Omaha Public Power District

*Fort Calhoun Station*
*P.O. Box 550, Highway 75*
*Fort Calhoun, NE 68023-0550*

May 16, 2003
LIC-03-0068

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

References:
1. Docket No. 50-285
2. Letter from OPPD (W.G. Gates) to NRC (Document Control Desk) dated January 9, 2002 (LIC-02-0001)
3. Letter from OPPD (W.G. Gates) to NRC (Document Control Desk) dated January 18, 2002 (LIC-02-0009)
4. Letter from OPPD (R. P. Clemens) to NRC (Document Control Desk) dated April 5, 2002 (LIC-02-0042)
5. Letter from OPPD (S. K. Gambhir) to NRC (Document Control Desk) dated May 16, 2003 (LIC-03-0069)
6. Letter from NRC (P. T. Kuo) to OPPD (R. T. Ridenoure) dated May 15, 2003

**SUBJECT: Fort Calhoun Station Unit 1**
**Annual Update to Application for Renewed Operating License**

In the Reference 2 letter, Omaha Public Power District (OPPD) transmitted the Fort Calhoun Station Unit 1 Application for Renewed Operating License. In the Reference 3 letter, OPPD provided a corrected version of the Application Appendix E, *Applicant's Environmental Report*. In the Reference 4 letter, OPPD transmitted major revisions to certain portions of the Application.

Pursuant to 10 CFR 54.21(b), the attachment to this letter provides an annual update amendment to the renewal application that identifies changes to the Current Licensing Basis of Fort Calhoun Station Unit 1 that materially affect the contents of the license renewal application, including the FSAR supplement. The Reference 5 letter transmitted revised boundary drawings associated with this annual update. Other changes to the license renewal application have been previously documented in OPPD responses to Requests for Additional Information and Potential Open Items.

The attachment also includes (as new section 4.7.4) the OPPD response to the Reference 6 letter. This response contains commitments to perform a new Time Limited Aging Analysis and submit a License Amendment as follows:

> OPPD will perform the fracture mechanics evaluation of the small-bore instrument nozzle j-weld region at the repaired instrument nozzle in the side of the pressurizer lower shell.

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OPPD will submit a License Amendment Request, containing the fracture mechanics evaluation of the small-bore instrument nozzle j-weld region at the repaired instrument nozzle described above, to the NRC before the period of extended operation.

Please contact T.C. Matthews at 402-533-6938 if you have any questions. I declare under penalty of perjury that the foregoing is true and correct. (Executed on May 16, 2003)

Sincerely,

S. K. Gambhir
Division Manager
Nuclear Projects

TCM/tcm

Attachment

c: E.W. Merschoff, NRC Regional Administrator, Region IV (w/o Attachment)
A. B. Wang, NRC Project Manager (w/o Attachment)
W.F. Burton, NRC License Renewal Project Manager
W.C. Walker, NRC Senior Resident Inspector (w/o Attachment)
Division Administrator - Public Health Assurance, State of Nebraska (w/o Attachment)
Winston & Strawn

**LIC-03-0068**
**Attachment**

**Fort Calhoun Station Unit 1**
**Annual Update to Application for Renewed Operating License**
**May 2003**

**Fort Calhoun Station Unit 1**
**Annual Update to Application for Renewed Operating License**

Pursuant to 10 CFR 54.21(b), this attachment provides an annual update amendment to the Fort Calhoun Station Unit 1 License Renewal Application that identifies changes to the Current Licensing Basis that materially affect the contents of the application, including the FSAR supplement.

## STARTING AIR

In **LRA Table 2.3.3.7-1,** add AMR Results Item 3.3.2.01. This addition is due to a change of the pressure regulator valve body material from carbon steel to aluminum. The new link is to **LRA Table 3.3-2**, *FCS Auxiliary Systems Component Types Subject to Aging Management Not Evaluated in NUREG-1801*, Row Number 3.3.2.01. There are no aging effects requiring management (AERMs) for this material type in ambient air.

**TABLE 2.3.3.7-1**
**STARTING AIR**
**Component Types Subject to Aging Management Review and Intended Functions**

| Component Type | Intended Functions | AMR Results |
|---|---|---|
| Valve Bodies | Pressure Boundary | 3.3.1.05<br>**3.3.2.01**<br>3.3.2.10<br>3.3.2.13<br>3.3.2.20<br>3.3.2.23<br>3.3.2.37<br>3.3.2.40<br>3.3.2.71<br>3.3.2.75<br>3.3.3.07 |

## FIRE PROTECTION

In the list of drawings in **LRA Section 2.3.3.14,** add new LR boundary drawing 11405-M-266, Sheet 9A, *Dry Pipe and Deluge System Details P&ID*, after drawing 11405-M-266, Sheet 9, *Dry Pipe and Deluge System Details P&ID*. This new drawing shows the revised control room outside air filter flow control valve detail which was originally depicted on drawing 11405-M-266, Sheet 9. This new drawing has been included in reference letter LIC-03-069. Drawing 11405-M-266, Sheet 9, has been revised to include the new fabrication (fab) shop connection and dry pipe valve detail, and has also been included in reference letter LIC-03-069. The addition of the fab shop sprinkler system brings several new valves and piping into scope and these are shown on the revised drawings. There are no Scoping/Screening (i.e., new component types) or AMR changes (new AERMs or AMPs) as a result of this new fab shop addition to the fire protection system, because the valves and piping are already included in the list on Table 2.3.3.14. There were no new materials introduced into the system as a result of this addition to the fire protection system.

## AUXILIARY FEEDWATER

1. The FCS Appendix R analysis credits an auxiliary feedwater flow path during certain fire scenarios to utilize feedwater regulating valves FCV-1101 and FCV-1102. As a result of this flow path, portions of the feedwater system piping, including feedwater heaters FW-16A and FW-16B, are included in scope for pressure boundary because there are no isolation valves between the AFW flow path and the feedwater flow path. This flow path was identified during an engineering analyses review. The following discussion addresses changes to the FCS LRA for including this flow path.

   In the list of drawings in **LRA Section 2.3.4.2**, add new drawing, 11405-M-253, Sheet 3, *Flow Diagram Steam Generator Feedwater & Blowdown P&ID,* after drawing 11405-M-253, Sheet 1. The following drawings have been revised to include the new feedwater flow path: 11405-M-253, Sheet 1, *Flow Diagram Steam Generator Feedwater & Blowdown P&ID*, and 11405-M-253, Sheet 4, *Flow Diagram Steam Generator Feedwater & Blowdown P&ID*. These new and revised boundary drawings are included in reference letter LIC-03-0069.

   In **LRA Table 2.3.4.2-1**, *Auxiliary Feedwater Component Types Subject to Aging Management Review and Intended Functions,* under Component Type "Heat Exchanger" add AMR Results Items 3.4.1.02 and 3.4.1.05 (see revised table row below). This addition is due to the inclusion of the feedwater heaters FW-16A and FW-16B. There are no new AERMs as a result of this change.

**TABLE 2.3.4.2-1**
**AUXILIARY FEEDWATER**
**Component Types Subject to Aging Management Review and Intended Functions**

| Component Type | Intended Functions | AMR Results |
|---|---|---|
| Heat Exchanger | Pressure Boundary<br>Heat Transfer | **3.4.1.02**<br>**3.4.1.05**<br>3.4.2.03<br>3.4.2.04<br>3.4.2.05<br>3.4.2.06 |

2. Two new valves, LO-PS-5061-T and LO-PS-5061-B, have been added to the Auxiliary Feedwater System as shown on boundary drawing E-4144 listed in **LRA Section 2.3.4.2**. This revised drawing has been included in reference letter LIC-03-0069.

In **LRA Table 2.3.4.2-1**, *Auxiliary Feedwater Component Types Subject to Aging Management Review and Intended Functions,* under Component Type "Valve Bodies," add AMR Results Item 3.4.3.01 (see revised table row below). This table change incorporates the new valves LO-PS-5061-T and LO-PS-5061-B, which have stainless steel bodies. There are no new AERMs for this material in this system.

**TABLE 2.3.4.2-1**
**AUXILIARY FEEDWATER**
**Component Types Subject to Aging Management Review and Intended Functions**

| Component Type | Intended Functions | AMR Results |
|---|---|---|
| Valve Bodies | Pressure Boundary | 3.4.1.02<br>3.4.1.05<br>3.4.1.13<br>3.4.2.03<br>3.4.2.05<br>3.4.2.06<br>3.4.2.08<br>3.4.2.09<br>**3.4.3.01**<br>3.4.3.05 |

## CONTAINMENT

For the fuel transfer penetration, a new high strength alloyed steel bolting material is now being used for securing the blind flange. In **LRA Table 2.4.1-1**, *Containment Component Types Subject to Aging Management Review and Intended Functions*, under Component Type "Fuel Transfer Penetration," add AMR Results Item 3.5.2.34 as shown below.

**TABLE 2.4.1-1**
**CONTAINMENT**
**Component Types Subject to Aging Management Review and Intended Functions**

| Component Type | Intended Functions | AMR Results |
|---|---|---|
| Fuel Transfer Penetration | Pressure Boundary/fission product retention | 3.5.3.03<br>3.5.2.28<br>**3.5.2.34** |

This bolting change requires new AMR line item 3.5.2.34 to be added to **LRA Table 3.5-2**, *Aging Management Programs For Containment, Structures And Component That Are Not Addressed In NUREG-1801*, as shown below. The new material is not subject to general corrosion because of the high alloy content of nickel, chromium and molybdenum. Therefore, general corrosion is not a plausible AERM for this material and environment. Since the bolts are not stainless steel, there is a potential for boric acid corrosion this will be managed by the Bolting Integrity Program. However, boric acid attack is highly remote since the flange bolts are not in a wetted environment because they are removed prior to flooding of the refueling cavity.

**TABLE 3.5-2**
**Aging Management Programs For Containment, Structures and Components that Are Not Addressed in NUREG-1801**

| Row Number | Component Types | Material | Environment | AERMs | Program/Activity |
|---|---|---|---|---|---|
| 3.5.2.34 | Fuel Transfer Penetration Flange Bolting | High Strength Alloyed Steel | Ambient Air | Loss of Material Boric Acid Corrosion | Bolting Integrity Program (B.1.1) |

## PLANT HEATUP/COOLDOWN (PRESSURE/TEMPERATURE) CURVES

New references 4.2.4 and 4.2.5 were included in **LRA Section 4.8**, and other Section 4.2 references were renumbered. (See discussion on TLAA References below.) In **LRA Section 4.2.1,** the new references were added in the second paragraph, fifth sentence:

"Heatup and cooldown rates are determined such that the resulting stress intensity does not exceed the material reference critical stress intensity factor $K_{IC}$ (References 4.2-4 and 4.2-5)."

## PRESSURIZED THERMAL SHOCK (PTS)

The reference number sequence change noted above also required changes to the second paragraph of **LRA Section 4.2.3**: "(Reference 4.2-4)" was changed to "(Reference 4.2-6)," and "(Reference 4.2-5)" was changed to "(Reference 4.2-7)."

## OTHER TLAAs

Add a new **LRA Section 4.7.4** to address the pressurizer lower shell J-Weld analysis as follows:

### 4.7.4 ALLOY 600 J-WELD LEFT IN PLACE

The temperature nozzle in the pressurizer lower shell was repaired by adding a weld pad to the existing weld build-up to the lower shell OD and welding this pad to the existing nozzle. This moved the pressure boundary from the ID to this location. The Alloy 600 J-weld and original crack were left in place at the inside surface of the pressurizer as part of the repaired configuration.

- In a letter dated October 25, 2000, Westinghouse provided OPPD the technical justification for the weld on the liquid space Alloy 600 instrument nozzle on the OD of the pressurizer. This letter stated that the subject repair should be made in accordance with later editions of Section III, or the 1992 Edition (or later) of Section XI.
- In April 2002, Westinghouse notified OPPD that their technical justification of October 2000 only considered the effects of the repair on the requirements of ASME Section III, and did not consider the Section XI requirements related to leaving the flaw in place after the repair was completed and the vessel returned to service.
- In April 2003, OPPD received the "calculation note" titled "Evaluation of Fatigue Crack Growth of Postulated Flaw at Omaha Fort Calhoun Pressurizer Lower Shell Instrumentation Nozzle," dated January 8, 2003, that evaluated the Section XI requirements related to leaving the flaw in place after the repair was completed and the vessel returned to service.

Omaha Public Power District (OPPD) has evaluated the crack, and any potential future growth of the crack, and determined it does not impact the structural integrity of the vessel for the current licensed 40 year life. OPPD has elected to defer completion of the evaluation that demonstrates that the crack and any potential future growth of the crack does not impact the structural integrity of the vessel for the period of extended operation. Based on NEI 95-10, Rev. 3 guidance (Section 5.1.4), the following details are provided to explain how the effects of aging will be addressed for this evaluation.

OPPD will perform the fracture mechanics evaluation of the small-bore instrument nozzle j-weld region at the repaired instrument nozzle in the side of the pressurizer lower shell. A general outline of the evaluation process is provided below. Design specification transients are typically used to determine the applied stresses. In certain cases, it has been determined that the use of the design specification cooldown transients generates excessively conservative results. In these cases, a more realistic transient was developed, based on typical plant operating parameters, and was used for analysis. This resulting governing rate would then be carried through to the Fatigue Crack Growth evaluation. The new flaw size would then be used in a final flaw stability check to confirm that the IWB-3600 criterion is satisfied.

Analyses are performed for the repaired pressurizer nozzle location. The general methodology is summarized as follows:
1) Design drawings are reviewed to determine vessel, nozzle and J-weld dimensions and materials.
2) The initial flaw size to be used in the evaluation is calculated.
3) Manufacturing records are reviewed to determine the $RT_{NDT}$ of the base metal at the location of interest.
4) Design operation transients are reviewed to determine their appropriateness for use in the generation of stresses for use in the flaw analysis.

5) When the design transients are not appropriate, a realistic bounding transient is developed for analysis purposes.
6) Thermal transient analyses are performed to determine through-wall temperatures for use in the stress analysis.
7) Stress analyses are performed at various time points during each plant operating event of interest.
8) Pressure and mechanical load stresses are calculated.
9) A survey of the combined pressure, thermal and mechanical stresses is conducted to determine the limiting time point for evaluation.
10) Stresses are determined to calculate the applied stress intensity factor, $K_I$.
11) The applied stress intensity factor is calculated for comparison to allowable values.
12) Fatigue crack growth of the flaw is calculated over the 60 years.
13) The final flaw size is used to confirm flaw stability over the remaining life of the plant.
14) The flaw stability checks defined above are performed for normal and upset conditions and emergency and faulted conditions using the respective allowable define per ASME Section XI.
15) Primary stress limits per NB-3000 are checked considering the effect of the final flaw size.

The following acceptance criteria will be applied in the evaluation.

Linear Elastic Fracture Mechanics (LEFM)

Section XI, IWB-3610 states that the flaw is acceptable for continued service during the evaluated time period if the following two criteria are satisfied:

1. Either the criteria of IWB-3611 or IWB-3612.
   - In this evaluation, paragraph IWB-3612 is utilized.

   Specifically, the acceptance criterion of IWB-3612 is based on applied stress intensity factor. Acceptability is shown if the applied stress intensity factors at the flaw size $a_f$ satisfy the following criteria:

$$K_I < \frac{K_{Ia}}{\sqrt{10}} \text{ (Equation 1)}$$

$$K_I < \frac{k_{Ic}}{\sqrt{2}} \text{ (Equation 2)}$$

where:

$K_I$ = the maximum applied stress intensity factor for normal (including upset and test) conditions for the flaw size $a_f$ using Equation 1 and for emergency and faulted conditions using Equation 2.

$a_f$ = the maximum size to which the detected flaw is calculated to grow in a specified time period

$K_{Ia}$, $K_{Ic}$ = the available fracture toughness based on crack arrest and crack initiation respectively for the corresponding crack tip temperature. Values were determined as follows.

Curves for the lower bound $K_{Ia}$ and $K_{Ic}$ values for the base metal steels are provided in Figure A-4200-1 in Section XI. Equations to calculate the value of $K_{Ia}$ are provided in articles A-4200(b) and G-2110(a) of Section XI.

$$K_{Ia} = 26.78 + 1.223e^{[0.0145(T - RT_{NDT} + 160)]}$$

$$K_{Ic} = 33.20 + 2.806e^{[0.0200(T - RT_{NDT} + 100)]}$$

where,
$K_{IA}$ = Crack arrest reference stress intensity factor, ksi-$\sqrt{in}$
$K_{IC}$ = Crack initiation reference stress intensity factor, ksi-$\sqrt{in}$
T = Temperature at the postulated crack tip, °F
$RT_{NDT}$ = Adjusted reference nil ductility temperature at postulated crack tip, °F

The fatigue crack growth rate is defined in Article A-4300 of Section XI.

The values of $K_{Ia}/\sqrt{10}$ and $K_{Ic}/\sqrt{2}$ are also referred to as the allowable fracture toughness criteria. The crack depth at which the stress intensity factor equals the allowable fracture toughness is the maximum allowable crack depth. The allowable fracture toughness limits must be satisfied for remaining life of the plant.

2. The primary stress limits of NB-3000, assuming a local area reduction of the pressure retaining membrane, accounting for the presence of the flaw.

<u>Elastic-Plastic Fracture Mechanics (EPFM)</u>

ASME Section XI, Appendix K, provides guidance on performing an EPFM evaluation to demonstrate flaw stability. The criterion specifies that a flaw in a component is acceptable for continued service when the criteria of K-2200, K-2300, and K-2400 are satisfied.

In this evaluation, rather than utilizing the various safety factors specified for different load types in these criteria, a conservative safety factor of 3.0 is applied to the calculated combined plastic-zone adjusted stress intensity factor used to calculate J-Applied. As is demonstrated later in this evaluation, the principal criteria that a flaw is considered acceptable and stable for continued service if the applied J-integral curve for the crack falls below the material resistance J-value, the J-R curve, continues to be satisfied.

The fracture mechanics evaluation of the small-bore instrument nozzle j-weld region at the repaired instrument nozzle shall include evaluation of corrective actions that can be performed to provide reasonable assurance that the component in question will perform its intended function when called upon, or will

not be outside of its design basis established by the plant's current license basis. Such corrective actions include assuring that the pressure at any temperature should not be any higher than the higher of the following two limits:
[1] The saturation pressure plus 200 psi
[2] 350 psi and maximum rate of temperature decrease is 200°F/hr.

OPPD will submit a License Amendment Request, containing the fracture mechanics evaluation of the small-bore instrument nozzle j-weld region at the repaired instrument nozzle described above, to the NRC before the period of extended operation.

Revise **LRA Table 4.1-1**, *Time-Limited Aging Analyses Applicable to FCS*, by adding a new sub-row in TLAA Category as shown below.

| TLAA Category | Analyses | § 54.21(c)(1) Resolution |
|---|---|---|
| Other TLAAs | Alloy 600 J-weld left in place at the inside surface of the pressurizer as part of the repaired configuration of the temperature nozzle in the lower shell | (i) The analyses remain valid for the period of extended operation. (4.7.4) |

## TLAA REFERENCES

In **LRA Section 4.8**, add new reference 4.2-4, Alan B. Wang (USNRC) to R. T. Ridenoure (OPPD), "Fort Calhoun Station, Unit No. 1 – Issuance of Amendment (TAC No. MB3654)"

Add new reference 4.2-5, Alan B. Wang (USNRC) to R. T. Ridenoure (OPPD), "Fort Calhoun Station – Exemption From The Requirements of Appendix G To 10 CFR Part 50 (TAC No. MB3606)"

Change existing references 4.2-4 and 4.2-5 to 4.2-6 and 4.2-7, respectively.

Add new reference 4.4-1, 10CFR Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants

Add new reference 4.5-1, Regulatory Guide 1.35, "Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containments", Revision 3

**CONTAINMENT INSERVICE INSPECTION PROGRAM**

License Amendment No. 216, issued February 26, 2003, relocated Technical Specification 3.5(5), Requirements for Testing Prestressed Concrete Containment Tendons, to the UFSAR. To reflect this, **LRA Section B.1.3, Operating Experience**, second sentence was revised to read, "Inspections of the tendons and tendon anchorages have been conducted in accordance with the USAR and plant procedures."

**DIESEL FUEL MONITORING PROGRAM**

A review of the OPPD response to RAI B.2.3-2 revealed an error. The fifth paragraph, first sentence was:

> "The acceptance criterion for water and sediment is 'no adverse trend' and for microbiological activity is 'none detectable.'"

The corrected wording is:

(Note: the wording below has already been incorporated in the draft SER, Section 3.3.2.3.1.2, page 3-135, middle of first paragraph.)

> "The acceptance criterion for water and sediment is "<0.05% by volume" and for microbiological activity is "none detectable."