ATTACHMENT 2

PROPOSED METHODOLOGY FOR IMPLEMENTING MECHANICAL CLEANING OF SERVICE WATER PIPING AND REPAIR OF SERVICE WATER ISOLATION VALVES

NORTH ANNA POWER STATION
UNITS 1 AND 2

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1.0 INTRODUCTION

The service water system piping at North Anna Power Station has undergone severe corrosive attack due to the aggressive nature of the water and the presence of sulfate reducing bacteria. The corrosion is in the form of general wall thickness reduction and wide spread pitting. Some small bore piping has required replacement due to through wall leaks or restricted flow.

In order to preserve the integrity of the service water system piping, and thereby avert or postpone any requirement for further pipe replacements, a corrosion inhibitor chemical treatment program has been initiated. Corrosion inhibitor chemicals were added to the reservoir on July 13, 1984. The corrosion inhibitor is a molybdate-based chemical that has been effective in significantly reducing the corrosiveness of the service water. The Corrosion Inhibitor Chemical Treatment Program was developed for this particular application by Calgon Corporation and consists of the following chemicals:

1. Calgon TRC-256 Molybdate Solution Corrosion Inhibitor
2. Calgon CL-36 Surfactant Deposit Inhibitor
3. Calgon H-130 Microbiocide
4. Hypochlorite Solution

Carbon steel test coupons exposed to the treated service water for periods of up to 90 days have experienced corrosion rates of less than 1 mil per year.

However, the treated service water cannot presently come in contact with the internal surface of a majority of the service water system piping due to the layer of corrosion product, silt and slime that has developed over the years of plant operation. In order for the corrosion inhibitor to be effective on service water piping, the internal surfaces must be cleaned to bare metal. Until the piping is thoroughly cleaned, corrosion will continue to occur beneath the build up in spite of the presence of corrosion inhibiting chemicals in the service water.

The desired pipe surface preparation will be accomplished by chemical and mechanical cleaning methods. The amount of corrosion product on the pipe internal surfaces makes it impractical to clean the piping using chemical methods alone. In order to reduce the amount of chemicals required, reduce the time required for final chemical cleaning, and insure the effectiveness of the chemical cleaning process, the piping will first be cleaned using a mechanical technique referred to as hydrolasing.

Hydrolasing is a process whereby a high pressure (4000 to 8000 psi) water jet is directed at right angles to the internal surface of the pipe. The dislodged corrosion product is flushed out through an opening in the pipe.

Hydrolasing was chosen as the mechanical cleaning method because it is flexible, effective and is least likely to remove metal from the pipe wall. Hydrolasing is flexible in that both small and large sections of piping can be cleaned with only minor setup adjustments. Cleaning operations can be scheduled to comply with station technical specifications. Hydrolasing performed

previously at North Anna on small bore service water piping has been very effective in removing corrosion product build up from the pipe surface with no apparent metal removal.

Hydrolasing also has several economic advantages that makes it the preferred process for service water piping mechanical cleaning. The process is economical in that (1) it will be accomplished by on-site construction personnel, (2) the equipment is already available on site, and (3) access requirements can be satisfied by relatively minor modifications, such as removing small sections of piping or valves. Hydrolasing can also be accomplished without unplanned plant outages which requires purchase of replacement power. Waste product created by the hydrolasing operation can be easily handled and disposed of.

Operating experience has shown that many of the valves in the service water system do not provide tight shutoff. This failure to properly seat causes difficulties in isolating equipment for maintenance and Type "C" testing. The majority of the valves that create isolation problems are flanged or wafer type butterfly valves.

The exact cause and extent of the isolation problems are not known at this time. The three most probable causes are (1) buildup of corrosion product around the valve seating area, (2) corrosion attack of the cast iron butterfly valve disc and (3) butterfly valve discs being "pulled through" their seats causing seat damage. It is likely that a combination of all of these causes exists. Isolation problems are most prevalent with the butterfly valves. A realistic assumption is made that all of the butterfly valves have seating problems. It is also likely that some of the gate and check valves are also leaking through and will likewise require maintenance.

The future chemical cleaning operations to be performed on the service water piping will require that all valves in the system provide proper isolation. Those valves that do not seat properly must be repaired or replaced before some sections of the service water piping can be mechanically cleaned.

The remainder of this report presents the detailed methodology by which the mechanical cleaning of the service water piping and repair of isolation valves will be accomplished.

2.0 PROJECT SCOPE

Service water system piping, 3" diameter and larger, will be hydrolased with the following exceptions:

- The 4" diameter and smaller piping servicing the charging pump lube oil coolers and instrument and service air compressors. These lines have been replaced with stainless steel piping and do not require mechanical cleaning.

- The 3" diameter and smaller piping servicing the containment penetration coolers. These lines have been switched over to the component cooling system under Design Changes 84-12 and 84-13.

- The 36" diameter piping which has an internal coal tar epoxy lining.

- The 24" diameter return lines in the service water pump house. This piping will be taken out of service once the new spray array is put into operation.

- The 20" diameter piping between the service water pump discharge flanges and the 36" diameter main supply headers. This piping consists of all fittings which is much thicker than the system piping and since flow rates in this piping is high corrosion is not a serious problem.

The project scope also includes all engineering and operations activities required to prepare implementation documents such as engineering work requests, design change packages, valve repair procedures, jumpers and temporary operating procedures.

In addition, minor modifications to facilitate main header draining, installation of a corrosion rate monitoring system and cross ties to eliminate stagnant areas will be included.

The design and installation of temporary provisions for collecting, handling and disposal of waste product and recovery of residual service water are also included in the project scope of work.

3.0 OVERALL PROJECT APPROACH

The Service Water System Mechanical Pipe Cleaning and Valve Repair Program has been broken down into 34 individual work packages. The boundaries for each work package are shown on Figure 1. A list of the work packages and a summary of the Scope of Work for each is included in Appendix B.

The work packages can be grouped into categories according to their relationship with station operating conditions and technical specifications. The work has been broken down in a manner that minimizes the amount of time that technical specification action statement time limits are in effect. The various categories are described as follows:

Category A - There are four work packages that can be accomplished during normal plant operation without entering into any technical specification action statement time period. This category includes portions of the control room air conditioning condenser cooling piping and portions of the auxiliary service water supply piping.

Category B - There are fifteen work packages that can be accomplished during normal plant operation within existing technical specification action statement time limits with one of the redundant service water main supply and return headers isolated. This category includes the main headers and lines that branch off of them up to the first isolation valve.

Category C - There are five work packages that can be accomplished during normal operation within existing technical specification action statement time limits with one redundant supply and return branch header to safety related components isolated.

This category includes the branch lines to the component cooling heat exchangers, charging pump gear box and seal coolers and control room air conditioning system condensers.

Category D - There are eight work packages that will be accomplished during single unit maintenance outages which are currently scheduled during the Fall of 1985. This category includes the branch lines to the recirculation spray heat exchangers outside of the containment isolation valves.

Category E - There are two work packages that will be accomplished during single unit refueling outages that are currently scheduled during the Spring of 1986. This category includes the service water piping inside the containments that service the recirculation spray heat exchangers.

The estimated duration for the implementation of each work package is shown on the project schedule which is included as Figure 2. The time periods when the main and branch headers are isolated and technical specification action statements are in effect are highlighted. A total of fourteen 72 hour-long main header isolations will be required to implement the fifteen Category B work packages. Four of the Category C work packages will require 72 hour-long isolations of branch headers. One Category C work package will require that branch headers servicing the component cooling heat exchangers be isolated a total of 10 times with each period of isolation lasting less than five hours. As shown on the schedule all main and branch header isolations are estimated to occur over an 11 month period between March 1985 and January 1986. Based on the information presented above it is estimated that technical specification action statement time periods will be in effect for approximately 17 percent of the time during that period.

In general, Category A work packages will be implemented early in the project since no technical specification action statements are involved. Experience gained during the implementation of these packages will aid the detailed planning and implementation of those packages that will be completed under technical specification time constraints. Category B and C packages will be implemented based on availability of materials and work package documentation. Category D and E packages will be implemented as the appropriate plant outages occur. These packages will take presidence over the other categories of work packages.

All pipe cleaning and valve repair work will be accomplished using Design Change Packages prepared in accordance with the Vepco Nuclear Power Station Quality Assurance Manual and the Vepco Engineering and Construction Nuclear Design Control Program. Implementation of all work will be done in accordance with the applicable Station Administrative Procedures and Technical Specifications.

A typical work package consists of all the activities required to isolate a specific section of piping, gain access to the inside of the pipe, hydrolase the internal surface of the pipe, repair or replace isolation valves, make modifications as required, perform required acceptance testing and return the system to operation.

In most cases access to the inside of the piping will be gained by the removal of flanged valves and expansion joints. However, in some of the smaller lines, access will be gained by temporarily cutting out a short section of the piping.

During all hydrolasing activities, provisions will be made for collecting and discharging corrosion product wastes. These provisions will consist of providing the following temporary installations:

- Collection troughs to collect waste product
- Settling drums to collect the heavier solids
- Pumps and piping to transfer decanted waste water to the plant settling basin

The collected corrosion product will be drummed and disposed of as a non-hazardous waste.

The majority of valve repairs will involve the refurbishment of butterfly isolation valves. Typical repair activities will consist of disassembly of the valve, thoroughly cleaning the body and reassembly using new seats, stainless steel discs, packing, etc. In order to minimize the number of valves that must be refurbished during technical specification action statement time periods replacement valves obtained from North Anna 3 and 4 stock will be used where possible. Valves that are replaced will be refurbished and reused in other work packages. Some gate and check valves may also require refurbishment.

Some work packages will include minor modifications which will improve corrosion control in stagnant areas of the system, allow the effectiveness of the corrosion inhibitor chemical treatment program to be monitored or improve techniques for draining the main service water headers.

4.0 SAFETY CONSIDERATIONS

The North Anna Service Water System is a safety related system that is shared between Units 1 and 2. The system is required to operate in all modes of plant operation and under all accident conditions. Station Technical Specification 3/4.7.4 governs the operation of the system during operating modes 1 through 4. Although the Technical Specifications do not require two loops of the service water system to be operating in Modes 5 and 6, at least one loop must be opreating in these modes to remove heat from the RHR system and fuel pool. Technical Specifications also govern the operation of several safety related components that are serviced by the service water system. However, the intent of the Technical Specifications, as related to this project, is to minimize the amount of time a safety related system is operated without redundancy of flow paths.

The Technical Specifications make provisions for system maintenance and modifications during operation by allowing only one of the two redundant service water loops to be taken out of service for a period of 72 hours. The isolated loop must be placed back into service within 72 hours or both units must begin shutting down. Similar provisions are made in the Technical Specifications governing the operation of other safety related components and systems. The Technical Specifications do not put any limits on the number of times a particular system or component can be removed from service.

Maintenance and repairs to the Service Water System and other safety related systems under Technical Specification action statement time constraints are performed as required in order to maintain safe and economical operation of the plant. An Action Statement Status Log (1-LOG-11) is maintained in accordance with Station Administrative Procedure 19.1 which documents each time an action statement is entered. Action statements are not entered indescriminately. The operational and safety consequences for each instance are thoroughly reviewed prior to voluntarily entering an action statement.

The work described in this report has been carefully reviewed to insure that it can be accomplished safely with one or both North Anna units in operation. To minimize the number of times that Technical Specification Action Statements are challenged much of the work will be accomplished during planned single unit outages. Some of the work can be accomplished during one or two unit operation without impacting the Technical Specifications. Isolation of operating service water system loops or components will be done only when necessary and will be controlled using existing station administrative procedures. The duration of each period of isolation will be kept to a minimum.

A total of twenty-eight separate header or branch line isolations are anticipated, many of which will last less than five hours. The total time of isolation is estimated to be approximately 1,346 hours. These isolations will be spread over a time period of approximately 7,920 hours (11 months). Main or branch headers will be isolated approximately 17 percent of time during completion of the work. Each period of isolation required to complete pipe cleaning and valve repairs will be separated by an average of 7 days of normal operation of both redundant headers with a minimum separation of 3 days of normal operation. However, half of the ten 5 hour long isolations required by work package DC84-86 will be separated by a period of approximately 5 hours. These periods of isolation will affect only the component cooling heat exchangers.

It is highly unlikely that an accident or component failure will occur during any period of main or branch header isolation that will render the unisolated header inoperable or that will require a site evacuation. However, should either of these events occur quick action will be required to restore the isolated header to flowing condition. Therefore, work packages that involve isolating main or branch headers will include an emergency contingency plan. Contingency plans will provide instructions for installing temporary devices such as spool pieces and pipe couplings to insure reasonably reliable flow conditions. Temporary installations would be returned to normal status as soon as conditions allow.

Each work package will include a detailed review in accordance with the requirements of 10CFR50.59 to insure that the work does not create an unreviewed safety question. A review of the operational safety inplications will also be included in each package. These reviews will include discussions delineating precautions to be taken to minimize risks. All work packages will be approved by the Chairman of the Station Nuclear Safety Operating Committee prior to initiation of any work related to that package.

5.0 PROJECT PLANNING AND MONITORING

Although this project is not critical to insure near-term operability of the service water system, it should be expedited to reduce the damage being done to the piping due to corrosion and thereby promote long-term system integrity. As shown on the schedule in Figure 2, the work packages are to be completed by June, 1986 during the Unit 1 refueling outage. Schedule dates for completion of the outage related work will change if the scheduled outage dates change. Scheduled dates for performance of other categories of work packages will be revised as required to accomodate plant outages. Therefore the dates shown on Figure 2 are to be considered preliminary. However, changes in the schedule due to revised outage dates will not cause an increase the amount of time main or branch line headers are isolated.

Prior to isolating any piping segment for modifications, hydrolasing or valve repair, a detailed hour by hour schedule will be prepared covering every activity to be performed during the period of isolation. A drop dead point providing ample time for system closure and pressure testing will be included to insure that the 72-hour Technical Specification action statement is not violated. A sample of the detailed schedule is included as Figure 3. The sample is an actual schedule to be used during the implementation of work package DC84-73. Work will be subdivided into small enough portions to provide ample margin for completion within the allowable time limit. All equipment set-up will be completed and a thorough check-out of all equipment and tools performed prior to isolating the segment. Also, all personnel performing any portion of the work will be thoroughly briefed prior to start of work. Work will be performed around the clock with shifts overlapping to insure continuity.

A consolidated flow diagram of the service water system has been prepared which cross references to erection control isometrics for each line to be hydrolased. Also, the diagram shows the boundaries of each work package. The flow diagram is included as Figure 1. This diagram will be used as an aid in planning the work and for tracking project progress. In addition, status lists will be maintained providing status of hydrolasing and valve repair activities.

VEPCO management will be kept informed as to the status of the project through weekly reports issued by Project Management Engineering. The NRC resident inspector will also be kept informed regarding project status and changes to the schedule that may be required.

6.0 INTERFACES WITH OTHER ACTIVITIES

The performance of the mechanical cleaning and valve repair efforts affects and is affected by other service water system improvement projects.

Chemical cleaning of the service water piping is not feasible until the mechanical cleaning is complete and the redundant loops can be isolated from each other. Efforts to obtain the services of a chemical cleaning contractor must begin several months prior to the actual cleaning effort. This long lead in time is required to request bids, analyze pipe samples, develop the cleaning process, obtain and review bids, develop and implement modification required to facilitate hook-up and to develop the required temporary operating procedures. The obtaining of pipe samples for evaluation by the prospective chemical

cleaning contractors will be accomplished under this project. The actual chemical cleaning process is not included in the scope of work for this project.

A permanently installed corrosion rate monitoring system is to be installed in the service water system piping. Piping modifications to install corrator probes and corrosion coupon holders will be required. These modifications will be implemented while their locations are isolated for hydrolasing or valve repairs to reduce the overall number of isolations required. The electrical hook up and commissioning of the monitoring system will be accomplished under a separate project.

7.0 GENERIC PROCEDURE

In order to expedite the completion of this project, it is necessary to break the work down into numerous individual work packages. This is in lieu of preparing one all inclusive package that would be cumbersome, would require considerable time to prepare and would require numerous revisions during the implementation process. Implementation of the work under individual packages will allow flexibility in planning the work effort to suit changes in circumstances.

The process of preparing individual work packages will be very similar in each case. The general process and procedure is described below:

- A detailed walkdown of the piping segment to be hydrolased or valve to be repaired will be performed by the project team. Existing provisions for drainage, isolation, water recovery and access will be noted. Requirements for temporary or permanent modifications to provide the above will be determined. The waste collection and disposal scheme for that segment will be formulated.

- Implementing procedures such as DCP, EWR, TOP, MMP and/or jumpers will be prepared and submitted to SNSOC for approval.

- All temporary installations not requiring system isolation will be installed and tested.

- All required equipment will be set up and tested.

- All personnel performing the work will be thoroughly briefed on the procedures, precautions, time constraints, work schedule and potential trouble spots. All personnel required to provide support during system isolation will also be briefed.

- All materials and/or valve repair parts will be moved into work areas.

- Connections for draining, etc. or any other work that can be performed without system isolation will be completed.

- Required tag reports and tags will be completed.

- The piping segment will be isolated at which time the action statement time clock will start.

- Piping segment will be drained and access points for hydrolasing opened as called for in the implementation documents.

- Hydrolasing operation will be performed. At the same time, preparations will be made for system closure (weld end preparation, flange face preparation, etc.)

- Valve repairs will be made.

- At a pre-determined time, even if hydrolasing has not been completed, system closure will begin.

- Piping segment will be pressure tested as called for in the implementation documents.

- The completed implementation documents will be reviewed and signed off by SNSOC.

- The piping segment will be placed back into service and the tags removed.

- Temporary installations will be removed.

In the event the entire piping segment is not cleaned during the period of isolation, portions of the procedure will have to be repeated at another time. As stated earlier in this report, the work has been broken down into small work packages in order to minimize the risk of not being able to complete the work within the allotted time period.

8.0 PROJECT TEAM

To implement the mechanical cleaning and valve repairs, a Project Team consisting of Operations, Engineering and Construction personnel will be established. Full time involvement by key personnel will be required. Part time support on an as requested basis will be required from certain departments. Support during periods of system isolation will be provided on a priority basis to insure that the 72-hour action statement is not violated. Project Team personnel requirements, responsibilities and commitment requirements are provided in Appendix A.

Support from other departments such as estimating, cost and safety, will be required. This support will be coordinated by the Project Management Engineer.

Installation of all temporary and permanent modifications and all hydrolasing and valve repair activities will be performed by Power Station Construction under the direction of the Project Team.

In order to insure project continuity, personnel assigned to this project should not be changed unless absolutely necessary.

APPENDIX A
PERSONNEL REQUIREMENTS, RESPONSIBILITIES AND COMMITMENTS

PERSONNEL	RESPONSIBILITIES	COMMITMENT
Project Management Engineer	1. Provide overall coordination and control of all project activities. 2. Insure proper interface with other service water projects. 3. Monitor project progress and provide reports to management. 4. Assist in resolution of technical and procedural problems. 5. Provide interface with management.	As required (approx. mately 75% of full time)
Coordinator	1. Assist the Project Management Engineer in the day to day coordination of of project activities and on the preparation of status reports. 2. Prioritize project work activities to insure maximum use of isolation time. 3. Insure that proper interface between working groups occurs. 4. Insure that appropriate working groups are notified prior to implementation of work packages to allow adequate time for preparation.	Full time for one Coordinator
Mechanical Engineer	1. Determine scope of modification required to implement each hydrolasing activity. 2. Determine methods of recovering drained service water and hydrolaser waste product. 3. Prepare implementing documentation (EWR's and DCP's) to control Construction activities. 4. Determine piping segment boundaries. 5. Provide full time support during hydrolasing and valve repair activities to insure timely resolution to technical problems. 6. Review valve isolation capabilities and determine required valve repairs. 7. Specify valve repair parts. 8. Review North Anna 3 & 4 butterfly documentation to determine acceptability for use on Units 1 and 2 service water system. 9. Provide schedule inputs for all engineering activities.	Full time for Engineers (Additional support may be required while around the clock hydrolasing is being performed and as required to maintain the the project schedule.

PERSONNEL	RESPONSIBILITIES	COMMITMENT
Station Operator	1. Prepare temporary operating procedures and/or jumpers required to determine valve isolation capabilities 2. Prepare any temporary operating procedures and/or jumpers required to allow the hydrolasing and valve repair work to be performed during plant operation. 3. Prepare all required tag reports and prepare tags as required. 4. Arrange for all valve manipulations required to achieve designated isolations. 5. Review implementation procedures for operational acceptability. 6. Provide schedule inputs pertaining to system isolation time requirements.	Full time for one operator that is knowledgeable of the SW system. (Additional support will be required at various times.)
Advisory Operations	1. Provide all required testing procedures. 2. Assist, as requested, in resolution of operational concerns and problems. 3. Perform required testing.	As required. (Performance of testing must be on a priority basis.)
Construction Engineering	1. Revise erection isometrics to reflect any modifications. 2. Prepare weld data packs. 3. Review implementation procedures to insure that adequate instructions are provided. 4. Coordinate construction activities. 5. Provide schedule inputs pertaining to all construction activities. 6. Determine construction manpower requirements and arrange for those requirements to be met.	As required (approximately 60%-70% of full time-additional support may be required at times of peak activity.)
Health Physics	1. Insure that proper ALARA considerations are included in all in-plant activities. 2. Sample all waste product released from the plant. 3. Perform decontamination and cleanup of waste spillage in potentially contaminated areas. 4. Prepare and issue the required Radiation Work Permits.	As required (sampling of wastes must be done on a priorty basis).

PERSONNEL	RESPONSIBILITIES	COMMITMENT
Planning	1. Prepare and maintain all project schedules. (a) Level 3 overall (b) Hour by hour for hydrolasing and valve repairs.	Full time for One Planner
Purchasing	1. Procure all require materials 2. Expedite delivery as necessary	As required.
Quality Control	1. Review implementation documentation during development to insure that proper QC Holds, etc. are included. 2. Provide continuous coverage of work activities during periods of isolation. 3. Perform all inspections as required by procedures. 4. Coordinate coverage by Station NDE and the Insurance Inspector.	As required.