMH Feed Equipment (Continued)

[2] **ENSURE** no leaks are present in the BCDMH feed equipment located at the IPS before placing the system in service. If leaks are observed, **THEN**

NOTIFY the Responsible Chemical Engineer for corrective actions.

[3] **CONTACT** the Unit Operator (UO) to obtain the number of RCW and ERCW pumps running in Pit A and the number of RCW and ERCW pumps running in Pit B.

[4] **DETERMINE** the total flow into the IPS with the following formulas:

a. [(# ERCW pumps I/S in Pit A)*(11800 gpm)]+[(# RCW pumps I/S in pit A)*(5135 gpm)] = Flow to A pit (gpm)

b. [(# ERCW pumps I/S in Pit B)*(11800 gpm)]+[(# RCW pumps I/S in pit B)*(5135 gpm)] = Flow to B pit (gpm)

c. Flow to A pit + Flow to B pit = Total flow to IPS (gpm)

[5] **DETERMINE** the raw water temperature at the IPS.

[6] **REFER TO** Appendix D to determine the total required inlet water flow rate to the BCDMH feed equipment.

NOTE The total inlet water flow rate to the BCDMH feed equipment should be obtained from the curve on Appendix D which is closest to the temperature reading obtained in Step [5].

[7] **USE** the following equation to calculate the required flow to IPS pit A from the BCDMH feed equipment.

$$\frac{\text{Flow In Pit A (Step [4]a))}}{\text{Total Flow to IPS (Step [4]c)}} * \text{Total Water Flow To BCDMH equipment (Step [6])} = \text{Outlet Flow Pit A}$$

[8] **USE** the following equation to calculate the required flow to IPS pit B from the BCDMH feed equipment.

$$\frac{\text{Flow In Pit B (Step [4]b))}}{\text{Total Flow to IPS (Step [4]c)}} * \text{Total Water Flow To BCDMH equipment (Step [6])} = \text{Outlet Flow Pit B}$$

NOTE The sum of Steps [7] and [8] must equal the flow obtained in Step [6].

6.1 **Normal Startup of BCDMH Feed Equipment** (continued)

[9] **VERIFY** the following valves are in the required position:

NOTE Chemistry Group personnel are responsible for adjusting valves located on the BCDMH skid, and outlet rotameter isolation/control valves. Appendix E is a flow diagram of the BCDMH equipment with valve identification.

Valves Located At BCDMH Feed Equipment Skid

• Vent (0-50-696)	CLOSED
• Sample (0-50-689)	CLOSED
• Eductor Suction To Tank (0-50-685)	CLOSED
• Auxiliary Eductor Suction (0-50-683)	CLOSED
• Eductor Supply (0-50-686)	CLOSED
• Inlet Motorized Ball Valve (0-FCV-50-675)	CLOSED

NOTE The valve has a blue disk with a white arrow that rotates and stops at a point marked either OPEN or CLOSED. A red light on the valve's motor operator should be lit when the valve is CLOSED.

• Outlet Header Isolation (0-50-701)	CLOSED
• Flow Shut-Off (0-50-684)	OPEN
• Inlet Flow Control 0-50-681 or 0-50-679 (Only one valve open, the other must be closed.)	THROTTLED PARTIALLY OPEN
• Future B Pit Injection Point Isolation (0-50-697)	CLOSED
• Future A Pit Injection Point Isolation (0-50-698)	CLOSED

Valves Located Inside Biocide Shed

• Outlet Rotameter A Isolation/Control (0-50-691)	THROTTLED OPEN (see caution below)
• Outlet Rotameter B Isolation/Control (0-50-693)	THROTTLED OPEN (see caution below)

CAUTION **The outlet rotameter isolation/control valve for any pit with no operating pumps must be CLOSED. This is to prevent chemical treatment of a pit which is out of service.**

• Raw Service Water Supply (0-ISV-25-622)	OPEN
• Raw Service Water Washdown Supply (0-50-780)	CLOSED

[10] IF the raw water supply to the bromination skid is isolated and flow cannot be re-established, **THEN**

CONSULT the Responsible Supervisor to decide if an alternate source of water should be temporarily connected to the system.

6.1 Normal Startup of BCDMH Feed Equipment (continued)

[11] IF a temporary source of water is to be supplied, **THEN**

PERFORM the following:

[a] **INITIATE** a WR to connect a hose from a suitable source of water to Valve 0-50-780.

[b] **CLOSE** Valve 0-ISV-025-622.

[c] **OPEN** Valve 0-50-780.

[d] **ESTABLISH** flow through the temporary hose.

[12] **PRESS** the OVERRIDE button in the timer control box to open the Inlet Motorized Ball Valve (0-FCV-50-675). The valve position arrow should move to the OPEN position and the green light on the valve's motor operator should be lit.

[13] **OPEN** the Outlet Header Isolation Valve (0-50-701).

[14] **ADJUST** the appropriate Inlet Flow Control Valve (0-50-681 or 0-50-679) to obtain the flow determined in Step [6].

[15] **ADJUST** the A- Outlet Rotameter Isolation/Control Valve (0-50-691) until the flow calculated in Step [7] is achieved.

[16] **ADJUST** the B- Outlet Rotameter Isolation/Control Valve (0-50-693) until the flow calculated in Step [8] is achieved.

[17] **ENSURE** the sum of flow going to pit A and pit B approximates the inlet flow meter reading. (Fine tuning inlet and outlet control valves may be necessary to balance the flows.)

NOTE Due to inherent inaccuracies in flow instrumentation, the inlet flow meter may read slightly different than the outlet rotameters.

[18] **READ** the Pressure Gauge (0-PI-50-695) on top of the BCDMH feed tank, **AND**

ENSURE the pressure is $\geq$5 psig and $\leq$20 psig. (It may be necessary to open 0-50-681 or 0-50-679 more and/or throttle the Outlet Rotameter Isolation/Control Valves closed to achieve a positive pressure.)

NOTE A positive pressure in the tank must be maintained in order to achieve steady outlet flow rates.

6.1 Normal Startup of BCDMH Feed Equipment (continued)

[19] IF a positive pressure on the BCDMH feed tank cannot be achieved by making small adjustments to the inlet control and outlet rotameter isolation valves, THEN

CLOSE the Outlet Header Isolation Valve (0-50-701).

[20] WAIT until the pressure indicated by 0-PI-050-695 is $\geq$ 5 psig and $\leq$ 20 psig, THEN

OPEN the Outlet Header Isolation Valve (0-50-701).

[21] THROTTLE the Outlet Rotameter Isolation/Control Valves closed while maintaining the correct inlet flow until the pressure on the BCDMH feed tank is satisfactory and stable.

[22] RECORD the date and time in service and flow rates on Appendix C.

NOTE Flow rates were calculated in Steps [7] and [8].

[23] WAIT approximately 60 minutes before performing Step [24].

[24] COLLECT a sample from ERCW and from RCW/RSW at suitable locations designated by the Responsible Engineer.

[25] DETERMINE the TRO concentration of the samples in accordance with appropriate Hach Method for non-environmental samples and CM Chapter 11.01 for environmental samples, AND

RECORD the results as required.

NOTE The TRO concentration in each pit at the IPS may need to be maintained >0.3 ppm to achieve the required concentration of $\geq$0.1 ppm and $\leq$0.3 ppm throughout the plant raw water systems. The limits of $\geq$0.1 ppm and $\leq$0.3 ppm TRO are required to be maintained in the plant.[1,2] The goal is to maintain a TRO concentration $\geq$0.2 ppm when the feed equipment is in service.

[26] IF the in plant TRO concentration is $\geq$0.2 ppm and $\leq$0.3 ppm, THEN

GO TO Step [31].

6.1 Normal Startup of BCDMH Feed Equipment (continued)

[27] IF the in plant TRO concentration is <0.2 ppm, **THEN**

INCREASE the flow to the feed tank inlet and appropriate outlet rotameter in 1.0 gpm increments, **THEN**

GO TO Step [23].

[28] IF the in plant TRO concentration is >0.3 ppm, **THEN**

DECREASE the flow to the feed tank inlet and appropriate outlet rotameter in 1.0 gpm increments, **THEN**

GO TO Step [23].

[29] **REPEAT** Steps [23] through [28] as necessary until two attempts have been made at achieving the correct TRO concentration.

[30] IF the TRO concentration is not within the range of 0.2 to 0.3 ppm after two attempts, **THEN**

INITIATE an out of limit condition report, **AND**

CONTACT the Responsible Chemical Engineer who will evaluate the circumstances and take the necessary corrective actions.

[31] **RESUME** regular sampling frequency of once per day.

[32] **ROUTE** completed Appendix C forms to the Responsible Engineer for review.

CN-1

6.2 Off Normal Startup of BCDMH Feed Equipment[7]

NOTE This section of the instruction is to be used if electricity to the BCDMH feed equipment is off and if Valve 0-FCV-50-675 is open.

[1] **NOTIFY** the Responsible Engineer if Valve 0-FCV-50-675 is deenergized in the CLOSED position.

[2] **PERFORM** Steps [1] through [8] in Section 6.1.

6.2 Off Normal Startup of BCDMH Feed Equipment (Continued)

[3] **VERIFY** the following valves are in the required position:

NOTE Chemistry Group personnel are responsible for adjusting valves located on the BCDMH skid, and outlet rotameter isolation/control valves. Appendix E is a flow diagram of the BCDMH equipment with valve identification.

Valves Located At BCDMH Feed Equipment Skid

• Vent (0-50-696)	CLOSED
• Sample (0-50-689)	CLOSED
• Eductor Suction To Tank (0-50-685)	CLOSED
• Auxiliary Eductor Suction (0-50-683)	CLOSED
• Eductor Supply (0-50-686)	CLOSED
• Inlet Motorized Ball Valve (0-FCV-50-675) The valve has a blue disk with a white arrow that rotates and stops at a point marked either OPEN or CLOSED.	OPEN
• Outlet Header Isolation (0-50-701)	CLOSED
• Flow Shutoff (0-50-684)	CLOSED
• Inlet Flow Control 0-50-681 or 0-50-679 (Only one valve open, the other must be closed.)	THROTTLED PARTIALLY OPEN
• Future B Pit Injection Point Isolation (0-50-697)	CLOSED
• Future A Pit Injection Point Isolation (0-50-698)	CLOSED

Valves Located Inside Biocide Shed

• Outlet Rotameter A Isolation/Control (0-50-691)	THROTTLED OPEN (see caution below)
• Outlet Rotameter B Isolation/Control (0-50-693)	THROTTLED OPEN (see caution below)

CAUTION **If all RCW and ERCW pumps are out of service in either A or B pit, then the outlet rotameter isolation/control valve for that pit must be CLOSED. This is to prevent chemical treatment of a pit which is out of service.**

• Raw Service Wtr Supply (0-ISV-25-622)	OPEN
• Raw Service Wtr Washdown Supply (0-50-780)	CLOSED

[4] **OPEN** the Flow Shutoff Valve (0-50-684).

[5] **OPEN** the Outlet Header Isolation Valve (0-50-701).

[6] **ADJUST** the Inlet Flow Control Valve (0-50-681 or 0-50-679) to obtain the flow determined in Section 6.1, Step [6].

[7] **PERFORM** Steps [13] through [32] in Section 6.1.

6.3 Normal Shutdown of BCDMH Feed Equipment

[1] PRESS the OVERRIDE button in the timer control box to close the Inlet Motorized Valve (0-FCV-50-675).

NOTE The rotating disc on the valve has a white arrow which points to CLOSED when the valve is CLOSED.

[2] CLOSE the Outlet Header Isolation Valve (0-50-701) quickly to isolate the tank with a positive pressure.

[3] RECORD the time out of service on Appendix C data sheet located in the IPS biocide shed.

CN-1

6.4 Off Normal Shutdown of BCDMH Feed Equipment[7]

NOTE This section is to be used if electricity to the BCDMH feed equipment is off and if Valve 0-FCV-050-675 is open.

[1] CLOSE the Flow Shutoff Valve (0-50-684).

[2] CLOSE the Outlet Header Isolation Valve (0-50-701) quickly to isolate the tank with a positive pressure.

[3] RECORD the time out of service on Appendix C data sheet located in the IPS biocide shed.

6.5 Programming BCDMH Feed Equipment for Automatic Operation

[1] SET all flowrates and valve alignments in accordance with instructions in Section 6.1 prior to placing the feed equipment in the automatic mode.

CAUTION **Normal operation of the BCDMH feed equipment will be performed manually. Automatic operation will only be at the direction of the Chemistry Supervisor or Responsible Chemical Engineer to ensure appropriate controls are in place to ensure the potential for an NPDES permit non-compliance does not exist.**

NOTE Automatic operation of the BCDMH feed equipment will cause the Inlet Motorized Ball Valve (0-FCV-50-675) to open and close as programmed.

A. Setting Time/Day

[1] PRESS RESET button, the display will show "12:00 AM."

[2] PRESS "±h" button once if daylight savings time is in effect.

6.5 Programming BCDMH Feed Equipment for Automatic Operation (Continued)

[3] HOLD the SET TIME button in during the time set sequence (Steps [4] thru [6]).

[4] PRESS the button under the current day of the week.

[5] PRESS "h+" or "h-" to advance display to the correct hour.

[6] PRESS "m+" or "m-" to advance display to correct minute.

[7] RELEASE SET TIME button. Seconds colon flashes.

B. Programming An On Time

[1] PRESS day or days of week for on time.

[2] PRESS "h+" or "h-" for on time hour.

[3] PRESS "m+" or "m-" for on time minute.

[4] PRESS 1/0 button once until dash appears under the 1.

[5] PRESS WRITE for program entry.

NOTE To program an off time, Steps [1] through [5] are to be repeated above, but press 1/0 button twice until dash appears under the 0.

C. Programming Review

[1] PRESS the READ button to review programs entered. (Programs will display in order they were entered.)

D. Cancelling Programs

[1] PRESS the READ button until the desired program is displayed, THEN

PRESS the cancel button to cancel the program.

[2] PRESS the reset button to cancel all programs.

E. Manual Override

NOTE The manual override may be pushed to actuate the Inlet Motorized Ball Valve (0-FCV-50-675) at any time. When the valve is opened during the manual override, it is important to press the button again to close the valve. That assures that the valve will be in the closed position allowing automatic operation to resume. If the valve is not returned to the closed position, the next program will be missed.

6.5 Programming BCDMH Feed Equipment for Automatic Operation (continued)

F. ± 1h Button

NOTE This button is used to change all programs in the case of a time change. It is important to make sure the timer is on the right setting when programming. During daylight savings time, a bar should appear next to the "+1h" on timer.

6.6 Periodic Check of BCDMH Product Level

CN-1

The BCDMH product level should be checked as necessary based on the need for increased flow to maintain adequate concentrations.[7]

NOTE The Responsible Engineer is responsible for ensuring an adequate supply of product is available.[7]

[1] **CLOSE** the Inlet Motorized Ball Valve (0-FCV-50-675) by pressing the OVERRIDE button in the timer control box or the Flow Shutoff Valve (0-50-684) and the Outlet Header Isolation Valve (0-50-701).

[2] **RECORD** the time out of service on Appendix C.

[3] **ENSURE** the drain hose from the vent is routed to the plastic drum prior to relieving tank pressure to prevent spilling chemicals on the floor.

[4] **OPEN** the BCDMH Tank Vent Valve (0-50-696) until 0 psig is indicated on the Pressure Gauge (0-PI-50-694) and leave the Vent (0-50-696) OPEN.

[5] **REMOVE** the fill cap from the tank.

CAUTION **Do not drain water from the BCDMH feed tank during this operation. The product must remain covered with water to avoid the presence of harmful fumes and potential for exothermic reactions which could result in an explosion.**

[6] **RETRIEVE** the measuring stick from the biocide shed, **AND**

INSERT into the tank through the open fill cap.

[7] **MEASURE** the distance in inches between the chemical level and the top of the curved portion of the tank. (This distance is the freeboard.)

[8] **RECORD** freeboard on Appendix C.

6.6 Periodic Check of BCDMH Product Level (Continued)

[9] **ENSURE** the gasket is in place and free from dirt or debris which could impair the seal.

[10] **REPLACE** the fill cap, **AND**

TIGHTEN tee handle screw snugly.

[11] **ENSURE** the Flow Shutoff Valve (0-50-684) is OPEN.

[12] **IF** the Inlet Motorized Ball Valve (0-FCV-50-675) was closed in Step [1], **THEN**

OPEN the valve by pressing the "override" button in the timer control box.

[13] **ADJUST** the small Inlet Flow Control Valve (0-50-681) slowly until a flow of approximately 5 gpm is established.

[14] **CLOSE** the Vent Valve (0-50-696) when water begins to discharge.

[15] **CLOSE** the Flow Shutoff Valve (0-50-684) when the BCDMH feed tank pressure is between 5 and 20 psig (0-PI-50-695).

[16] **IF** the Inlet Motorized Ball Valve (0-FCV-50-675) was opened in Step [12] to refill the brominator, **THEN**

CLOSE the valve by pressing the "override" button in the timer control box.

[17] **PLACE** the BCDMH equipment in service in accordance with Section 6.1 or 6.2 as applicable if required for operation.

6.7 Filling the BCDMH Feed Tank

NOTE 1 The chemical supplier may be called upon to load BCDMH into the feed tank. Under these circumstances, Chemistry personnel will perform all valve manipulations and the chemical supplier will pour the BCDMH product into the feed tank.

NOTE 2 The Inlet Motorized Ball Valve (0-FCV-50-675) is required to be in the open position before beginning this section.

[1] **CLOSE** all valves on the BCDMH equipment skid.

NOTE Valve 0-FCV-50-675 must remain OPEN if electricity is OFF to the valve motor.

6.7 Filling the BCDMH Feed Tank (Continued)

[2] **ENSURE** the drain hose from the vent valve is routed to the plastic drum prior to opening the vent valve to prevent spilling chemicals on the floor.

[3] **OPEN** BCDMH Tank Vent Valve (0-50-696) and allow pressure to equalize with ambient conditions.

[4] **ROTATE** the tee handle on top of the BCDMH tank in the counterclockwise direction to loosen.

PIVOT the handle away from the recessed fill cap, **THEN**

REMOVE the cap carefully.

[5] **OPEN** the following valves in order:

NOTE All valves must be completely OPEN.

- Outlet Rotameter A Isolation/Control (0-50-691)
- Outlet Rotameter B Isolation/Control (0-50-693)
- Outlet Header Isolation (0-50-701)
- Eductor Suction to Tank (0-50-685)
- Eductor Supply (0-50-686)

[6] **PRESS** OVERRIDE in the timer control box to open the Inlet Motorized Valve (0-FCV-50-675). Water will pass through the eductor creating a suction to lower the water level in the tank.

NOTE If electricity to the BCDMH feed equipment is out of service, then water will begin flowing through the eductor when the valves in Step [5] are opened.

[7] **WHEN** the water level is lowered to within approximately one inch of the top of the existing chemical level, **THEN**

CLOSE the following valves:

- Eductor Suction to Tank (0-50-685)
- Eductor Supply (0-50-686)
- Outlet Header Isolation (0-50-701)

[8] **CLOSE** the Inlet Motorized Valve (0-FCV-50-675) by pressing OVERRIDE in the timer control box.

NOTE If electricity to the valve is out of service, then the valve must remain OPEN.

6.7 **Filling the BCDMH Feed Tank** (continued)

NOTE Steps [9] and [10] may be performed by the chemical supplier as directed by the Responsible Engineer.

[9] **POUR** the BCDMH product into the tank. A crane or mobile hoist may be needed for positioning BCDMH containers over top of feed tank.

[10] **CONTINUE** filling feed tank until the desired level, as determined by the Responsible Engineer, is achieved.

[11] **OPEN** Flow Shutoff Valve (0-50-684).

[12] **IF** electricity to the BCDMH feed equipment is out of service and Valve 0-FCV-50-675 is open, **THEN**

DO NOT PERFORM Step [13].

[13] **OPEN** Inlet Water Motorized Valve (0-FCV-50-675) by pressing OVERRIDE in the timer control box.

[14] **OPEN** large Inlet Flow Control Valve (0-50-679) until 20-30 gpm is indicated on the dial meter (0-FI-50-680).

[15] **ALLOW** feed tank to fill while periodically checking water level.

[16] **WHEN** water level gets within 12 inches of the top of the feed tank, **THEN**

REDUCE flow by throttling closed the large Inlet Flow Control Valve (0-50-679) until water level is near the cap.

[17] **CLOSE** the Flow Shutoff Valve (0-50-684).

[18] **IF** electricity to the BCDMH feed equipment is out of service and the valve is open, **THEN**

DO NOT PERFORM Steps [19].

[19] **CLOSE** Inlet Water Motorized Valve (0-FCV-50-675) by pressing OVERRIDE in the timer control box.

[20] **CLOSE** the BCDMH Feed Tank Vent Valve (0-50-696).

[21] **MEASURE** the BCDMH feed tank freeboard.

[22] **ENSURE** the gasket at the fill cap is in place and free from debris which could impair the seal.

[23] **REPLACE** the fill cap and tighten the tee handle screw snugly.

6.7 **Filling the BCDMH Feed Tank** (continued)

[24] **RECORD** the quantity of BCDMH added and the final tank freeboard on Appendix C located inside of the IPS biocide shed.

[25] **PLACE** the BCDMH feed equipment in service for at least 30 minutes.[4]

[26] **IF** the BCDMH feed equipment is to be operated in the manual mode, **THEN**

RETURN the BCDMH feed equipment to service in accordance with Section 6.1 or 6.2 as applicable.

[27] **IF** the BCDMH feed equipment is to be operated in the automatic mode, **THEN**

VERIFY the Inlet Motorized Ball Valve (0-FCV-50-675) is closed and program timer is set in accordance with Section 6.5.

6.8 **High Pressure Fire Protection System**[1]

NOTE It may be necessary to leave the BCDMH feed equipment in service continuously during HPFP flushing activities. Determination is made by the Responsible Engineer.

[1] **REFER TO** SSP-12.15 for Periodic flushing and testing of HPFP equipment.

[2] **FLUSH** the major headers, hose stations, and sprinklers at least twice during the year with chemical treatment in progress. Flushing should continue until the TRO is $\geq$0.1 ppm.

[3] **IF** the TRO fails to reach $\geq$0.1 ppm, **THEN**

TERMINATE flushing of that point as directed by the Chemistry Group.

7.0 **POST PERFORMANCE ACTIVITY**

None

8.0 **RECORDS**

8.1 **QA Records**

Appendixes A and B are QA records and are processed in accordance with SSP-2.09.

8.2 **Non-QA Records**

Appendix C is a non-QA record for Chemistry Group information which should be retained in Chemistry Files for at least one month following completion.

APPENDIX A
Page 1 of 1

SYSTEM EVALUATION AFTER LOSS OF BIOCIDE TREATMENT FOR MORE THAN 14 CONSECUTIVE DAYS[1]

1. Date the chemical feed system taken out of service. _____

2. Date the chemical feed system returned to service. _____

3. Total duration the chemical feed system out of service (days). _____

4. Reason the chemical feed system taken out of service:

_____

_____

_____

5. Actions taken to return the chemical feed system to service:

_____

_____

_____

6. Has the chemical feed system been taken out of service for the same reason within the past year? Yes _____ No _____

Date out of service _____ Date returned to service _____.

7. Has the system been in service for at least four consecutive days upon being returned to service? Yes ___ No ___

8. Determine if raw water systems should be shock treated or flushed.

RECORD recommendations: _____

_____

_____

Prepared By: _____/_____
Responsible Engineer Date

Reviewed By: _____/_____
Responsible Supervisor Date

QA Record

APPENDIX B
Page 1 of 3

FLUSH PACKAGE

1. **PERFORM** Section 6.1 or 6.2 to initiate BCDMH injection. ☐

2. **REQUEST** Operations group to assist with performance of this Appendix. ☐

3. **FLUSH** water through each point listed on the Data Sheet, **AND** ☐

   SAMPLE for TRO per applicable Hach method.

4. **CONTINUE** flushing until a TRO concentration of $\geq$0.1 ppm is obtained. ☐

5. **IF** a TRO of $\geq$0.1 ppm is **not** achievable, **THEN**

   INCREASE the flow to the feed tank inlet (valve 0-50-681 or 0-50-679) and appropriate outlet rotameter in 1.0 gpm increments. ☐

6. **WAIT** approximately 1 hour, and

   RESAMPLE flush points that do not have at least 0.1 ppm TRO. ☐

7. **IF** the TRO remains below 0.1 ppm, **THEN**

   REPEAT Steps [4] through [6] until satisfactory results are obtained or the Responsible Engineer determines that it is acceptable to stop flushing these points.

8. **RECORD** all flushing results on the Data Sheets. ☐

9. **ROUTE** the completed Appendix B to the Responsible Engineer. ☐

_____ / _____
Responsible Engineer Date

_____ / _____
Responsible Supervisor Date

QA Record

APPENDIX B
Page 2 of 3

DATA SHEET

VALVE NO.	EQUIPMENT IDENT.	LOCATION	DRAWING NO.	TIME/DATE	TRO (ppm)	INITIALS
1-24-612	HOTWELL PMP CLR	TB 685 T3-F	47W844-2 COORD F-5			
1-24-595	#3 HTR DR PMP HX 1A DRN	TB 685 T3-E	47W844-2 COORD G-6			
1-24-596	#3 HTR DR PMP HX 1B DRN	TB 685 T3-D/E	47W844-2 COORD G-6			
1-24-597	#3 HTR DR PMP HX 1C DRN	TB 685 T3-D	47W844-2 COORD F-6			
1-24-761	#3 HTR DRN PMP COOLER 1E P-TEST CONN	TB 680 T3-E SEE REMARKS	47W844-2 COORD G-8			
1-24-762	COND VAC PMP CLR P-TEST CONN	TB 685 T3-F/G	47W844-2 COORD E-5			
1-24-998	COND VAC PMP HX 1A DRAIN	TB 685 T3-F/G	47W844-3 COORD E-11			
1-24-995	COND VAC PMP HX 1B DRAIN	TB 685 T3-G	47W844-3 COORD E-11			
1-24-993	COND VAC PMP HX 1C DRAIN	TB 685 T3-G/H	47W844-3 COORD D-11			
1-24-676	#7 DRN PMP HX A	TB 685 T7-E	47W844-2 COORD G-10			
1-24-677	#7 DRN PMP HX B	TB 685 T7-E	47W844-2 COORD G-10			
1-24-674	COND BOOSTER PMP HX 1A DRAIN	TB 685 T7.5-G	47W844-2 COORD F-10			
1-24-673	COND BOOSTER PMP HX 1B DRAIN	TB 685 T7.5-F	47W844-2 COORD F-10			
1-24-672	COND BOOSTER PMP HX 1C DRAIN	TB 685 T7.5-F	47W844-2 COORD F-10			
1-24-755	#7 HTR DR PMP CLR 1A PRESS TEST CONN	TB 685 T8-E	47W844-2 COORD D-3			
0-25-528	HOSE CONNECTION	TB 685 T10-F	47W850-1 COORD G-6			
1-24-621	SPACE COOLER 1B PRESS TEST	TB 685 T6-D	47W844-1 COORD F-7			

QA Record

1128Q

APPENDIX B
Page 3 of 3

DATA SHEET

VALVE NO.	EQUIPMENT IDENT.	LOCATION	DRAWING NO.	TIME/DATE	TRO (ppm)	INITIALS
1-24-363	FW PMP TURB OIL HX FE ROOT VLV	TB 708 T2-H/J	47W844-3 COORD G-6			
1-24-923	FW PMP TURB OIL 1B1/1B2	TB 729 T2-H	47W844-3 COORD F-5			
1-25-549	HOSE CONNECTION	TB 708 T3-D	47W850-1 COORD C-9			
1-25-537	HOSE CONNECTION	TB 708 T3-J	47W850-1 COORD E-11			
1-24-963	STANDBY MFP OIL HX P-TEST CONNECTION	TB 729 T1.5-J	47W844-3 COORD G-9			
1-24-678	EXCITER HX COMPART. DRAIN	TB 729 T5.5-C/D	47W844-1 COORD G-3			
1-24-520	SEAL OIL AIR SIDE HX DRAIN	TB 729 T6-D	47W844-1 COORD G-9			
1-24-557	SEAL OIL HYDROGEN SIDE HX DRAIN	TB 729 T6-D	47W844-1 COORD F-9			
0-25-508	HOSE CONNECTION	NaOCl BLDG (NORTH WALL)	47W832-1 COORD C-6			
1-24-541	MAIN BUS HX	TRANSFORMER YARD	47W844-1 COORD F-1			
0-25-619	HOSE CONNECTION	CCW PUMPING STATION	47W832-1 COORD B-5			
2-67-983	D/G 2B-B COOLING WATER EFFLUENT	D/G BLDG	47W845-1 COORD C-5			
1-67-983	D/G 1B-B COOLING WATER EFFLUENT	D/G BLDG	47W845-1 COORD C-7			
0-25-506	SERVICE CONNECTION INTAKE	IPS EL 741 ERCW PMP H-B	47W832-2			

QA Record

APPENDIX C
Page 1 of 1

BCDMH USAGE LOG

DATE	TIME IN SERVICE	TIME OUT OF SERVICE	INLET FLOW (gpm)	FLOW TO A PIT (gpm)	FLOW TO B PIT (gpm)	TANK FREEBOARD (inches)	POUNDS OF BCDMH ADDED	INITIALS

REMARKS: _____

_____

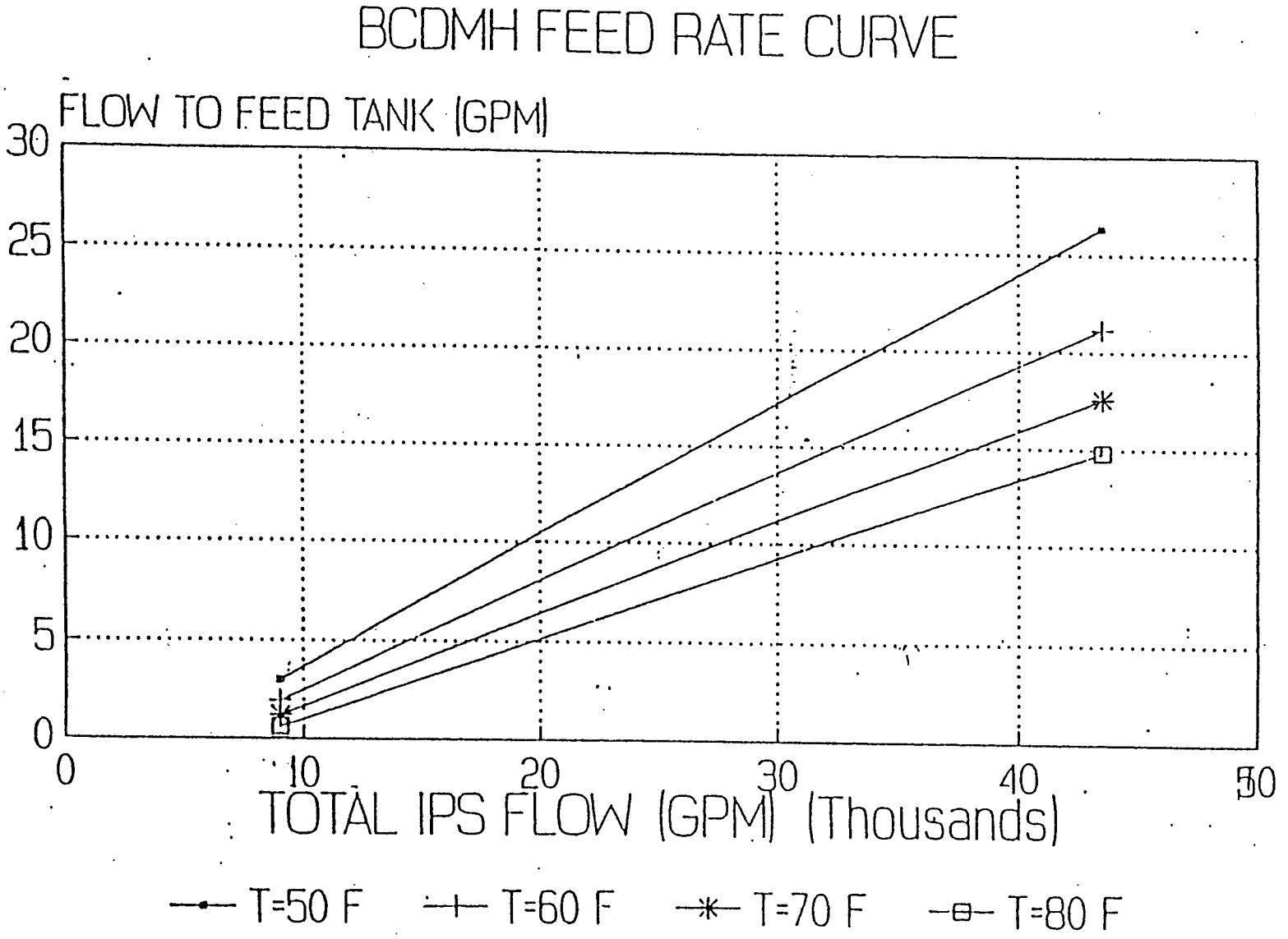
_____

_____

_____

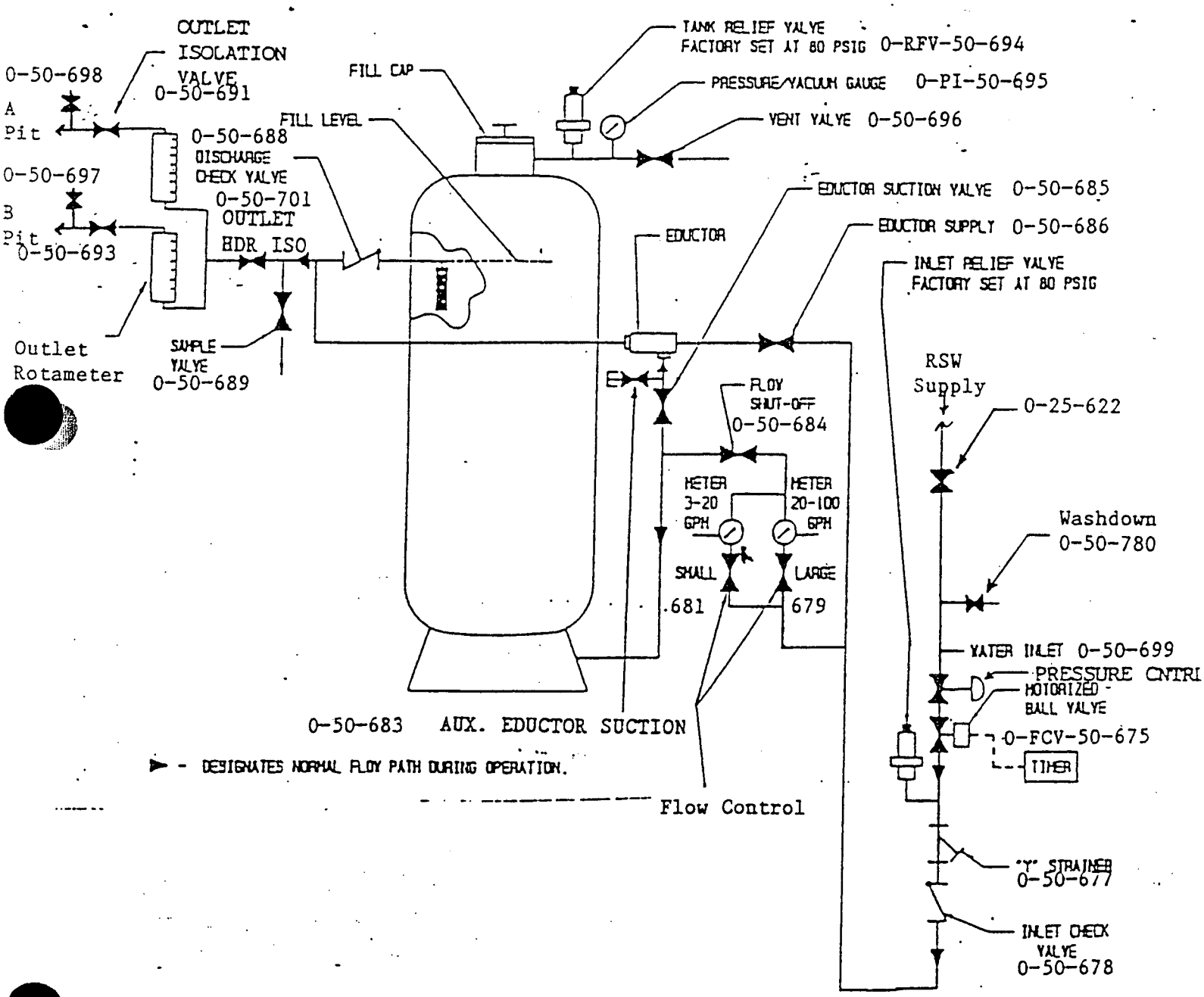
_____ / _____
Responsible Supervisor Date

11280


BCDMH FEED RATE CURVE
FLOW TO FEED TANK (GPM)
30
25
20
15
10
5
0
0
10
20
30
40
50
TOTAL IPS FLOW (GPM) (Thousands)
T=50 F
T=60 F
T=70 F
T=80 F

APPENDIX E
Page 1 of 1

BCDMH FEED EQUIPMENT FLOWPRINT



SOURCE NOTES

Page 1 of 1

SOURCE NOTE	SOURCE DOCUMENT	SUMMARY
1	TVA response to NRC Office of Inspection and Enforcement Bulletin (IEB) 81-03	Asiatic Clam Control
2	TVA response to NRC Generic Letter (GL) 89-13	Raw Water Fouling
3	WBN Environmental Compliance Manual (ECM) Chapter 3, "National Pollutant Discharge Elimination System (NPDES) Permit"	NPDES Permit
4	II-W-93-018, Manufacturing Standard Improperly Applied	Prevent BCDMH Decomposition
5	WBPER930161 corrective action to reference G-71	Reference G-71
6	WBPER940298 R1	Vendor Manuals CN-1
7	WBPER930307 R1	BCDMH Decomposition Event

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT

CHEMISTRY MANUAL

CHAPTER 4.05

NON-OXIDIZING BIOCIDE INJECTION FOR CONTROL OF ASIATIC CLAMS, ZEBRA MUSSELS, AND MIC

Revision 2

Unit 0

QUALITY RELATED

PREPARED BY: J. Keith Riggle
(Type Name)

SPONSORING ORGANIZATION: Chemistry

APPROVED BY: [signature] DATE: 5/10/94

EFFECTIVE DATE: 5/24/94

LEVEL OF USE: REFERENCE

REVISION LOG

REVISION OR CHANGE NUMBER	EFFECTIVE DATE	AFFECTED PAGE NUMBERS	DESCRIPTION OF REVISION/CHANGE
Rev 0	08/09/93	All	New Instruction.
Rev 1	10/22/93	All	Add ERCW flush connections per DCN 26454-A. Correct minor errors. Revise Figure 1 to include a 2 ppm line.
Rev 2	5/24/94	All	• Add section 6.5 for provisions to flush the HPFP system. • Add section 6.6 and Appendix H to monitor the effectiveness of chemical treatment on MIC and clams. • Correct minor errors. • Add valve locations. • Add Section 7.2, Equipment Restoration.
CN-1	8/31/94	19	• Add Step [16] to close out the FPI-0100 Appendix C form. • Modify Step [12] to remove the FPI-0100 Appendix C form.

1.0 INTRODUCTION

1.1 Purpose

This Instruction provides the necessary information and guidance for injecting a non-oxidizing biocide into the Essential Raw Cooling Water (ERCW), Raw Cooling Water (RCW), and High Pressure Fire Protection (HPFP) systems.

1.2 Scope

This Instruction will normally be used to inject the non-oxidizing biocide into the raw water systems through permanently installed plant equipment. Chemical injection may also be performed at alternate locations under the Chemistry Supervisor's direction. Under these circumstances only applicable portions of this Instructions should be used.

1.3 Frequency and Conditions

A. This Instruction should be performed at least once each calendar quarter.

B. This Instruction can be performed during any plant mode of operation.

2.0 REFERENCES

2.1 Performance References

A. CM Chapter 4.02, Startup and Normal Operation of the Pyrophosphate, Zinc, and Copolymer Equipment.

B. CM Chapter 4.04, BCDMH Injection for Control of Clams, Slime, and MIC.

C. CM Chapter 6.02, MIC Sampling.

D. ECM Chapter 3, National Pollutant Discharge Elimination System (NPDES) Permit.

E. SOI-24.01, Raw Cooling Water System.

F. SOI-67.01, Essential Raw Cooling Water System.

G. FPI-0100, Administrative Controls.

3.0 PRECAUTIONS AND LIMITATIONS

A. The Yard Holding Pond (YHP) could be filled to the point of discharging at the overflow weir, thus resulting in a reportable environmental event and possible non-compliance.

B. Diffuser discharge valves must remain closed for the duration of chemical injection to prevent an environmental non-compliance.

C. Diesel generator oil must not be cooled below 85 degrees F.

D. Personnel contact with concentrated chemicals is possible, therefore safety showers must be operable or portable equipment available and applicable manufacturer safety data sheet (MSDS) guidelines adhered to.

E. Placing the condenser circulating water (CCW) system in service during chemical injection will help to detoxify the product, thus making it easier to meet environmental regulations.

F. All other raw water chemical injections must be terminated prior to initiating non-oxidizing biocide feed if using the permanent chemical addition system.

G. Addition of non-oxidizing biocide should be terminated if water from the fire protection system is needed to extinguish a fire.

H. Makeup water treatment plants (vendor-supplied or permanent plant equipment) should not be placed in service during addition of non-oxidizing biocide to the raw water systems.

4.0 PREREQUISITE ACTIONS

NOTE Sections 4.1, 4.2, and 4.3 and actions contained therein are not required to be performed in the order listed.

4.1 Preliminary Actions

[1] **OBTAIN** a working copy of this Instruction. ☐

[2] **RECORD** the date this instruction was initiated. _____ Date Initiated

[3] **SCHEDULE** Operation's support for performing valve manipulations for flushing. ☐

4.1 Preliminary Actions (Continued)

[4] IF necessary, INITIATE a work request to install flush hoses at the applicable blind flange connections listed below:

WR#_____
Date Initiated_____ Date Installed_____

ERCW

A. Flood mode supply to CCS-SS equipment - Unit 1, A8-v, el 735'
B. Flood mode supply to CCS-SS equipment - Unit 2, A8-v, el 735'
C. Flood mode return from CCS-SS equipment - Unit 1, el 692' penetration room
D. Flood mode return from CCS-RCP TB - Unit 1, el 692' penetration room
E. Emergency makeup supply to CCS surge tank A, behind surge tank el 757'
F. Emergency makeup supply to CCS surge tank B, behind surge tank el 757'
G. Flood mode return from CCS-SS equipment - Unit 2, el 692' penetration room
H. Flood mode return from CCS-RCP TB - Unit 2, el 692' penetration room
I. CCS spent fuel pit HX's and TB booster pump supply, A6,8-s above CCS HX C

HPFP

A. Motor driven AFW pump 1A-A, located at AB 737', A3-S
B. Motor driven AFW pump 1B-B, located at AB 737', A3-S
C. Motor driven AFW pump 2A-A, located at AB 737', A13-S
D. Motor driven AFW pump 2B-B, located at AB 737', A13-S

NOTE It is not required that flushes be performed simultaneously; therefore, it is permissable to remove hoses after flushing and relocate to next flush point.

[5] ROUTE hoses to the nearest acceptable drains. ☐

[6] VERIFY that there is a sufficient quantity of non-oxidizing biocide either in the Intake Pumping Station (IPS) chemical tank D or in portable containers if using an alternate addition point. ☐

NOTE Approximately 12.5 gallons will be required for each ERCW pump, 5.5 gallons for each RCW pump, and 2 gallons for each HPFP pump in service to achieve a 3 ppm concentration for six hours.

4.1 Preliminary Actions (Continued)

[7] **VERIFY** that a sufficient quantity of laboratory reagents, standards, and equipment are available to perform the analyses required by this Instruction. ☐

[8] **PERFORM** a pre-job briefing with appropriate Operations, Chemistry, Fire Operations, and Environmental personnel. ☐

[9] **REVIEW** the applicable MSDS forms for Betz Clam-Trol (CT-1) non-oxidizing biocide. ☐

[10] **COORDINATE** performance of this Instruction with the Environmental Section to ensure compliance with environmental regulations. ☐

[11] IF the ERCW or RCW systems will be treated, **THEN**

REQUEST the Unit Operator (UO) to place as many headers and components in service as possible in accordance with SOI-67.01 and SOI-24.01. ☐

[12] **REQUEST** the UO to place the Condenser Circulating Water (CCW) system in service if possible. ☐

System in service? YES ☐ NO ☐

[13] **VERIFY** safety shower and eyewash station near chemical feed equipment is operable or portable eye wash tanks available. ☐

[14] IF HPFP valves are taken out of their normal position, **THEN**

INITIATE FPI-0100 permits as necessary. ☐

[15] IF the HPFP system is to be treated, **THEN**

PERFORM Steps [1] and [2] in Section 6.5 prior to initiating chemical addition.

[16] **COLLECT** and **ANALYZE** samples for MIC in accordance with Section 6.6 prior to initiating chemical addition. ☐

4.2 Special Tools, Parts, and Supplies

[1] **OBTAIN** the sections of flush hose equipped with Parker disconnects from the chemistry storage cage. ☐

4.3 Field Preparations

[1] **CONTACT** the Unit Operator (UO) to determine which ERCW, RCW, or HPFP pumps are in service, and

RECORD the results below.

ERCW Pumps In Service (check all that apply):

A-A [ ] B-A [ ] C-A [ ] D-A [ ]
E-B [ ] F-B [ ] G-B [ ] H-B [ ]

_____ / _____ / _____
Initials Date Time

RCW Pumps In Service (check all that apply):

A [ ] B [ ] C [ ] D [ ]
E [ ] F [ ] G [ ]

_____ / _____ / _____
Initials Date Time

HPFP Pumps In Service (check all that apply):

1A-A [ ] 1B-B [ ] 2A-A [ ] 2B-B [ ]

_____ / _____ / _____
Initials Date Time

[2] **OBSERVE** the water level in the YHP, and

RECORD the level below. ☐

YHP Level _____ _____ / _____
Date Time

[3] **DETERMINE** if sufficient space exists in the YHP for the diffuser discharge valves to remain closed for approximately 24 hours. The pond level should be approximately 699' before beginning. ☐

Sufficient Space in YHP Available? YES ☐ NO ☐

[4] **IF** there is insufficient YHP capacity, **THEN**

REQUEST the UO to drain the YHP the necessary amount as determined by the Environmental Section. ☐

Final YHP Level _____ _____ / _____
Date Time

4.4 Approvals and Notifications

[1] NOTIFY the UO and SOS of the intent to proceed with performance of this Instruction. ☐

5.0 ACCEPTANCE CRITERIA

A. Non-oxidizing biocide concentrations should range between 1 to 3 ppm throughout most of the plant to treat bacteria which can cause microbiologically induced corrosion (MIC). These limits may be increased at the Chemistry Supervisor's discretion if targeted areas are being treated and there is no danger of exceeding environmental discharge specifications.

B. Chemical injection should remain in effect for approximately 6 hours or as otherwise specified by the Chemistry Supervisor.

C. Non-oxidizing biocide concentration at the diffuser discharge must remain below detectable levels.

6.0 PERFORMANCE

NOTE 1 Steps in Section 6.1 may be performed in any order.

NOTE 2 Sections 6.2 through 6.6 may be performed out of order if necessary.

6.1 General

[1] IF treating ERCW, THEN

PLACE a check in each box below to identify which ERCW headers are in service.

A. ERCW Header 1A ☐
B. ERCW Header 1B ☐
C. ERCW Header 2A ☐
D. ERCW Header 2B ☐

[2] REFER to the applicable appendixes listed below for each ERCW header checked in Step [1], and

REQUEST Operations support in verifying which individual components are receiving flow from applicable ERCW headers.

A. Appendix A, Equipment Supplied from ERCW Header 1A. ☐
B. Appendix B, Equipment Supplied from ERCW Header 1B. ☐
C. Appendix C, Equipment Supplied from ERCW Header 2A. ☐
D. Appendix D, Equipment Supplied from ERCW Header 2B. ☐

6.1 General (Continued)

[3] IF necessary, REQUEST Operations to monitor diesel generator oil temperature, and

ISOLATE ERCW if the temperature drops to 85°F. ☐

[4] IF treating RCW, THEN,

PLACE a check in each box below for each RCW strainer in service.

A. 1-STN-24-105 (1A) ☐
B. 1-STN-24-106 (1B) ☐
C. 1-STN-24-1137 ☐
D. 2-STN-24-107 (2A) ☐
E. 2-STN-24-108 (2B) ☐
F. 2-STN-24-1137 ☐

NOTE Live adult Asiatic clams have been observed in these strainers; therefore, it is advisable to place as many in service as possible during chemical treatment.

6.2 Normal Chemical Injection

NOTE Steps may be performed out of order if necessary.

[1] REQUEST information on predicted Watts Bar Dam generation schedules from the Main Control Room, and

COORDINATE chemical injection with the Watts Bar Dam schedule to ensure that the diffuser discharge valves can be opened before the yard holding pond reaches its maximum level. ☐

[2] REQUEST the UO to CLOSE the diffuser discharge valves manually, and

MONITOR the YHP level frequently. ☐

[3] RECORD the date/time diffuser discharge valves were CLOSED. _____ / _____ Date Time

6.2 Normal Chemical Injection (Continued)

[4] TERMINATE all other raw water chemical injections in accordance with the instructions listed below:

A. Pyrophosphate, zinc sulfate, copolymer (CM Chapter 4.02). ☐

B. BCDMH (CM Chapter 4.04). ☐

[5] PLACE dilution water for chemical treatment in service by opening the following valves.

	Valve Identification	Description	
A.	0-THV-050-0722	- Throttling Vlv to Press Reg. Vlv	☐
B.	0-THV-050-0746	- Isolation Vlv to Pit A (as necessary)	☐
C.	0-THV-050-0747	- Isolation Vlv to Pit B (as necessary)	☐
D.	0-THV-050-0752	- Throttling Vlv to Pit A	☐
E.	0-THV-050-0764	- Throttling Vlv to Pit A	☐
F.	0-THV-050-0753	- Throttling Vlv to Pit B	☐
G.	0-THV-050-0742	- Throttling Vlv to Pit B	☐
H.	0-FCV-050-0748	- Flow Control Vlv to Pit A (Operable)	☐
I.	0-FCV-050-0749	- Flow Control Vlv to Pit B (Operable)	☐

[6] VERIFY the following valves are CLOSED:

	Valve Identification	Description	
A.	0-ISV-050-0805	- Isolation For Dilution Water Supply	☐
B.	0-ISV-050-0807	- Isolation For Chem Tank E Purge Line	☐
C.	0-ISV-050-0808	- Isolation For Chem Tank D Purge Line	☐
D.	0-ISV-050-0745	- Isolation Valve From Chem Tank E	☐

[7] OPEN 0-ISV-050-0739, Isolation Valve From Chem Tank D, to align chemical tank D to the suction side of the pump. ☐

[8] PRIME the non-oxidizing biocide pump (0-PMP-050-0800) by carefully loosening the pump casing vent plug until the biocide is discharging. ☐

[9] TIGHTEN the pump casing vent plug after satisfactorily removing entrapped air. ☐

[10] OPEN 0-ISV-050-0741, Isolation Valve From Chem Tank D, to align the pump discharge to the dilution water line. ☐

6.2 Normal Chemical Injection (Continued)

[11] **RECORD** the total IPS flow from flow controller 0-FC-050-0709 located on elevation 712 inside of the IPS.

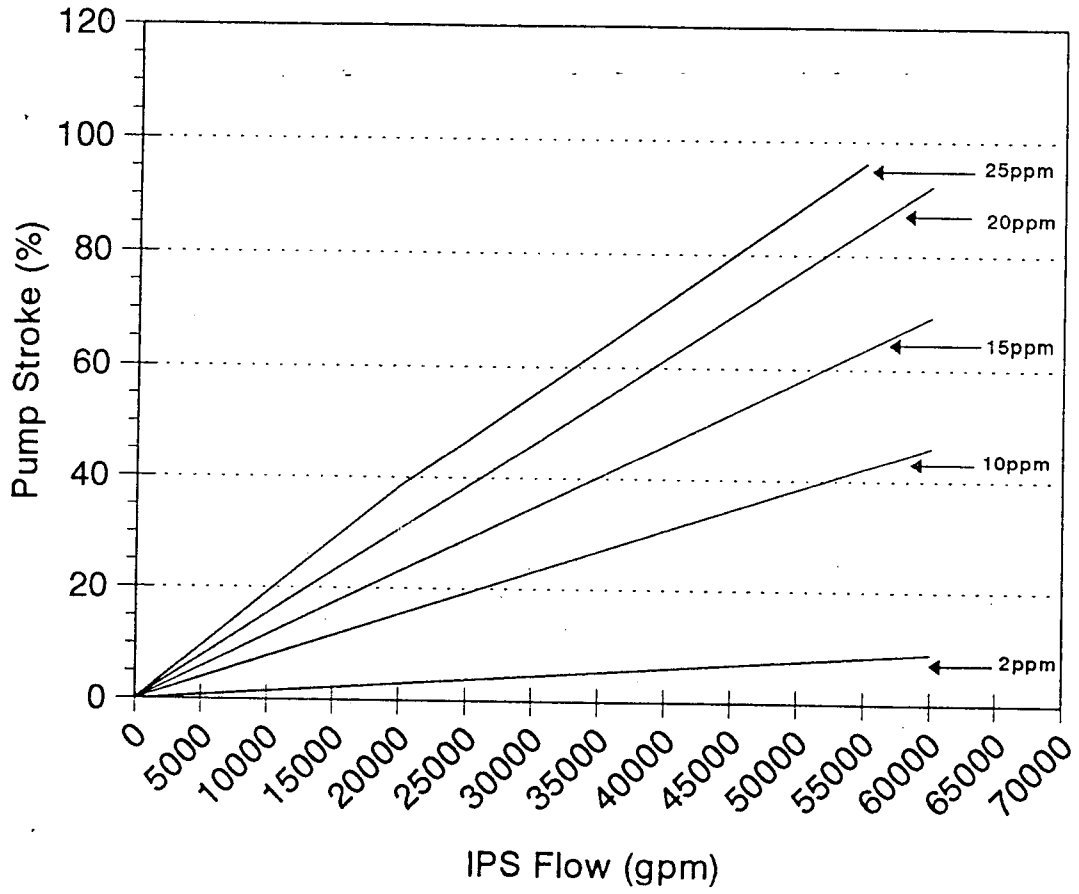
Total Flow _____ gpm

[12] **OBTAIN** the required pump stroke setting from Figure 1, Non-Oxidizing Biocide Pump Settings, for the desired concentration at the IPS or as specified by the Chemistry Supervisor, and

RECORD below.

_____ppm	_____%
Desired concentration	Required pump stroke

FIGURE 1
NON-OXIDIIZING BIOCIDE PUMP SETTINGS



6.2 Normal Chemical Injection (Continued)

[13] ADJUST the stroke control knob on the non-oxidizing biocide pump to the value determined in Step [12]. ☐

[14] NOTIFY the UO that biocide injection is being initiated. ☐

[15] PLACE handswitch 0-HS-050-0800 located on Junction Box -JB-299-5886 for the non-oxidizing biocide pump in the ON position. ☐

[16] RECORD the time chemical injection was placed in service, and

DETERMINE the time for termination by adding the desired duration to the in-service time.

_____	_____
Time In Service	Desired Termination Time

[17] MONITOR the chemical tank D level periodically to ensure that the pump does not run dry. ☐

[18] PERFORM Sections 6.4, 6.5, 6.6 as necessary. ☐

6.3 Chemical Injection at Alternate Locations

NOTE Steps may be performed out of order if necessary.

[1] CONTACT the Chemistry Supervisor or designee to determine the required quantity of non-oxidizing biocide required for the specific application. ☐

_____ gallons

[2] OBTAIN the required amount of non-oxidizing biocide in suitable containers, and

TRANSPORT the containers to the desired location. ☐

[3] OBTAIN necessary equipment such as portable pumps, hoses, extension cords, etc., to facilitate chemical addition. ☐

[4] DOCUMENT on Appendix G a description of the alternate feed point and other activities necessary to adequately document performance of this Instruction. ☐

[5] NOTIFY the UO that the non-oxidizing biocide injection will be initiated. ☐

6.3 Chemical Injection at Alternate Locations (Continued)

[6] TERMINATE BCDMH addition (CM Chapter 4.04) before the non-oxidizing biocide is injected. ☐

[7] INJECT the non-oxidizing biocide as directed by the Chemistry Supervisor, and

PERFORM applicable sample collection/monitoring in accordance with Sections 6.4, 6.5, and 6.6. ☐

6.4 Flushing and Sampling the ERCW/RCW Systems

NOTE 1 Steps may be performed concurrently or out of order if necessary.

NOTE 2 Vendor support may be utilized as necessary to collect and analyze samples for non-environmental compliance monitoring.

[1] WAIT approximately 30 minutes after chemical injection was initiated or adjustments made, THEN

OBTAIN samples from the following locations as applicable:

A. IPS Pit A - ERCW, 1-DRV-67-929A-A or 2-DRV-67-929A-A ☐
B. IPS Pit B - ERCW, 1-DRV-67-932B-B or 2-DRV-67-932B-B ☐
C. IPS Pit A - RCW, 2-SMV-24-1127 ☐
D. IPS Pit B - RCW, 1-SMV-24-1127 ☐

[2] WAIT until chemial injection has been in progress approximately one hour, THEN

COLLECT samples from the following locations as applicable at the Hypochlorite Building. ☐

NOTE Headers that were not chemically treated do not need to be sampled.

Unit 1-ERCW, 1-ISV-050-0765 (Root Valve 1-ISV-050-0758 at cooling tower flume must be OPEN) ☐

Unit 1-RCW, 1-ISV-050-0762 (Root Valve 1-ISV-050-0761 at cooling tower flume must be OPEN) ☐

Unit 2-ERCW, 2-ISV-050-0760 (Root Valve 2-ISV-050-0759 at cooling tower flume must be OPEN) ☐

Unit 2-RCW, 2-ISV-050-0762 (Root Valve 2-ISV-050-0761 at cooling tower flume must be OPEN) ☐

6.4 Flushing and Sampling the ERCW/RCW Systems (Continued)

[3] ANALYZE each sample from the IPS and Hypochlorite Building to determine the concentration of non-oxidizing biocide and MIC bacteria (Section 6.6), THEN

RECORD the results on Appendixes E and F, IPS Sample Results and Hypochlorite Building Sample Results as appropriate. ☐

[4] MAKE pump stroke adjustments as necessary to achieve satisfactory chemical residuals at the Hypochlorite Building. ☐

[5] REPEAT Steps [1] through [4] as necessary until the concentrations are within limits, greater than 1 ppm but less than 3 ppm at the Hypochlorite Building or as otherwise specified by the Chemistry Supervisor.

[6] COLLECT samples from the IPS and Hypochlorite Building at approximately 3 hour intervals until chemical addition has been terminated. ☐

[7] ANALYZE each sample from the IPS and Hypochlorite Building to determine the concentration of non-oxidizing biocide, and

RECORD the results on Appendix E for the IPS Building and Appendix F for the Hypochlorite Building. ☐

[8] REQUEST Operation's support as necessary to flush as many of the following locations as possible, and

DOCUMENT deficiencies on Appendix G. Each location should be flushed for at least 15 minutes. ☐

NOTE Flushes may be performed in any order and simultaneously.

A. Flush connection at the emergency makeup supply to Unit 1 CCS-Surge Tank (Valves 1-67-543A, 543B, (el 737', A4-U above general vent chiller A) and 544 (el 757', behind U-1 surge tank) will require manipulation). The connection is located on el 757' behind the surge tank. ☐

Start time:_____ Stop time:_____

6.4 Flushing and Sampling the ERCW/RCW Systems (Continued)

B. Flush connection at the emergency makeup supply to Unit 2 CCS-Surge Tank (Valves 2-67-543A, 543B, (el 737', A12-U above MCR chiller B-B) and 544 (el 757', behind U-2 surge tank) will require manipulation). The connection is located on el 757' behind the surge tank. . ☐

Start time:_____ Stop time:_____

C. Flush connection at the Unit 1 flood mode supply to CCS-SS equipment (Valve 1-67-687 will require manipulation). The connection is located at A8-v near the ceiling at el 735'. ☐

Start time:_____ Stop time:_____

D. Flush connection at the Unit 2 flood mode supply to CCS-SS equipment (Valve 2-67-687 will require manipulation). The connection is located at A8-v near the ceiling at el 735'. ☐

Start time:_____ Stop time:_____

E. Flush connection at the Unit 1 flood mode return from CCS-SS equipment (Valve 0-67-528A and 0-67-559A will require manipulation). The connection is located in the U-1 el 692' penetration room near the ceiling, above the grating. ☐

Start time:_____ Stop time:_____

F. Flush connection at the Unit 2 flood mode return from CCS-SS equipment (Valve 0-67-528B and 0-67-559B will require manipulation). The connection is located in the U-2 el 692' penetration room near the ceiling, above the grating. ☐

Start time:_____ Stop time:_____

G. Flush connection at the Unit 1 flood mode return from CCS-RCP TB (Valve 0-67-528A and 0-67-558A will require manipulation). The connection is located in the U-1 el 692' penetration room near the ceiling, above the grating. ☐

Start time:_____ Stop time:_____

6.4 Flushing and Sampling the ERCW/RCW Systems (Continued)

H. Flush connection at the Unit 2 flood mode return from CCS-RCP TB (Valve 0-67-528B and 0-67-558B will require manipulation). The connection is located in the U-2 el 692' penetration room near the ceiling, above the grating. ☐

Start time:_____ Stop time:_____

I. Flush connection at the CCS spent fuel pit HX and TB booster pump supply (Valve 0-67-529 will require manipulation). The connection is located at approximately el 748' between A6,8-S above CCS heat exchanger C. ☐

Start time:_____ Stop time:_____

J. Flood mode return from CCS-SFPCS HX (Valves 0-67-556B and 0-67-556A should be opened for at least 15 minutes to flush piping between main discharge headers A and B). The valves are located on el 713' at A3-t above the AFW pump space cooler. ☐

Start time:_____ Stop time:_____

[9] REMOVE the temporary flush hoses. ☐

[10] PERFORM Section 7.0, Post Performance Activities, when the desired chemical injection termination time has been reached or as otherwise directed by the Chemistry Supervisor. ☐

[11] OBSERVE the YHP for the presence of dead fish, and

REPORT findings to the Environmental Section. ☐

NOTE A fish kill in the YHP is an NRC and NPDES reportable event.

6.5 Flushing and Sampling the HPFP System

NOTE 1 Steps may be performed concurrently or out of order if necessary.

NOTE 2 Vendor support may be utilized as necessary to collect and analyze samples for non-environmental compliance monitoring.

[1] REQUEST support from Operations and Fire Operations as necessary to perform the valve manipulations needed to flush the system as described below. ☐

6.5 Flushing and Sampling the HPFP System (Continued)

[2] ESTABLISH continuous flow through as many of the following locations as possible prior to initiating chemical addition. The maximum achievable flow rates should be obtained at each point.

NOTE The following valves may be opened in any order.

Service Water Connection	1-25-534	708', T7-k	☐
Unit 1 Seal Oil Unit	1-26-625	729', T8-d	☐
Unit 2 Seal Oil Unit	2-26-625	729', T9-e	☐
Feedwtr Pmp Turb Oil Tnk 1B	1-26-607B	729', T2-k	☐
Feedwtr Pmp Turb Oil Tnk 2B	2-26-607B	729, T15-k	☐
Auxiliary Bldg Roof Hydrant	0-26-654	east side	☐
Office Bldg Roof Hydrant	0-26-722	west side	☐
Switchyard Valve Pit A Drain	0-26-812	switchyard	☐
Switchyard Valve Pit B Drain	0-26-813	switchyard	☐
Switchyard Valve Pit C Drain	0-26-1674	switchyard	☐
WTC Strainer Flush Valve	0-26-1974	WTC near mech shop	☐
0-HYD-26-573	0-26-573	U-2 cooling twr	☐
0-HYD-26-647	0-26-647	Behind IOB	☐

[3] PERFORM either Section 6.2 (Normal Chemical Injection) or Section 6.3 (Chemical Injection at Alternate Locations) to initiate chemical feed. ☐

[4] WAIT approximately two hours after initiating chemical addition or making pump adjustments, and

COLLECT samples from the following locations:

NOTE Samples may be collected in any order.

Unit 1 Seal Oil Unit	1-26-625	☐
Auxiliary Bldg Roof Hydrant	0-26-654	☐
Office Bldg Roof Hydrant	0-26-722	☐
WTC Strainer Flush Valve	0-26-1974	☐

[5] ANALYZE each sample to determine the concentration of non-oxidizing biocide and MIC bacteria (Section 6.6), and

RECORD the non-oxidizing biocide results below:

			Initials
Unit 1 Seal Oil Unit	0-26-625	_____ppm	_____
Auxiliary Bldg Roof Hydrant	0-26-654	_____ppm	_____
Office Bldg Roof Hydrant	0-26-722	_____ppm	_____
WTC Strainer Flush Valve	0-26-1974	_____ppm	_____

6.5 Flushing and Sampling the HPFP System (Continued)

[6] **MAKE** pump stroke adjustments as necessary until the concentrations are within limits (greater than 1 but less than 3 ppm) or as otherwise specified by the Chemistry Supervisor. ☐

[7] **IMPLEMENT** the FPI-0100, Appendix C form, and

UNLOCK and **CLOSE** valves 0-26-645 and 648 (motor driven AFW flood mode supply headers). ☐

[8] **OPEN** the following valves and flush for at least 30 minutes, **THEN**

COLLECT samples for non-oxidizing biocide determination.

		Elevation	Start Time	Stop Time
To Mtr Driven AFW Pmp 1A-A	1-26-688	737',A3-s	_____	_____
To Mtr Driven AFW Pmp 1B-B	1-26-650	737',A3-s	_____	_____
To Mtr Driven AFW Pmp 2A-A	2-26-650	737',A13-s	_____	_____
To Mtr Driven AFW Pmp 2B-B	2-26-688	737',A13-s	_____	_____

NOTE Simultaneous flushing of the above locations is preferred.

[9] **CLOSE** the following valves: Initials

To motor driven AFW pump	1A-A	1-26-688 el 737',A3-s	_____
	1B-B	1-26-650 el 737',A3-s	_____
	2A-A	2-26-650 el 737',A13-s	_____
	2B-B	2-26-688 el 737',A13-s	_____

[10] **ANALYZE** the following samples to determine the concentration of non-oxidizing biocide and

RECORD the results below:

		Final Conc	Initials
To Mtr Driven AFW Pmp 1A-A	1-26-688	_____ppm	_____
To Mtr Driven AFW Pmp 1B-B	1-26-650	_____ppm	_____
To Mtr Driven AFW Pmp 2A-A	2-26-650	_____ppm	_____
To Mtr Driven AFW Pmp 2B-B	2-26-688	_____ppm	_____

[11] IF the above samples do not contain the desired concentration of non-oxidizing biocide, **THEN**

INCREASE the pump stroke, and

RE-PERFORM Steps 4, 5, 6, 8, 9, and 10. ☐

6.5 Flushing and Sampling the HPFP System (Continued)

[12] IF the above samples contain the desired concentration of non-oxidizing biocide, THEN

Initials

OPEN and LOCK valves 0-26-645 and 648 to return the header to its normal configuration. _____/_____ Date CN-1

_____/_____ 2nd Party Date

[13] TERMINATE flushing by closing the following valves:

NOTE Valves may be closed in any order.

			Initials
Service Water Connection	1-25-534	708', T7-k	
Unit 1 Seal Oil Unit	1-26-625	729', T8-d	
Unit 2 Seal Oil Unit	2-26-625	729', T9-e	
Fdwtr Pmp Turb Oil Tnk 1B	1-26-607B	729', T2-k	
Fdwtr Pmp Turb Oil Tnk 2B	2-26-607B	729', T15-k	
Aux Bldg Roof Hydrant	0-26-654	east side	
Office Bldg Roof Hydrant	0-26-722	west side	
Switchyd Vlv Pit A Drain	0-26-812	switchyard	
Switchyd Vlv Pit B Drain	0-26-813	switchyard	
Switchyd Vlv Pit C Drain	0-26-1674	switchyard	
WTC Strainer Flush Valve	0-26-1974	WTC near mech shop	
0-HYD-26-573	0-26-573	U-2 cooling twr	
0-HYD-26-647	0-26-647	Behind IOB	

[14] PERFORM Section 7.0, Post Performance Activities, after closing all flush valves. ☐

[15] OBSERVE the YHP for the presence of dead fish, and

REPORT findings to the Environmental Section.

NOTE A fish kill in the YHP is an NRC and NPDES reportable event.

CN-1

Initials

[16] CLOSE the FPI-0100, Appendix C form to document the configuration. _____/_____ Date

6.6 Monitoring Chemical Effectiveness

NOTE Steps may be performed concurrently or out of sequence if necessary.

[1] DETERMINE the concentration of MIC causing bacteria in the water before and during chemical treatment.

6.6 Monitoring Chemical Effectiveness (Continued)

[A] **COLLECT** at least two different samples from the raw water systems to be treated (i.e. ERCW, RCW, or HPFP) in accordance with Chemistry Manual (CM) Chapter 6.02. Samples must be be collected prior to initiating chemical addition. □

NOTE Sample locations and numbers may be determined by the Responsible Individual.

[B] **COLLECT** at least two samples in accordance with CM Chapter 6.02 from the same locations identified in Step [A] after chemical addition has been in service for at least 2 hours. □

[C] **STORE** all samples for the same length of time as the total duration of chemical addition. □

[D] **PROCEED** with sample analysis in accordance with CM Chapter 6.02 to determine the total aerobic and sulfate reducing bacteria concentrations. □

[2] IF living adult clams are available, **THEN**

ESTIMATE their mortality due to the chemical treatment.

[A] **PLACE** an equal number of live clams in a bio-box which is connected to a source of untreated water and one which is also connected to a representative source of treated water. □

[B] **ESTABLISH** a steady flow of water through each bio-box. □

[C] **INITIATE** Appendix H, Estimated Clam Mortality, to determine the effectiveness of chemical treatment on clams. □

[D] **PROCEED** with chemical addition. □

[E] **DISPOSE** of all clams upon completion of this test, and

RETURN the bio-boxes to their proper storage location in the Hypochlorite Building. □

7.0 POST PERFORMANCE ACTIVITIES

7.1 Equipment Shutdown

NOTE 1 Section 7.2 may be performed prior to completing Steps [6] through [13] of Section 7.1.

NOTE 2 Only Steps [4] through [13] of Section 7.1 are required if the chemical addition was made at an alternate location.

[1] PLACE handswitch 0-HS-050-0800 located on junction box 0-JB-299-5886 in the OFF position. ☐

[2] RECORD the time chemical injection was terminated.

_____ / _____
Date Time

[3] CLOSE 0-ISV-050-0739, Isolation Valve From Chemical Tank D. ☐

[4] NOTIFY the UO when chemical injection was terminated, and

REQUEST that the diffuser discharge valves remain closed until the YHP level reaches an approximate elevation of 705 feet to dilute the chemical concentration. ☐

NOTE The YHP must not be allowed to overflow.

[5] REQUEST UO to notify Chemistry laboratory when the diffuser discharge valves are opened.

_____ /
Date Time opened

[6] COLLECT duplicate samples from the diffuser discharge within one hour from the time the valves were opened.

Sampled: _____ / _____ _____
Date Time Analyst Initials

[7] ANALYZE the samples for non-oxidizing biocide, and

RECORD the results below:

Sample #1 _____ppm Analyst Initials_____ ☐
Sample #2 _____ppm Analyst Initials_____ ☐

7.1 Equipment Shutdown (Continued)

[8] IF any non-oxidizing biocide is present in either sample, THEN

CONTACT the UO, and ☐

REQUEST that the diffuser discharge valves be closed and only the minimum number of ERCW/RCW pumps be left in service to prevent overfilling the YHP. ☐

[9] CONTACT the lead site Environmental Engineer, designee, or Radwaste/Environmental Supervisor for guidance if non-oxidizing biocide is present in the diffuser discharge samples. ☐

[10] RESUME normal operation of the BCDMH equipment in accordance with CM Chapter 4.04 if necessary. ☐

[11] REQUEST Maintenance to remove flush connection hoses from the ERCW and/or HPFP systems. ☐

[12] DOCUMENT program enhancements, deficiencies on Appendix G, Comment Log. ☐

[13] REVIEW this Instruction, and

VERIFY satisfactory results were achieved.

_____ /

Chemistry Supv Date

7.2 System Restoration

NOTE This section is only applicable if the permanently installed system was used for Clam-Trol addition.

[1] CONNECT a flexible hose to the dilution water service fitting at valve 0-ISV-050-0805. ☐

[2] OPEN valve 0-ISV-050-0805 on the dilution water header, and

FILL at least three empty five gallon containers with water for flushing out residual chemical. ☐

[3] CLOSE valve 0-ISV-050-0805 on the dilution water header. ☐

7.2 System Restoration (Continued)

[4] **OPEN** the following valves near the Copper-Trol pump (0-PMP-050-0801):

Copper-Trol pmp suction isolation vlv	0-ISV-050-0743 ☐
Copper-Trol pmp discharge isolation vlv	0-ISV-050-0825 ☐
Copper-Trol pmp discharge isolation vlv	0-ISV-050-0826 ☐
Copper-Trol discharge header isolation vlv	0-ISV-050-0745 ☐

[5] **ENSURE** the Copper-Trol pump drain isolation valve 0-ISV-050-0807 is CLOSED. ☐

[6] **PRIME** pump 0-PMP-050-0801 by pouring water into the suction hose. ☐

[7] **ADJUST** the pump stroke on 0-PMP-050-0801 to approximately 90%. ☐

[8] **PLACE** handswitch 0-HS-050-0801 on junction box 0-JB-050-5886 in the ON position to energize pump 0-PMP-050-801. ☐

[9] **PUMP** the contents of the containers of water through the system to flush out remaining chemicals. ☐

[10] **PLACE** handswitch 0-HS-050-0801 on junction box 0-JB-050-5886 in the OFF position when finished. ☐

[11] **CLOSE** the following valves to secure the Copper-Trol pump:

Copper-Trol pmp suction isolation vlv	0-ISV-050-0743 ☐
Copper-Trol pmp discharge isolation vlv	0-ISV-050-0825 ☐
Copper-Trol pmp discharge isolation vlv	0-ISV-050-0826 ☐
Copper-Trol discharge header isolation vlv	0-ISV-050-0745 ☐

[12] **REMOVE** the flexible hose from the dilution water service fitting at valve 0-ISV-050-0805. ☐

8.0 RECORDS

8.1 QA RECORDS

Listed below are QA records and are processed in accordance with SSP-2.09, Records Management.

A. Section 4.1, Preliminary Actions

B. Section 4.2, Special Tools, Parts, and Supplies

8.1 QA RECORDS (Continued)

C. Section 4.3, Field Preparations

D. Section 4.4, Approvals and Notifications

E. Section 6.0, Performance

F. Section 7.0, Post Performance Activities

G. Appendix A, Equipment Supplied From ERCW Header 1A

H. Appendix B, Equipment Supplied From ERCW Header 1B

I. Appendix C, Equipment Supplied From ERCW Header 2A

J. Appendix D, Equipment Supplied From ERCW Header 2B

K. Appendix E, IPS Sample Results

L. Appendix F, Hypochlorite Building Sample Results

M. Appendix G, Comment Log

N. Appendix H, Estimated Clam Mortality

8.2 **Non-QA Records**

None

APPENDIX A
Page 1 of 1

EQUIPMENT SUPPLIED FROM ERCW HEADER 1A

Component Description	Flow Present? Y/N
Biocide Treatment Recirculation Line 1A (1-67-715A, 716A OPEN)	
Lower Containment Vent Cooler 1A (El 716)	
Lower Containment Vent Cooler 1C (El 716)	
Control Rod Drive Vent Cooler 1A (El 703)	
Control Rod Drive Vent Cooler 1C (El 703)	
Reactor Coolant Pump #1 Motor Coolers CLR-68-8C and CLR-68-8D (El 731)	
Reactor Coolant Pump #3 Motor Coolers CLR-68-50C and CLR-68-50D (El 731)	
Instrument Room Water Cooler 1A (El 692)	
Upper Containment Vent Cooler 1A (El 801)	
Upper Containment Vent Cooler 1C (El 801)	
Containment Spray HX 1A Biocide Recirc (1-67-533A, 538A OPEN)	
Auxiliary Air Compressor A (El 757)	
Spent Fuel Pit Pump and TB Booster Pump Space Cooler 1A (El 737)	
CCS Pump and AFW Pumps Space Cooler 1A (El 713)	
CCP Room Cooler 1A (El 692)	
SIS Pump Room Cooler 1A (El 692)	
CS Pump Room Cooler 1A-A (El 676)	
RHR Pump Room Cooler 1A-A (El 676)	
Penetration Room Cooler 1A1 (El 692)	
Penetration Room Cooler 1A2 (El 713)	
Penetration Room Cooler 1A3 (El 737)	
Pipe Chase Cooler 1A (El 692)	
Electric Board Room A/C Condenser A-A (El 692)	
CCP 1A-A Oil Cooler	
Station Air Compressor A (El 708)	
Station Air Compressor B (El 708)	
Station Air Compressor C (El 708)	
Station Air Compressor D (El 708)	
Shutdown Board Room A/C Water Chillers A-A (El 737)	
Main Control Room A/C Water Chillers A-A (El 737)	
Diesel Generator 1A-A Heat Exchanger 1A1	
Diesel Generator 1A-A Heat Exchanger 1A2	
Diesel Generator 2A-A Heat Exchanger 2A1	
Diesel Generator 2A-A Heat Exchanger 2A2	
Additional Diesel Generator Heat Exchanger 0A2	

QA Record

APPENDIX B
Page 1 of 1

EQUIPMENT SUPPLIED FROM ERCW HEADER 1B

Component Description	Flow Present? Y/N
Diesel Generator 1B-B Heat Exchanger 1B1	
Diesel Generator 1B-B Heat Exchanger 1B2	
Diesel Generator 2B-B Heat Exchanger 2B1	
Diesel Generator 2B-B Heat Exchanger 2B2	
Turbine Driven AFW Pump Biocide Recirc (1-67-711, 712, 713, 714 OPEN)	
Lower Containment Vent Cooler 1B (El 716)	
Lower Containment Vent Cooler 1D (El 716)	
Control Rod Drive Vent Cooler 1B (El 703)	
Control Rod Drive Vent Cooler 1D (El 703)	
Reactor Coolant Pump #2 Motor Coolers CLR-68-31C and CLR-68-31D (El 731)	
Reactor Coolant Pump #4 Motor Coolers CLR-68-73C and CLR-68-73D (El 731)	
Instrument Room Water Cooler 1B (El 692)	
Upper Containment Vent Cooler 1B (El 801)	
Upper Containment Vent Cooler 1D (El 801)	
Containment Spray HX 1B Biocide Recirc (1-67-533B, 538B OPEN)	
Main Control Room A/C Water Chiller B-B (El 737)	
Spent Fuel Pit Pump and TB Booster Pump Space Cooler 1B (El 737)	
CCS Pumps and AFW Pump Space Cooler 1B (El 713)	
CCP Room Cooler 1B (El 692)	
Reciprocating Charging Pump Room Cooler 1C (El 692)	
SIS Pump Room Cooler 1B (El 692)	
CS Pump Room Cooler 1B-B (El 676)	
RHR Pump Room Cooler 1B-B (El 676)	
Penetration Room Cooler 1B1 (El 692)	
Penetration Room Cooler 1B2 (El 713)	
Penetration Room Cooler 1B3 (El 737)	
Pipe Chase Cooler 1B (El 692)	
Electric Board Room A/C Condenser B-B (El 692)	
Station Air Compressor A (El 708)	
Station Air Compressor B (El 708)	
Station Air Compressor C (El 708)	
Station Air Compressor D (El 708)	
CCS HX-A (El 737)	
Biocide Treatment Recirc Line 1B (1-67-715B, -716B OPEN)	

QA Record

APPENDIX C
Page 1 of 1

EQUIPMENT SUPPLIED FROM ERCW HEADER 2A

Component Description	Flow Present? Y/N
Turbine Driven AFW Pump (U-2) Biocide Recirc (2-67-711, 712, 713)	
Lower Containment Vent Cooler 2A, (El 716)	
Lower Containment Vent Cooler 2C, (El 716)	
Upper Containment Vent Cooler 2A, (El 801)	
Upper Containment Vent Cooler 2C, (El 801)	
EGTS Room Cooler 2A (El 757)	
BA Transfer Pump and AFW Space Cooler 2A (El 713)	
CCP Room Cooler 2A (El 692)	
CS Pump Room Cooler 2A-A (El 676)	
RHR Pump Room Cooler 2A-A (El 676)	
Penetration Room Cooler 2A1 (El 692)	
Penetration Room Cooler 2A2 (El 713)	
Penetration Room Cooler 2A3 (El 737)	
Pipe Chase Cooler 2A (El 692)	
CCS HX-B (El 737)	
Instrument Room Water Cooler 2A (El 692)	
CS HX-2A Biocide Recirc (2-67-533A, 538A OPEN)	
Diesel Generator 2B-B Heat Exchanger 2B1	
Diesel Generator 2B-B Heat Exchanger 2B2	
Diesel Generator 1B-B Heat Exchanger 1B1	
Diesel Generator 1B-B Heat Exchanger 1B1	
Additional Diesel Generator Heat Exchanger 0A1	
Biocide Treatment Recirc Line 2A (2-67-715B, -716B OPEN)	

QA Record

APPENDIX D
Page 1 of 1

EQUIPMENT SUPPLIED FROM ERCW HEADER 2B

Component Description	Flow Present? Y/N
Lower Containment Vent Cooler 2B (El 716)	
Lower Containment Vent Cooler 2D (El 716)	
Upper Containment Vent Cooler 2B (El 801)	
Upper Containment Vent Cooler 2D (El 801)	
Instrument Room Water Cooler 2B (El 692)	
CSS HX-2B Biocide Recirc (2-67-533B, -538B OPEN)	
EGTS Room Cooler 2B (El 757)	
Auxiliary Control Air Compressor B-B (El 757)	
BA Transfer Pump and AFW Space Cooler 2B (El 713)	
CCP Room Cooler 2B (El 692)	
Recip Charging Pump Room Cooler 2C (El 692)	
SIS Pump Room Cooler 2B (El 692)	
CSS Pump B-B Room Cooler (El 676)	
RHR Pump 2B-B Room Cooler (El 676)	
Penetration Room Cooler 2B1 (El 692)	
Penetration Room Cooler 2B2 (El 692)	
Penetration Room Cooler 2B3 (El 692)	
Pipe Chase Cooler 2B (El 692)	
Shutdown Board Room A/C Water Chiller B-B (El 737)	
CCS HX-C (El 737)	
Diesel Generator 1A-A Heat Exchanger 1A1	
Diesel Generator 1A-A Heat Exchanger 1A2	
Diesel Generator 2A-A Heat Exchanger 2A1	
Diesel Generator 2A-A Heat Exchanger 2A2	
Additional Generator Heat Exchanger 0A1	
Biocide Treatment Recirc Line 2B (2-67-715A, -716A OPEN)	

QA Record

APPENDIX E
Page 1 of 1

IPS SAMPLE RESULTS

DATE	TIME	SAMPLE IDENTIFICATION	BIOCIDE CONCENTRATION (PPM)	ANALYST INITIALS

QA Record

APPENDIX F
Page 1 of 1

HYPOCHLORITE BUILDING SAMPLE RESULTS

DATE	TIME	SAMPLE IDENTIFICATION	BIOCIDE CONCENTRATION (PPM)	ANALYST INITIALS

QA Record

APPENDIX G
Page 1 of 1

COMMENT LOG

A Record

APPENDIX H
Page 1 of 1

ESTIMATED CLAM MORTALITY

	Untreated Bio-Box	Treated Bio-Box
Date Started	_____	_____
Time Started	_____	_____
# of Clams Used	_____	_____
Avg Clam Size	_____	_____
Water Temp (F)	_____	_____
Water pH	_____	_____
Live Clams Day 1	_____	_____
Live Clams Day 2	_____	_____
Live Clams Day 3	_____	_____
Live Clams Day 4	_____	_____
Live Clams Day 5	_____	_____
Live Clams Day 6	_____	_____
Live Clams Day 7	_____	_____
Live Clams Day 8	_____	_____
Live Clams Day 9	_____	_____
Live Clams Day 10	_____	_____

Reviewed By _____ / _____

QA Record

SOURCE NOTES
Page 1 of 1

1. NC0910050005