Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

June 9, 2005
LIC-06-0067

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Reference:
1. Docket No. 50-285
2. Letter from Harry J Faulhaber to Document Control Desk (NRC) dated November 18, 2005, Request for an Extension to the Completion Date for Corrective Actions Taken in Response to Generic Letter 2004-02 and Information Regarding Actions taken as a Result of Information Notice 2005-26 (LIC-05-0131) (ML053220535)
3. Letter from Catherine Haney to R. T. Ridenoure dated April 10, 2006, Fort Calhoun Station, Unit No. 1 RE: Response to Request for an Extension to the Completion Date for Corrective Actions Taken in Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors (TAC NO. MC9564) (NRC-06-0046) (ML060100141)
4. Letter from Harry J Faulhaber to Document Control Desk (NRC) dated August 31, 2005, Follow-up Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors" (LIC-05-0101) (ML053070109)

SUBJECT: Revised Request for an Extension to the Completion Date for Corrective Actions Taken in Response to Generic Letter 2004-02

In Reference 2, the Omaha Public Power District (OPPD) requested an extension to the completion date for the corrective actions taken in response to Generic Letter 2004-02. In Reference 3 the NRC denied OPPD's request for an extension of the Fort Calhoun Station (FCS) Generic Letter 2004-02 GSI-191 sump modifications and corrective actions completion due date from December 31, 2007, to the end of the FCS 2008 refueling outage. The NRC noted "OPPD did not commit to any new, focused interim compensatory measures to mitigate post-LOCA sump pool calcium phosphate levels (e.g., removal or sequestration of either the TSP pH buffer or the large amount of calcium silicate insulation remaining after the FCS fall 2006 outage); nor did OPPD commit to installing a temporary strainer larger than the existing one."

OPPD has continued to actively pursue resolution of Generic Safety Issue (GSI) 191 and has evaluated our ability to implement focused interim corrective measures during our fall 2006 refueling outage. Some of the testing and analysis identified in Reference 2 has been completed and as a result of work being conducted by the Pressurized Water Reactor Owner's Group (PWROG), OPPD has identified candidate buffer materials that can mitigate the chemical effects from the combination of trisodium phosphate (TSP) and calcium silicate insulation identified in Information Notice 2005-26. However, full resolution of issues associated with chemical and downstream effects , that may affect the ultimate size of the replacement strainers, remains incomplete.

OPPD has conducted testing of sump strainer configurations using FCS-specific debris loadings. This testing was observed by the NRC as part of the pilot plant program for resolution of GSI 191, "Assessment of Debris Accumulation on PWR Sump Performance." As a result of a number of unresolved issues associated with this testing and, as discussed with the NRC staff during meetings on February 28 and May 25, 2006, some of this testing will have to be repeated. However, this testing and evaluation will not be completed in time to support design and installation of permanent replacement sump strainers during the scheduled fall 2006 refueling outage to ensure compliance by December 31, 2007. (The fall 2006 outage is the only refueling outage between April 1, 2006 and December 31, 2007.) As such, a short extension to the completion schedule is respectfully requested to extend the completion of the corrective actions required by Generic Letter 2004-02 until the spring 2008 refueling outage.

OPPD will implement the following compensatory measures during the fall 2006 outage: (1) increase the available sump strainer area from 56 ft^2 (for two trains) to approximately 1100 ft^2 for two trains (an increase of 1960%), and (2) replace the TSP pH buffer with a new pH buffer designed to mitigate post-LOCA sump pool calcium phosphate levels based on available test data. Replacement of the TSP pH buffer is contingent upon NRC approval of a License Amendment Request (LAR). The procedure enhancements described in Attachment 1 have already been implemented.

Therefore, pursuant to requested information Item 2.(b) of Generic Letter 2004-02, OPPD is revising our Reference 4 response and requests an extension of the completion date for some FCS corrective actions to the end of the 2008 refueling outage, which is currently scheduled to begin in April 2008. Consistent with SECY-06-0078, the attachment to this letter describes how these mitigative measures will minimize the risk of degraded emergency core cooling system (ECCS) and containment spray system (CSS) functions until the spring 2008 outage. Additionally, this attachment outlines the FCS plan with milestones and schedule to address outstanding technical issues relative to the resolution of GSI-191. It is requested that the NRC respond to this request by July 14, 2006 to allow proper planning for the fall outage.

I declare under penalty of perjury that the foregoing is true and correct. (Executed on June 9, 2006.)

If you have additional questions, or require further information, please contact Thomas R. Byrne at (402) 533-7368.

Sincerely,

Harry J. Faulhaber
Division Manager
Nuclear Engineering

HJF/TRB/trb

Attachment 1 -Justification for Extension Request for Completion Date of the Fort Calhoun Station Containment Sump Modification
Attachment 2 – List of Commitments

ATTACHMENT 1

Omaha Public Power District (OPPD)
Fort Calhoun Station
Justification for Extension of Completion Date for Generic Letter 2004-02 Corrective Actions

Omaha Public Power District (OPPD)
Fort Calhoun Station
Justification for Extension of Completion Date for Generic Letter 2004-02 Corrective Actions

In Generic Letter 2004-02, the applicable regulatory requirements are noted as follows:

> *NRC regulations in Title 10, of the Code of Federal Regulations Section 50.46,10 CFR 50.46, require that the ECCS have the capability to provide long-term cooling of the reactor core following a LOCA. That is, the ECCS must be able to remove decay heat, so that the core temperature is maintained at an acceptably low value for the extended period of time required by the long-lived radioactivity remaining in the core.*
>
> *Similarly, for PWRs licensed to the General Design Criteria (GDCs) in Appendix A to 10 CFR Part 50, GDC 38 provides requirements for containment heat removal systems, and GDC 41 provides requirements for containment atmosphere cleanup. Many PWR licensees credit a CSS, at least in part, with performing the safety functions to satisfy these requirements, and PWRs that are not licensed to the GDCs may similarly credit a CSS to satisfy licensing basis requirements. In addition, PWR licensees may credit a CSS with reducing the accident source term to meet the limits of 10 CFR Part 100 or 10 CFR 50.67. GDC 35 is listed in 10 CFR 50.46(d) and specifies additional ECCS requirements. PWRs that are not licensed to the GDCs typically have similar requirements in their licensing basis.*

Fort Calhoun Station (FCS) was not licensed to the GDCs, but to plant-specific criteria contained in Appendix G of the Updated Safety Analysis Report. These criteria include:

> *CRITERION 42 - ENGINEERED SAFETY FEATURES COMPONENTS CAPABILITY*
>
> *Engineered safety features shall be designed so that the capability of each component and system to perform its required function is not impaired by the effects of a loss-of-coolant accident.*
> *This criterion is met. The engineered safety features consist of three individual and separate systems, as follows:*
>
> *The Containment Spray System*
> *The Safety Injection System*
> *The Containment Air Recirculation and Cooling System*
>
> *The major components of the containment spray system and the safety injection system, including the pumps and the shutdown heat exchangers, are located outside the containment. The spray nozzles, the spray and injection piping and the safety injection valves located inside the containment are designed for operation in the environment produced by a major loss-of-coolant accident. Safety injection piping is designed to accept any reactor vessel motion resulting from forces generated by a loss-of-coolant accident.*
>
> *The containment air recirculation and cooling system components are located entirely within the containment. All components necessary for cooling and iodine filtration after the design basis*

accident are designed to withstand the accident and the environmental conditions following the accident. The heat transfer coil configuration and heat transfer capability have been tested by the manufacturer on a reduced version of the coil under post accident conditions. Motor control devices will be outside of the containment. A high temperature lubrication system and a high temperature, encapsulated insulation system for the motors has been specified. The means for providing reliable supplemental cooling, for control of moisture content of the cooling air, and for avoiding or neutralizing large air pressure differences across bearings has been specified. Frequent and careful preventative maintenance and periodic tests, particularly for insulation resistance, will be made.

CRITERION 52 - CONTAINMENT HEAT REMOVAL SYSTEMS
Where active heat removal systems are needed under accident conditions to prevent exceeding containment design pressure, at least two systems, preferably of different principles, each with full capacity, shall be provided.

This criterion is met. Two fully independent cooling systems are supplied to provide cooling of the containment building atmosphere following the MHA [Maximum Hypothetical Accident]. *Each system utilizes a different operating principle. The containment spray system reduces the temperature of the containment atmosphere by direct contact of the cool spray with the hotter containment atmosphere. The containment air recirculation and cooling system cools the containment atmosphere by recirculation of the hot gases through water cooled surface coolers. License Amendment No. 121 was approved and changed the Containment Spray surveillance testing and the basis requirement for minimum spray flow. USAR Section 14.16 provides the minimum requirements credited for each system.*

The containment spray pumps start automatically on a containment spray actuation signal which also opens the containment spray header isolation valves.

At the beginning of operation, the containment spray pumps take suction from the safety injection and refueling water tank. When this supply is depleted, pump suction is shifted to draw water from the containment building sump.

The testing of the containment spray system will be considered satisfactory if visual observations indicate that all but 10 nozzles per spray header have operated satisfactorily and no more than one nozzle on one spray header is missing. The minimum required single containment header spray flow is 1885 gpm.

The containment air recirculation and cooling system consists of four recirculation and cooling units. One, two or three units operate continuously during reactor operation. The other unit or units are automatically started on initiation of the safety injection system. The coolers have two sources of cooling water.

In the event of loss of outside power, equipment in the containment spray and the containment air recirculation and cooling systems which is required for containment cooling will receive power from the emergency diesel generators.

Both systems are considered highly reliable due to the inclusion of multiple components. In addition to system redundancy, the containment spray pumps and shutdown heat exchangers are located in separate rooms outside the containment building; consequently, it is possible to perform maintenance on this equipment during long-term operation.

Generic Letter 2004-02 also noted the following:

2. Addressees are requested to provide the following information no later than September 1, 2005:

(a) Confirmation that the ECCS and CSS recirculation functions under debris loading conditions are or will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. This submittal should address the configuration of the plant that will exist once all modifications required for regulatory compliance have been made and this licensing basis has been updated to reflect the results of the analysis described above.

(b) A general description of and implementation schedule for all corrective actions, including any plant modifications, that you identified while responding to this generic letter. Efforts to implement the identified actions should be initiated no later than the first refueling outage starting after April 1, 2006. All actions should be completed by December 31, 2007. Provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006. If all corrective actions will not be completed by December 31, 2007, describe how the regulatory requirements discussed in the Applicable Regulatory Requirements section will be met until the corrective actions are completed.

OPPD has conducted testing of sump strainer configurations using FCS-specific debris loadings. This testing was observed by the NRC as part of the pilot plant program for resolution of GSI 191, "Assessment of Debris Accumulation on PWR Sump Performance." As a result of a number of unresolved issues associated with this testing and, as discussed with the NRC staff during meetings on February 28 and May 25, 2006, some of this testing will have to be repeated. However, this testing and evaluation will not be completed in time to support design and installation of permanent replacement sump strainers during the scheduled fall 2006 refueling outage to ensure compliance by December 31, 2007. (The fall 2006 outage is the only refueling outage between April 1, 2006 and December 31, 2007.) As such, a short extension to the completion schedule is respectfully requested to extend the completion of the corrective actions required by Generic Letter 2004-02 until the spring 2008 refueling outage.

Therefore, pursuant to requested information Item 2.(b) of Generic Letter 2004-02, OPPD in this letter revises the responses to Generic Letter 2004-02 and requests an extension of the completion date for some FCS corrective actions (specifically, the final hardware modifications) to the end of the 2008 refueling outage, which is currently scheduled to begin in the Spring of 2008.

The following identifies mitigative measures to be put in place prior to December 31, 2007, and describes how these mitigative measures will minimize the risk of degraded ECCS and CSS functions during the period of January through April 2008.

1. Mitigative measures to be completed during the 2006 refueling outage:

    - Replacement of the TSP with an alternate pH buffer which reduces the risk for sump screen blockage caused by formation of chemical precipitates (this is being accomplished through a separate License Amendment Request);
    - Installation of two interim strainer modules (one per train) with approximately 1100 ft^2 of total surface area;
    - Removal of the automatic start feature for one containment spray (CS) pump (this is being accomplished through a separate License Amendment Request);
    - Installation of debris exclusion devices on reactor cavity and refueling cavity drain lines;
    - Installation of reactor vessel spacer rings to reduce the water hold-up in the upper cavity;
    - Replacement of the existing steam generators, pressurizer and reactor vessel head, resulting in replacement of approximately 823 ft^3 of calcium silicate insulation, and removal of approximately 7041 ft^2 of unqualified coatings. This represents removal of approximately 62% of the calcium silicate insulation behind the biological shield that may fall within the zones of influence and approximately 35% of the unqualified coatings; and,
    - Replacement of calcium silicate insulation on the pressurizer spray line to eliminate generation of calcium silicate debris from the small break loss of coolant accident that presents the greatest risk of debris generation and transport.

2. Mitigative measures currently in place with enhancements to be completed by the end of the 2006 refueling outage:

    - Procedural guidance and training

      The following procedure enhancements have already been implemented at FCS.

      As discussed in our responses to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," OPPD has implemented a number of interim corrective actions to assure core cooling and containment integrity (References 1 and 2).

      Operations personnel have procedural guidance to shutdown one of the redundant HPSI pumps on one header (2C in Figure 1), and one of the redundant CS pumps on the other header (3B or 3C in Figure 1). One of the remaining CS pumps is shutdown if containment pressure and temperature requirements are met and the containment coolers are operable. Upon initiation of recirculation this leaves one HPSI pump and one CS pump aligned to one header and one HPSI pump aligned to the other header. This action minimizes the approach velocity of material to the strainers allowing for maximum debris settling while maintaining the design basis of the plant.

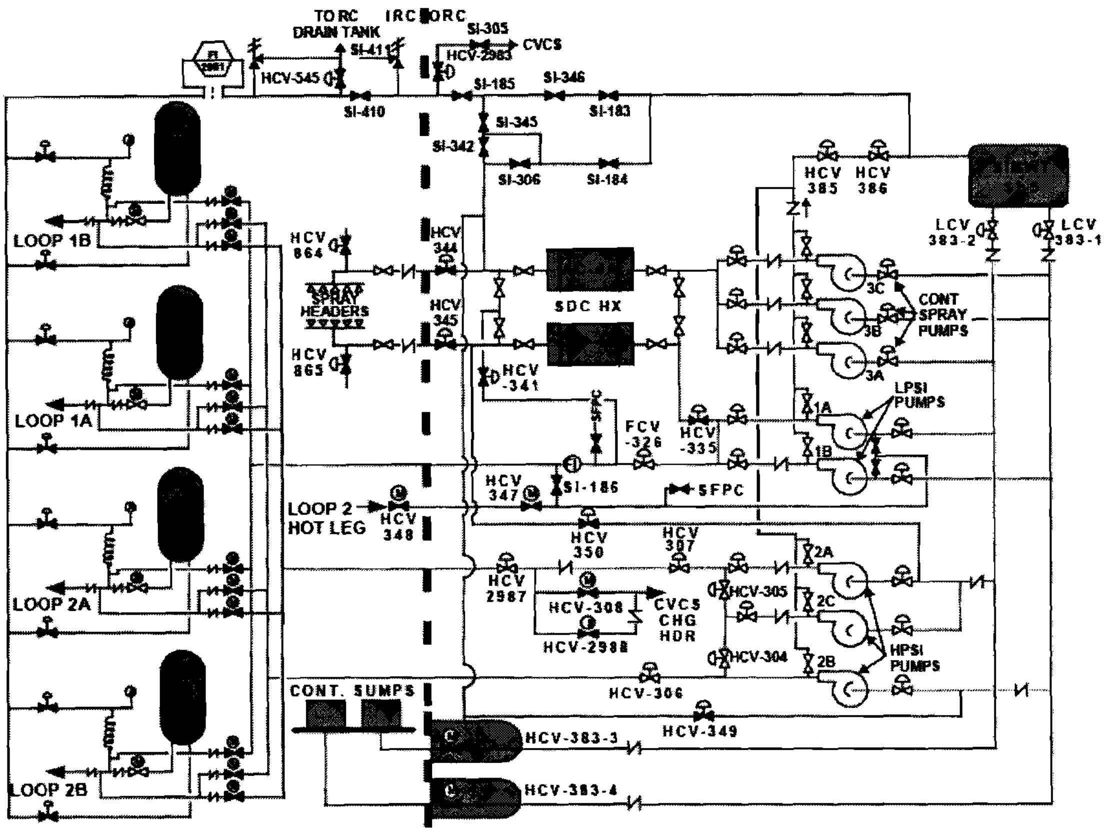

Figure 1 Emergency Core Cooling System

Operations personnel also have procedural guidance to monitor emergency core cooling system pumps for evidence of pump cavitation following initiation of recirculation. This procedural guidance and associated training instruct the operators to consider reducing the total sump flow when pump cavitation is detected.

This would be achieved by first throttling HPSI flow, then if necessary turning off the containment spray pump and relying on the containment air coolers for atmosphere control and heat removal. The flow from only one HPSI pump is needed to keep the core cooled and covered.

Procedural guidance on the refill of safety injection refueling water tank (SIRWT) has been provided. There are sufficient sources of borated and demineralized water at FCS such that the SIRWT can be refilled and safety injection can be continued until the containment is filled to the top of the reactor coolant system (RCS) hot legs while maintaining reactivity control.

If the HPSI suction via the containment sump strainers is lost, the HPSI can be re-aligned to the SIRWT and safety injection can be continued until the containment is filled to the top of the hot leg. Procedural guidance is provided to align equipment necessary for shutdown cooling prior to submergence. During this filling process core coverage is maintained by the HPSI pump flow, core cooling is maintained by break flow and containment cooling is provided by the containment coolers. In addition core cooling will be provided by water on the outside of the reactor vessel. Once the containment is filled to the top of the hot leg, shutdown cooling can be initiated. Unless the break is located in the shutdown cooling line, core cooling will be provided by shutdown cooling system taking suction from the hot leg. If the break is in the shutdown cooling line, suction will be taken from the containment pool or a combination of the hot leg and the pool depending on the size of the break.

- Leak-Before-Break

  OPPD currently has NRC approval to invoke the leak-before-break principle to address the dynamic effects of a cold leg or hot leg break in the RCS. This approval was based on the evaluation (WCAP- 9558, Revision 2) of the inherent toughness of the cold leg and hot leg piping at FCS. The evaluation concluded that the probability of a pipe failure before noticeable leakage could be detected and the plant brought into a safe-shutdown condition was negligibly small. While leak-before-break cannot be used to establish the design basis debris load on the sump strainer, it does provide a basis for safe continued operation until the beginning of the 2008 refueling outage.

- Containment Inspection and Cleanliness

  OPPD has implemented a number of actions to enhance containment cleanliness as documented in the response to Bulletin 2003-01. OPPD has revised surveillance procedures to provide specific guidance for inspection of containment sump screens to ensure no adverse gaps and breaches exist. These procedures require Quality Control verification of this inspection.

  In addition to our housekeeping and Foreign Material Exclusion (FME) programs, OPPD drafted and validated a latent debris collection procedure during the 2005 RFO. The procedure is used to collect latent debris samples from more than 20 locations inside containment including both horizontal and vertical surfaces. The procedure is also used to calculate the total latent debris load that is then compared to the values used in the debris generation and transport analysis to ensure FCS remains within the design parameters specified. The 2005 results indicated debris loads less than the values used in the design basis calculations. This procedure will be fully implemented prior to the completion of the 2006 refueling outage.

3. Description of how these mitigative measures will minimize the risk of degraded ECCS and CSS functions:

   - Replacement of the TSP pH buffer with an alternate pH buffer which will essentially eliminate the post-LOCA sump pool chemical effects (i.e., formation of calcium phosphate). Potential candidate pH buffers include sodium tetraborate, sodium metaborate, and sodium tripolyphosphate.

- Installation of the interim strainer modules, removal of the auto-start of one of the containment spray pumps, and implementation of procedural guidance and training to secure and throttle ECCS and CSS pumps significantly reduces the approach velocity of debris to the screens during recirculation. With the interim strainer modules in place, the approach velocity with one HPSI and one CS pump in service would be 0.015 ft/sec and the approach velocity with one HPSI pump in service would be 0.002 ft/sec. Thus only small fines of suspended fibrous insulation and particulates would be transported to the sump strainers. Based on the information provided in NUREG/CR-6808, "Knowledge Base for the Effects of Debris on PWR Emergency Core Cooling Sump Performance, February 2003," a significant fraction of this material would settle to the floor of containment before reaching the strainer.

- Head loss testing using the FCS specific debris mix, crediting the removal of the calcium silicate insulation and non-qualified coatings has been conducted. This testing conservatively assumes a LOOP/LOCA with all of the debris load on one strainer with a surface area of approximately 1500 ft^2 (one train). The strainer head loss from this test was less than 1 ft. A design margin of greater that 1.75 ft for the CS pumps and greater that 4.75 ft for the HPSI pumps is available for the large break loss of coolant accident LOCA case. This testing result, when combined with the conservatism of the testing methodology, provides assurance that the interim strainers with approximately 550 ft^2 of surface area per train can successfully mitigate the consequences of a number of small and medium break LOCAs.

  For the LBLOCA worst case debris loading, the interim strainer will assure HPSI flow which is less than 500 gpm. However, containment spray flow (approximately 3200 gpm) may have some operating limitations. If the containment spray pump is secured due to limited NPSH margin, containment cooling is assured by the containment fan coolers which are redundant to the containment spray system for providing containment cooling. If a LBLOCA occurs with more than one train is available, the debris will be distributed among the two strainer modules providing approximately 1100 ft^2 of surface area, which is close to the design basis case tested of 1500 ft^2. With multiple trains operating, the minimum NPSH margin is greater than 2.5 ft for CS pumps and greater than 7 ft for HPSI pumps which is a considerable improvement compared to single train operation. Considering the low probability of a LOOP/LOCA, with a break occurring at the worst location for debris generation, and the limitation of only a reduction in CS function (which is redundant to the fan coolers for containment cooling) FCS will be able to successfully mitigate the consequences of all design basis accidents.

- The leak-before-break analysis provides assurance that a leak could be detected and the plant brought into a safe-shutdown condition before a pipe failure occurred.

- By maintaining high standards of containment cleanliness and inspection, OPPD is able to minimize debris loads and ensure the sump strainer is in optimal condition should a LOCA occur.

OPPD continues to pursue a plan to address outstanding technical issues relative to the resolution of GSI-191. OPPD has completed plant specific analyses and conducted testing of sump strainer configurations using FCS-specific debris loadings. These analyses and testing were observed by the NRC as part of the pilot plant program. OPPD will continue to pursue additional plant specific analyses and testing as described in our meetings with the NRC on February 28 and May 24, 2006 as well as in the presentation provided to the NRC by General Electric on May 25, 2006.

References:

1) Letter from OPPD (Richard P. Clemens) to NRC (Document Control Desk) dated August 8, 2003 Fort Calhoun Station Unit No. 1, 60 Day Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors" (LIC-03-0105) (ML032240032)

2) Letter from Ralph L. Phelps (OPPD) to Document Control Desk (NRC) dated June 11, 2004, Response to Requests for Additional Information on the Fort Calhoun Station Unit No. 1 Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors" (LIC-04-0072) (ML041630106)

ATTACHMENT 2

List of Commitments

List of Commitments

1. OPPD will complete the following corrective measures during the 2006 refueling outage:

   - Replacement of the TSP with an alternate pH buffer which reduces the risk for sump screen blockage caused by formation of chemical precipitates (this is being accomplished through a separate License Amendment Request);
   - Installation of two interim strainer modules (one per train) with approximately 1100 ft^2 of total surface area;
   - Removal of the automatic start feature for one containment spray (CS) pump (this is being accomplished through a separate License Amendment Request);
   - Installation of debris exclusion devices on reactor cavity and refueling cavity drain lines;
   - Installation of reactor vessel spacer rings to reduce the water hold-up in the upper cavity;
   - Replacement of the existing steam generators, pressurizer and reactor vessel head, resulting in replacement of approximately 823 ft^3 of calcium silicate insulation, and removal of approximately 7041 ft^2 of unqualified coatings. This represents removal of approximately 62% of the calcium silicate insulation behind the biological shield that may fall within the zones of influence and approximately 35% of the unqualified coatings; and,
   - Replacement of calcium silicate insulation on the pressurizer spray line to eliminate generation of calcium silicate debris from the small break loss of coolant accident that presents the greatest risk of debris generation and transport.

2. The latent debris collection procedure will be fully implemented prior to the completion of the 2006 refueling outage.