September 5, 2003

LICENSEE: Omaha Public Power District

FACILITY: Fort Calhoun Station, Unit 1

SUBJECT: SUMMARY OF TELECOMMUNICATION WITH OMAHA PUBLIC POWER DISTRICT (OPPD) TO DISCUSS DRAFT RESPONSES TO FOUR ELECTRICAL OPEN ITEMS ASSOCIATED WITH THE STAFF'S SAFETY REVIEW OF THE FORT CALHOUN STATION, UNIT 1 (FCS) LICENSE RENEWAL APPLICATION (LRA)

On May 8, 2003, the NRC staff (the staff) and representatives from OPPD held a telecommunication (telecon) to discuss draft responses to FCS LRA safety evaluation report (SER) Open Items 3.6.2.3.1.2-1, 3.6.2.4.3.2-1, 3.6.2.4.4.2-1, and 3.6.2.4.5.2-1. A summary of each open item, OPPD's draft response, and the telecon discussion is provided below. OPPD has had an opportunity to review and comment on this summary.

3.6.2.3.1.2-1 The staff reviewed the USAR Supplement for the non-EQ cable AMP and found that the supplement does not provide an adequate description of the revised program, as required by 10 CFR 54.21(d). The applicant should submit to the staff a revised USAR Supplement that is consistent with the descriptions for GALL AMPs XI.E1, XI.E2, and XI.E3 to satisfy 10 CFR 54.21(d).

**Response:**

The following revised USAR Supplement description supersedes the Section A.2.15 previously submitted:

**A.2.15 Non-EQ Cable Aging Management Program**

The FCS Non-EQ Cable Aging Management Program is a new program that will perform periodic inspections and testing of non-EQ medium-voltage and instrumentation cables. This includes: (1) visual inspection of medium voltage cables in adverse localized environments for cable and connection jacket surface anomalies, (2) instrumentation loop calibrations, and (3) actions to ensure cables are not exposed to significant moisture, or, testing of inaccessible medium voltage cables that are exposed to significant moisture. The inspections will be performed at least once every ten (10) years with the initial inspections performed prior to entering the extended period of operation. This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

**Telecon summary:**

OPPD should submit a revised USAR Supplement for the cable AMP. The USAR Supplement should mimic the FSAR Supplement write-up for GALL programs E1, E2, and E3 in SRP Table 3.6-2.

3.6.2.4.3.2-1 LRA Table 2.5.20-1 states that electrical bus bars and bus bar stand offs have no aging effects that require management. The basis for the applicant's conclusion was unclear to the staff. By letter dated February 20, 2003, the staff issued POI-6(b), requesting the applicant to provide information on the components' materials and environments, along with the basis for concluding that these components have no plausible aging effects. By letter dated March 14, 2003, the applicant responded to POI-6(b), stating that:

The bus bar materials are copper and aluminum; their environment is in indoor air and outdoor air. In accordance with EPRI TR-114882, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 2, 1999, no aging effects were identified for aluminum, aluminum alloys, copper, or copper alloys (brass, bronze) in an indoor or outdoor air environment.

The stand offs include fiberglass reinforced polyester resin and porcelain materials that are in ambient air external environment and are not continuously wetted. Internal environments are not applicable.

Table 7-17 of EPRI NP-1558, A Review of Equipment Aging Theory and Technology lists the continuous use temperature of plastics. The continuous use temperature listed for polyester with 40% glass content is 266 °F (compared with the bounding temperature value of 122 °F). Applying the Arrhenius methodology, it is clear that fiberglass reinforced polyester is acceptable. Figure C-2 of EPRI NP-1558 contains the relative radiation stability of thermosetting resins. The threshold for gamma radiation for polyester (glass filled) is 1,000,000,000 Rads (compared with the bounding 60-year radiation dose of less than 1,000 Rads).

a. Continuous use temperatures were determined as the temperatures corresponding to 100,000 hours (11.4 years) on the Arrhenius curve of the material for an endpoint of 50% reduction in tensile strength.

b. Based on retention of tensile strength taken at 500 degrees F.

On the basis of its review of the applicant's response the POI-6(b), the staff was concerned that the applicant may not have considered all the aging effects of the bus bars/ducts. The staff discussed this issue with the applicant, pointing out that the industry experience has indicated several problems with the bus bar/duct, such as loosening of splice plate bolts, degradation of Noryl insulation, presence of moisture or debris, oxidation of aluminum electrical connections, and corrosion of metallic components. The staff requests the applicant to provide a

description of the aging management program used to detect the above aging effects, or provide justification why such a program is not needed.

**Response:**

When scoping and screening was performed for bus bars at FCS, as a conservative measure, all bus bars were included in the scope of license renewal with the exception of those associated with SBO (SBO beyond the plant boundary was added later in response to a staff RAI and the NRC Interim Staff Guidance on SBO). All bus bars previously identified were dispositioned as having no aging effects requiring management. This position is reinforced by the fact that all of the in-plant bus bars are enclosed and in areas of controlled environments not subject to environmental extremes; they therefore have no AERM.

The following discussion is applicable to the switchyard (SBO) buses (non-segregated and iso-phase), which are fed from 161 Kv and 345 Kv transmission lines from the switchyard to the primary side of the transformers (Auxiliary and Main), and connect to the plant from the secondary side of the transformers by bus work (non-segregated from Auxiliary transformers and iso-phase from the Main). The iso-phase bus connects the main transformer to the generator; the bus is contained in a tube-like carbon steel enclosure, which is continuously air-cooled. No moisture accumulation has ever been observed. Under this controlled environment, there are no plausible aging mechanisms.

The Auxiliary transformers utilize non-segregated buses to connect to the 4160-volt distribution system. Use of a flexible bus minimizes the effects of vibration from end devices. The connections of the bus to the transformers are inspected and greased periodically in accordance with OPPD Substation Maintenance Department procedures. The non-segregated bus work is insulated. However, past inspections of this area revealed peeling or flaking of the insulation (inspections were performed during the early to mid 1970s, prior to implementation of the current corrective action program). To preclude further degradation, OPPD taped a good portion of all non-segregated buses, including the affected areas. The taping was done with a combination of Bishops High Voltage tape with the ends taped off with Scotch 88 tape. OPPD inspects these buses on a “train outage schedule.” In one refueling outage, one bus is inspected and during the next outage, the other bus is inspected. These buses are inspected using a plant maintenance procedure, which inspects the bus and the switchgear cubicles associated with that bus.

The connections to the primary side of the auxiliary transformers are bolted connections. The OPPD Substation Maintenance crew inspects the connections periodically. The torque values of the connections are periodically checked. Routine inspection of the buses by Substation Maintenance Department and plant maintenance crews preclude the build-up of any dirt or debris or the existence of loose bolting.

**Telecon summary:**

OPPD should revise its response to provide separate discussions of the iso-phase buses and non-segregated buses. The discussions will clarify the scope of the buses and the interfaces of the buses with other components, as well as the aging effects and aging management associated with the iso-phase bus bars and the non-segregated bus bars. OPPD will clarify that management of the bus bars will be done as part of the periodic surveillance and

preventive maintenance program (PS/PMP). The response will include a revision of the Appendix B program description of the PS/PMP and the Appendix A USAR Supplement for the PS/PMP to include management of the bus bars.

3.6.2.4.4.2-1 The aging effect for the transmission ACSR conductor is loss of conductor strength and vibration. The applicant has addressed the vibration and the aluminum portion of the conductor, but did not address the steel portion. The most prevalent mechanism contributing to loss of conductor strength is corrosion, which includes corrosion of steel core and aluminum strand pitting. The staff requests the applicant to provide a description of its aging management programs used to manage the aging effects in high voltage conductors, or provide justification for why such programs are not needed.

**Response**:

OPPD has performed a thorough review of industry operating experience related to aging effects on high voltage components, including ACSR. For detailed discussion related to aging of high voltage components other than ACSR steel core, please see the OPPD response to POI-6a (LIC-03-0035, dated March 14, 2003). The portion of that discussion on surface contaminants also applies to ACSR steel core.

The aging effects identified for high-voltage insulators, transmission conductors, switchyard bus and un-insulated ground conductors are not heat-related so Ohmic heating is not required to be addressed (License Renewal Electrical Handbook, EPRI 1003057, Final Report, December 2001, page 12-2, Ohmic Heating for Power Applications).

For ACSR conductors, corrosion degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles chemistry, $SO_2$ concentration in air, precipitation, fog chemistry and meteorological conditions (Reference 24, EPRI License Renewal Electrical Handbook, pages 581, 584). Corrosion of ACSR conductors is a very slow-acting aging effect that is even slower for rural areas with generally less suspended particles and $SO_2$ concentrations in the air than in urban areas. Tests performed by Ontario hydroelectric showed a 30% loss of composite conductor strength of an 80-year old ACSR conductor due to corrosion.

There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. As illustrated in EPRI License Renewal Electrical Handbook, Final Report 1003057, December 2001, page 13-6, there is ample strength margin to maintain the transmission conductor intended function through the extended period of operation.

On the basis of the above, OPPD has determined that corrosion on high voltage conductors is not a significant aging mechanism at FCS, and loss of conductor strength is therefore not an aging effect requiring management. There are no applicable aging effects that could cause the loss of the intended function of the transmission conductors for the period of extended operation.

**Telecon summary:**

The staff finds that the applicant's draft response provides information to allow the staff finish its review.

3.6.2.4.5.2-1 In LRA Section 2.5.1, "Cables and Connectors," the applicant identifies fuse blocks as components within the scope of license renewal and subject to an AMR. The staff was unsure whether fuse holders were included within the component type "Fuse Block." By letter dated February 20, 2003, the staff issued POI-1(c), requesting the applicant to clarify whether fuse holders are within the scope of license renewal and subject to an AMR, and, if fuse holders are brought in and require aging management, to provide the associated aging management information.

By letter dated March 14, 2003, the applicant provided the requested information, stating that:

"Fuse holders are in the scope of license renewal as part of the cable and connector scoping and screening analysis. There are no fuse holders attached to electrical penetrations at FCS. Fuse holders at FCS that are within active enclosures such as power supplies, switchgear, and Motor Control Centers are considered outside the scope for license renewal. There are no fuse holders at FCS exposed to vibration or environments that would cause corrosion, chemical contamination, or oxidation of the connecting surfaces. Fuse holders within enclosures that are not considered active and subject to mechanical stress, fatigue and electrical transients will be included in the Fatigue-Monitoring Program (B.2.4)."

The staff reviewed the applicant's response to POI-1(c) regarding whether fuse holders within the enclosures are considered active and whether they are subject to stress and fatigue. The staff discussed this issue with the applicant. The applicant believed that there are no fuse holders that would fall within the definition of being in an outside environment that would need aging management review, but was not sure. The staff is still unclear regarding the aging management of fuse holders. ISG-5, which discusses scoping, screening, and aging management of fuse holders, states that fuse holders inside the enclosure of an active component, such as switchgear, power supplies, power inverters, battery chargers, and circuit boards, are considered to be piece parts of the larger assembly, and thus 10 CFR 54.21 considers them outside the scope for license renewal. The staff requests the applicant to make a positive statement that all fuse holders are within active enclosures and hence need not be subject to an AMR. If the applicant cannot make this statement, the applicant should clarify how fuse holders within the scope of license renewal and subject to an AMR will be managed during the period of extended operation. The staff was also concerned that the applicant may have missed fuse holders which are used in circuits to isolate safety loads from non-safety loads. The staff requests the applicant to investigate and confirm whether there are no fuse holders which fall into this category.

**Response**:

Fuse Blocks (Fuse Holders) at FCS are either in active components (panels, switchgear, or cabinets), which are outside the scope of license renewal, or are in enclosures (junction boxes), which are in controlled environments. A review of the FCS database for equipment identified 93 fuse holders in junction boxes at various locations in the plant, i.e., the auxiliary building, turbine building, containment building, and the penetration area. Two junction boxes with fuse holders were identified as being in Containment; these are associated with the polar crane and are only energized during shutdown for refueling activities; during normal operation this is a controlled environment. The remaining fuse holders (all within junction boxes) are in circuits that are located in controlled environments and not subject to aging due to environmental extremes. FCS does not have any fuse holders in circuits used to isolate safety loads from non-safety loads that are in areas of environmental extremes or that are subject to aging management.

**Telecon Summary:**

OPPD should commit to manage the fuse holders in accordance with the fuse holder ISG.

/***RA***/

William F. Burton, Project Manager
License Renewal Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure: As stated

cc w/enclosure: See next page

**Response:**

Fuse Blocks (Fuse Holders) at FCS are either in active components (panels, switchgear, or cabinets), which are outside the scope of license renewal, or are in enclosures (junction boxes), which are in controlled environments. A review of the FCS database for equipment identified 93 fuse holders in junction boxes at various locations in the plant, i.e., the auxiliary building, turbine building, containment building, and the penetration area. Two junction boxes with fuse holders were identified as being in Containment; these are associated with the polar crane and are only energized during shutdown for refueling activities; during normal operation this is a controlled environment. The remaining fuse holders (all within junction boxes) are in circuits that are located in controlled environments and not subject to aging due to environmental extremes. FCS does not have any fuse holders in circuits used to isolate safety loads from non-safety loads that are in areas of environmental extremes or that are subject to aging management.

**Telecon Summary:**

OPPD should commit to manage the fuse holders in accordance with the fuse holder ISG.

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William F. Burton, Project Manager
License Renewal Section
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Docket No. 50-285

Enclosure: As stated

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OMAHA PUBLIC POWER DISTRICT (OPPD)

FORT CALHOUN STATION, UNIT 1

May 8, 2003

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