VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

August 24, 1995

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 95-381
NL&P/JBL R6
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
RESPONSE TO NRC REQUESTS FOR ADDITIONAL INFORMATION
PROPOSED TEMPORARY TECHNICAL SPECIFICATIONS CHANGE
SERVICE WATER SYSTEM PIPING REFURBISHMENT

By letter dated July 19, 1995, the NRC issued a request for additional information (RAI) regarding our request for temporary North Anna Technical Specifications changes in support of refurbishment activities on the service water headers to/from the component cooling water heat exchangers. In addition, via a telephone conversion on August 9, 1995, the NRC staff requested supplemental information related to operation coincident with the refurbishment activities. Attachment 1 provides the response to the July 19, 1995 questions and Attachment 2 provides the response to the August 9, 1995 questions.

If you have any further questions, please contact us.

Very truly yours,

M. R. Kansler
Vice President - Nuclear Services

Attachments

cc: U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, N.W.
Suite 2900
Atlanta, Georgia 30323

Mr. R. D. McWhorter
NRC Senior Resident Inspector
North Anna Power Station

A065

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION PROPOSED TEMPORARY TECHNICAL SPECIFICATIONS CHANGE SERVICE WATER SYSTEM PIPING REFURBISHMENT NORTH ANNA POWER STATION UNITS 1 AND 2

By letter dated July 19, 1995, the NRC submitted a request for additional information (RAI) regarding our request for temporary North Anna Technical Specifications changes in support of refurbishment of the service water (SW) lines to/from the component cooling water (CC) heat exchangers (CCHXs). The following discussions are provided in response to the NRC's RAI.

NRC Request:

1. **It would seem that much of the SWS work could be performed during separately scheduled outages for each of the units. The licensee is requested to evaluate the pros and cons of this option and explain why this approach is less desirable than the option that has been selected.**

Response:

Most major system modifications or repair activities are best implemented during outage conditions to take advantage of reduced system operability requirements. For larger projects or projects affecting both units, it may also be necessary to implement portions of the project during separately scheduled outages for each of the units. Although it was not specifically discussed in the proposed Technical Specifications change request, submitted by letter dated March 30, 1995 (Serial No. 95-147), this suggested alternative approach was considered during the initial project evaluations for the refurbishment of the SW lines to the CCHXs. However, this approach was found not to be feasible.

The initial consideration of this approach was to determine if a single-unit outage offered any advantages from a required Technical Specifications operability standpoint. It was found that the Technical Specifications operability requirements for the SW and CC systems are no different for single-unit verses two-unit operating modes. The Technical Specifications operability requirements for these systems are only relaxed during a two-unit shutdown. The result of this review showed that the complex sequence of system alignments and pipe refurbishment activities would be the same with either one unit or two units operating. Hence, a temporary Technical Specification change would be required to implement the refurbishment activities whether the project was implemented during single-unit shutdown or during non-outage two-unit operation.

In addition, it has been estimated that up to 49 days each will be required to implement the refurbishment on the two main SW loops. The majority of this duration is made up of numerous system realignments for the removal of existing valves and their temporary replacement with blind flanges prior to start of piping refurbishment and reinstallation of the valves following piping refurbishment. The length of the project could easily exceed the length of a typical single-unit refueling outage. For example, the most recent refueling outage for Unit 1 (1994) was completed in 31 days. Due to increasing industry competition and improvements in outage management, continued emphasis on minimizing the length of future outages is expected. Only a portion of this time would be available for SW system refurbishment work since it would be required to tag and drain SW piping after unit cooldown activities are complete and return the system to service prior to unit restart activities. Hence, to perform any significant portion of the proposed SW piping refurbishment work during planned single-unit outages, the planned outage durations would have to be extended resulting in undue hardship on the Company in terms of power supply and replacement power costs.

Most importantly, however, it was determined that implementation of the refurbishment activities during the proposed two-unit operating mode would have a less risk-significant impact than performing the work during single-unit operation such as during refueling outages. As stated in our letter dated March 30, 1995, removal of one SW loop for up to 49 days has the potential to affect the reliability of the CC system and all of the equipment cooled by the CC system, most notably the residual heat removal (RHR) system. The RHR system is in operation for the majority of a refueling outage. Component cooling water is used to cool the RHR heat exchangers and, ultimately, the heat is rejected to the SW system via the CCHXs. A reduction in the reliability of the RHR system results from having only one SW header available to the CCHXs during project implementation. A Probabilistic Safety Assessment for unit shutdown conditions is currently not available for North Anna, therefore, a specific value for the increase in risk was not calculated. However, it was determined more prudent to implement the project when there are no planned RHR system operations, i.e., during non-outage conditions.

It should be noted that, during project implementation, the temporary alignment of the SW and CC systems will support use of the RHR system to reach cold shutdown (Mode 5) if it becomes necessary as a result of an unplanned unit shutdown. See the response to NRC Request #3b below for further details.

NRC Request:

2. **Due to ongoing aging and degradation of the SWS, the licensee has implemented actions to inspect and make necessary repairs to the system. During the initial 49-day repair outage, the SWS supply header of one unit will be isolated from its associated component cooling water heat exchangers and the supply header from the other unit will be aligned to provide service water cooling to the component cooling water (CCW) heat exchangers of both units. The licensee is requested to address to what extent the SWS is degraded and explain why a failure of the fully intact system is not likely to occur during the initial 49-day repair period. The licensee is also requested to discuss any deficiencies or degraded conditions associated with the service water pumps, and describe any additional measures that will be taken (beyond those that have been discussed in the March 30, 1995 submittal) to assure that the fully intact SWS and all service water pumps will remain operational while the SWS inspection and repairs are being completed.**

Response:

An extensive SW system inspection program has been in place for several years. The main purposes of this inspection program are three-fold: 1) to monitor the system piping for evidence of corrosion to ensure that the SW system remains fully capable of performing all of its intended safety functions, 2) to determine extent of corrosion and corrosion rates to monitor the effectiveness of and adjust various parameters of the chemical treatment program, and 3) to assess remaining life of the various portions of the SW system to schedule implementation of repair/replacement efforts.

Data collected from this inspection program indicates that the nature of the SW system corrosion consists of a relatively low general wall corrosion rate with more rapid localized random pitting corrosion, characteristic of microbiologically influenced corrosion (MIC). Analysis of this corrosion phenomenon has shown that overall piping structural integrity is not adversely impacted by this random pitting corrosion, even with postulated through-wall flaws. Analysis of the specific inspection data for the SW header to/from the CCHXs indicates that this portion of the system remains fully operable and is capable of performing its intended safety functions. The continuing inspection / monitoring of this piping will ensure that piping integrity is maintained.

Virginia Power has evaluated the risks associated with this proposed project. Construction mishaps are by far the most risk significant events evaluated. Suitable precautions and protection measures will be used to minimize the risk of construction mishaps to the fully intact SW header. All lifting and rigging will be inspected and load tested. Lifting of equipment and piping sections over the fully intact SW header will be limited to the extent possible. Impact shielding /

protection will be incorporated as determined necessary to minimize risk of damage to the intact piping system. In addition, planned compensatory measures are in place to address damage resulting from a construction mishap.

The main SW pumps are vertical, multi-stage, deep draft pumps. As with any pump of this type, periodic preventative maintenance (PM) and/or rebuild is required to ensure their long term reliability. A separate, ongoing SW project is planning to refurbish / rebuild each of the four main SW pumps. As described in the temporary change request submittal, the four pumps are required to be maintained operable during the proposed 49-day pipe refurbishment periods. The SW pump preventative maintenance / rebuild work and the SW piping refurbishment activities will be coordinated to ensure both the SW header and a SW pump are not disabled at the same time.

The four main SW pumps (two on Unit 1 and two on Unit 2) are tested quarterly in accordance with the North Anna ASME Section XI Pump and Valve Program. These quarterly tests verify that bearing lubrication, discharge pressure, flow rate, and vibration remain within appropriate acceptance criteria. The test procedures prescribe required actions if a test parameter is outside of its acceptable range. These periodic pump tests were most recently performed on August 1, 1995. Although each of the main SW pumps were determined to be within the acceptable range for all tested parameters, one pump was determined to have vibrations on one axis in the alert range. The pump is fully operable and is being tested more frequently as required by the applicable ASME code.

NRC Request:

3. **During the SWS repair, cooling of the CCW heat exchangers will be provided exclusively by either the Unit 1 or the Unit 2 SWS and the SWS of the other unit will only be available to supply cooling water for the other SWS heat loads. The licensee is requested to describe any special SWS alignment requirements (should any exist) that the plant operators must be aware of while the SWS inspection and repairs are being completed for the following situations:**

   a. during normal dual-plant operation;

Response:

In order to discuss the special SW system alignments which will be necessary during project implementation, it will be helpful to briefly describe normal SW system design and operation. In general, the SW system at North Anna is a common system, shared between Units 1 and 2. The two main loops are composed of 36-inch and 24-inch diameter piping which form the main supply and return headers. Each of the two main loops include branch connections to the Unit 1 and Unit 2 components cooled by SW. While any of the four pumps can be aligned to either supply header, one Unit 1 pump and one Unit 2 pump are normally aligned to each of the two main supply headers. The number of operating pumps varies between two and four depending on plant conditions and seasonal climate conditions. Normal SW system design and operation requires both main SW loops to operate continuously during all plant operating modes.

Figure 1 (see following page) provides a simplified SW system diagram. For convenience, the two main supply headers are designated as Header #1 and Header #2 and the two main return headers are designated as Header #3 and Header #4. One main SW loop ("A" loop, as described in the March 30, 1995 submittal) consists of supply Header #1 and return Header #4 and the other main SW loop ("B" loop) consists of supply Header #2 and return Header #3.

Individual components which are supplied with SW for cooling are normally dedicated to one of the two main loops. For example, the Unit 1 CCHXs are normally supplied by Header #1 and the Unit 2 CCHXs are normally supplied by Header #2. There are certain exceptions to this normal alignment. The coolers associated with the charging pumps (gear box, seal, and lube oil coolers) are normally aligned to both Headers #1 and #2. This alignment is provided to ensure uninterrupted SW flow to these coolers in the event of a spurious failure of one of the main headers. Therefore, each main SW loop

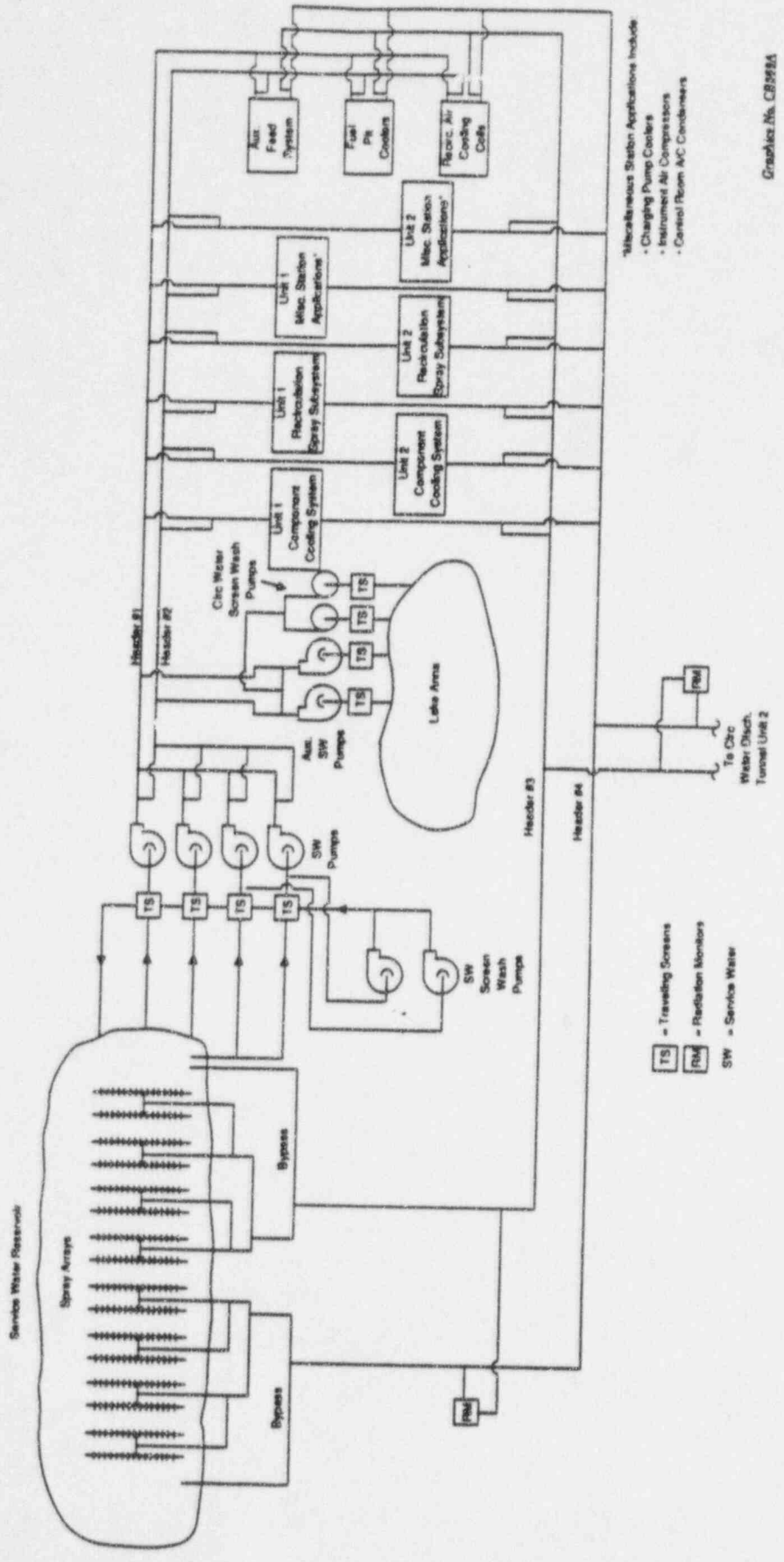

Figure 1
Service Water System Simplified Diagram

normally supplies Unit 1 and Unit 2 components and cannot be considered solely a "Unit 1" loop or a "Unit 2" loop.

The above summary describes the SW system design and operation during normal dual-unit operation. As described in the March 30, 1995 submittal, this normal system alignment is required to be temporarily altered to gain access for refurbishment of the SW piping to/from the CCHXs. Two special system alignment configurations will be necessary to isolate the subject piping and accomplish the refurbishment activities during each of the requested 49-day pipe refurbishment periods.

1) At the beginning of each 49-day period, all applicable components will be aligned to a single main SW loop so that the other loop can be isolated and drained. This is performed during an existing 168-hour Technical Specification action statement. This will permit the 24-inch diameter main supply and return header valves to be removed and replaced with blind flanges. A similar system alignment is required later in the 49-day period to permit subsequent reinstallation of the valves. Once the blind flanges are installed, the isolated loop is refilled and alignment is returned to normal except for the CCHXs which are being supplied by only one of the two main headers.

2) For the remainder of the 49-day period, components other than the CCHXs will require no special alignment changes. For the CCHXs, a precise sequence of steps must be followed to individually isolate one CCHX, remove its corresponding 18-inch diameter valves, install the blind flanges, and return the CCHX to service. This sequence was described on page 5 of 19 of the March 30, 1995 submittal. This sequence of steps permits placing the piping in a totally isolated condition for refurbishment, while maintaining the required number of CCHXs operable to comply with Technical Specifications.

   A temporary cross-connect with a manually operated butterfly valve will also be installed between the supply and return headers on the loop which is being refurbished. This was described on page 9 of 19 of the March 30, 1995 submittal. This cross-connect permits normal pump operation by bypassing the amount of flow which would normally have been supplied to the CCHXs.

The special system alignments required for operation of the SW system during these 49-day periods will be addressed by specially prepared temporary operating procedures (TOPs). These TOPs will include the detailed step-by-step alignment changes described above as well as the initial conditions which must be satisfied, special precautions and limitations which

apply, and any contingency actions which are necessary such as those described in the response to NRC Requests 3b and 3c, below.

It should be noted that, as part of their normal licensed operator continuing training, operating crews are trained on the simulator for operation of the facility in the 168-hour action statement. In addition, the operating crews will be trained for operation of the facility in accordance with the TOPs and for implementation of contingencies associated with the refurbishment of the SW headers to/from the CCHXs during the 49-day periods.

NRC Request:

3b. during anticipated operational occurrences that could have some impact on SWS operation including, for example, a reactor trip on the unit with the intact SWS or a trip on the other unit (i.e., are there any differences in the operator response that need to be recognized, depending on which unit is affected?), and

Response:

As stated above and in our March 30 submittal, the SW and CC systems remain capable of supporting a unit shutdown during project implementation with one SW header supplying the CCHXs if it became necessary to place a unit in a hot shutdown condition (Mode 4) or in a cold shutdown condition (Mode 5). Generally, there is no difference in the actions which would be taken for a Unit 1 or Unit 2 shutdown as it applies to the SW system alignment. Some special requirements are described below that would apply regardless of which unit were shutdown.

Depending on the nature of the unit shutdown, it may be necessary to place the unit in a hot shutdown condition (Mode 4) to resolve the concern and proceed to restart the unit. In this case, RHR system operation is not required. However, if a more prolonged shutdown were required and placing the unit in Mode 5 became necessary, this would be performed. Placing a unit on RHR increases the CC flow and heat load requirements at the onset. Therefore, if a unit were required to be placed in Mode 5 and if the SW supply temperatures were above 78.5°F, a third SW pump would be aligned to the SW header supplying the CCHXs.

The proposed repair work is currently planned to take place during the October to April time period when SW temperature is expected to remain below 78.5°F. Therefore, operator action to align the third SW pump on the SW header supplying the CCHXs will most likely not be needed.

The only potential challenge to placing a unit in Mode 5 would be if a coincident failure of the operating SW header supplying the CCHXs were to occur. This is judged to be a very unlikely event. This failure could be in the form of loss of the two SW pumps aligned to the SW header supplying the CCHXs. The response to this event would be to realign one of the remaining two SW pumps from the other SW header to this header. Alternately, the auxiliary SW pumps could be aligned to provide cooling water to this header. Another possible scenario would be the occurrence of an unisolatable leak in the SW header supplying the CCHXs. In this case, the unit would be held at a hot shutdown condition (Mode 4) pending one of two actions. If the leak were manageable, a temporary repair could be made to allow continued operation of this header. Capability to perform such an activity is one of the contingency measures described in our March 30 letter. If the leak cannot be stopped with the use of a temporary repair, steps would be taken to isolate and drain the piping and perform a more permanent repair, such as cut out and replacement of the damaged section.

The second option would be to return the SW header which is out of service for refurbishment to operable condition. Feasibility of this action would depend on the status of the refurbishment. Near the beginning or near the end of the evolution, it would be relatively easier to return the header to operation. If the project is at the point where all of the existing piping and supports are removed, then return to service would take longer to accomplish. For this reason, a judgment would be made as to which course to take. In either event, if a prolonged shutdown were expected, actions would be taken to return both headers to operation.

As stated in the response to NRC Request 3a, these actions will be addressed by the specially prepared temporary operating procedures. The operations staff will be trained in their use.

NRC Request:

3c. during a postulated loss-of-coolant accident on the unit with the fully intact SWS or on the other unit (i.e., is there a difference in operator response that needs to be recognized?) and a concurrent loss-of-offsite-power on both units.

Response:

As described in the March 30, 1995 submittal, the SW system configuration during the 49-day periods was evaluated during postulated design basis accident (DBA) conditions. The DBA condition for the SW system is a loss-of-coolant accident on one unit with simultaneous loss-of-offsite-power to both units. In response to a LOCA, a safety injection/containment depressurization actuation (SI/CDA) signal would start all four main SW pumps and would isolate

SW flow to the CCHXs of the affected unit to ensure adequate flow to the containment recirculation spray heat exchangers (RSHXs) on the accident unit. However, during the two 49-day periods with the CCHXs aligned to a single SW header, this normal response to an accident condition (i.e., isolating SW flow to the CCHXs in response to a CDA signal) may also result in the undesired interruption of CC cooling to the unaffected unit. Therefore, the automatic closure feature of the SW valves servicing the CCHXs shall be defeated to ensure SW flow to the CCHXs is not unnecessarily interrupted. (This is further clarified in the response to Supplemental Request S1 in Attachment 2.) A SW system hydraulic analysis has been performed to verify that adequate flow is provided to the RSHXs under these conditions. The design change package and detailed implementation procedures will provide the instructions for physically defeating this automatic closure function. It should be noted that only this control function will be defeated. The ability to manipulate the valves remotely from the control room will be retained. With this defeat in place, the operator response to a CDA on either unit is not affected by the performance of the refurbishment project.

The containment isolation valves in the SW lines to the RSHXs are closed during normal operation. These valves open in response to a CDA signal to provide SW flow to the RSHXs of the affected unit. Should an SI signal be received without concurrent CDA, all four SW pumps will start but the normally-closed containment isolation valves at the RSHXs will not open. In this case, it may be necessary to manually secure one of the SW pumps on the partially bypassed header to prevent pump operation at low flow conditions since the additional flow is not needed.

As stated in the response to NRC Request 3a, these actions will be addressed by the specially prepared temporary operating procedures. The operations staff will be trained in their use.

In addition to the request for additional information, the NRC staff provided the following comment on the proposed wording of the temporary change requested.

NRC Comment:

Aside from the additional information that is requested, the staff also believes that the actual wording of the temporary change that the licensee has proposed to the NA-1&2 TS should be changed to be more specific with regard to when the temporary specification will be effective and to remove the requirement that the "...condition is permitted two times only (once for each service water loop)..." Unforeseen circumstances may require a multiple entry to complete the repairs and the specification should be more flexible in this regard in order to avoid unnecessary complications.

Response:

The proposed Technical Specifications changes provide a set of temporary operating limitations which, when combined with the compensatory actions and contingency measures (as discussed in the March 30, 1995 submittal) required for implementation of the project, will allow a section of the SW piping to / from the CCHXs to be removed and replaced. The proposed changes have been analyzed and requested only as a temporary condition of the facility for the explicit purpose of refurbishing the SW piping to / from the CCHXs. The proposed wording of the temporary footnotes was chosen to eliminate any concern that the provisions allowed could be used more often or for any other purpose than that described.

Because the operating conditions allowed by the proposed changes are meant to be only temporary, the proposed changes are confined to single footnotes on the affected pages and are written to be explicitly used for this piping replacement effort. Sometime after the completion of the described piping refurbishment activities, a proposed change request can be submitted to eliminate the then unnecessary footnote.

The proposed Technical Specifications change needs to be temporary and NRC's suggested alternative wording change is considered unnecessary. The proposed refurbishment project has been carefully planned and alternatives to the wording in the proposed temporary specifications were evaluated. The additional component operability requirements, compensatory actions, and contingency measures discussed in the March 30, 1995 submittal provide justification for operation during the 49-day period with a single SW loop providing cooling to the CCHXs.

Although its desirable to limit use of the special conditions allowed by the footnotes, the actual implementation of the SW refurbishment activities is desired to remain somewhat flexible. This flexibility is needed to accommodate operating conditions and outage schedules, weather conditions, service water reservoir temperature, equipment / component availability, and electrical network system operating demands. While it is our intent to perform the refurbishment activities during the upcoming winter months, i.e., October 1, 1995 to March 30, 1996, planning for these 49-day periods is heavily dependent on weather conditions and planned outage scheduling. If the expected conditions change, one header may be refurbished this winter and the other header next winter. Therefore, we specifically do not want to limit when the refurbishment activities have to be implemented.

Once the SW header is isolated from the CCHXs, the focus of the project will be to replace the SW piping and then return the header to operable status as swiftly and safely as possible. As described in our March 30, 1995 submittal letter, the requested 49-day periods include contingency to accommodate unexpected conditions.

Attachment 2

In addition to the formal request for additional information, the NRC staff requested, via a telephone conversion on August 9, 1995, the following supplemental information be provided as part of our response. These questions relate to operation during the 49-day periods while also in the 168-hour action statement as currently allowed by the Technical Specifications.

NRC Supplemental Request:

S1. During the 49-day period with only one SW header providing cooling to the CCHXs, automatic isolation of the main SW valves going to the CCHXs is to be defeated to prevent the unnecessary disruption of SW flow to the CCHXs and to eliminate the need for operator action to reopen the valves in the event of a CDA signal. The licensee clearly states that the SW system can handle the normal loads of the CC system. Can the SW system handle the hydraulic and thermal loads of the RSHXs and the CC system during the 168-hour action statement with the autoclosure of the SW valves defeated? Are any special operator actions required?

Response:

The thermal and hydraulic loads on the SW system associated with operation of the RSHXs and the CCHXs while on single SW header operation have been evaluated. These analyses included the additional conditions of the 168-hour action statement and defeating the autoclosure of the SW valves to the CCHXs.

During the proposed 49-day period with only one SW header providing cooling to the CCHXs, automatic isolation of the main SW valves serving the CCHXs is to be defeated to prevent the unnecessary disruption of SW flow to the CCHXs. Thus, special operator actions to re-open the valves are eliminated for this period of time.

Initial condition assumptions of the postulated accident scenario, during a 168-hour action statement within one of the 49-day periods with the autoclosure of the SW valves to the CCHXs defeated, require the four main SW pumps to be aligned to the operating supply header (i.e., two pumps operating and two pumps in automatic) to ensure adequate flow to the RSHXs. In the event of an SI/CDA signal during this situation, the standby pumps would auto-start and the SW MOVs to the RSHXs would automatically open to provide cooling to the RSHXs.

While this approach has been evaluated and would be allowed by the temporary change, a more conservative compensatory requirement will be imposed for the periods of operation while in the 168-hour action statement.

The autoclosure of the SW valves to the CCHXs will not be defeated while the station is in a 168-hour action statement. Thus, a postulated accident scenario which results in an SI/CDA signal would auto-start the standby SW pumps, automatically open the RSHXs, and automatically close the SW valves to the CCHXs. The temporary operating procedures associated with operation during these 49-day periods will specify that, while in the 168-hour action statement, operator action will be required to manually re-open the main SW valves to the CCHXs.

NRC Supplemental Request:

S2. The licensee submittal states, as an assumption for the PSA, that the only equipment with a single SW header will be the CCHXs and all other equipment which normally has two SW headers available will still have two headers available. Does the use of the 168-hour action statement during this 49-day period invalidate this assumption of the PSA?

Response:

The probabilistic safety assessment (PSA) performed for the refurbishment of the SW headers to/from the CCHXs evaluated the impact of operating the SW system with only one header supplying the CCHXs for a cumulative period of 98 days (two 49-day periods). The PSA specifically addresses the effect on CC system unavailability and the effects on other systems cooled by the CC system. This evaluation recognized that, during the 168-hour action statements, only one SW header is supplying all SW loads.

Multiple entries into the 168-hour action statement on the SW system were evaluated previously for other recently completed SW refurbishment projects. The PSA analyses for use of the 168-hour action statement on the SW system were evaluated separately from the PSA analysis for a single SW header to/from the CCHXs for two 49-day periods. However, the combined increase in CDF for this period of time is negligible. The use of the 168-hour action statement during the 49-day periods has been evaluated and does not invalidate the PSA.

NRC Supplemental Request:

S3. The licensee has evaluated additional heat transfer loads from the CC system for required shutdown scenarios. Does the use of the 168-hour action statement affect this required shutdown capability? Are any additional compensatory actions / measures required?

Response:

During the 168-hour action statements, the SW and CC systems remain capable of supporting unit shutdown scenarios. The response to NRC Request #3b (Attachment 1) would be applicable in this case since CC system operation will be similar during the 168-hour actions statements to the remainder of the 49 days when the one SW header is temporarily blanked (i.e., one SW header is supplying flow to all CCHXs.)