March 11, 2005

10 CFR 54

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN P1-35
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 LICENSE RENEWAL APPLICATION (LRA) – RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION TO SECTION 3.3 CLARIFICATION RAIs (TAC NOS. MC1704, MC1705, AND MC1706)

By letter dated December 31, 2003, TVA submitted, for NRC review, an application pursuant to 10 CFR 54, to renew the operating licenses for the Browns Ferry Nuclear Plant, Units 1, 2, and 3. As part of its review of TVA's previous license renewal letters, the NRC staff, through an informal request on February 11, 2005, identified additional clarification questions for Section 3.3 RAIs. The questions concentrate on elastomer and polymer components, galvanic corrosion of potable water, and not properly referencing a selective leaching program in portions of the section 3.3 tables.

The enclosure to this letter contains the corresponding TVA response to the specific NRC requests for additional information.

If you have any questions regarding this information, please contact Ken Brune, Browns Ferry License Renewal Project Manager, at (423) 751-8421.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 11th day of March, 2005.

Sincerely,

Original signed by:

Mike D. Skaggs

Enclosure
cc (Enclosure):

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ENCLOSURE

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3
LICENSE RENEWAL APPLICATION (LRA),

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI),
RELATED TO INFORMAL REQUEST FOR SECTION 3.3
CLARIFICATION RAIs

(SEE ATTACHED)

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3
LICENSE RENEWAL APPLICATION (LRA),

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI), RELATED TO INFORMAL REQUEST FOR SECTION 3.3 CLARIFICATION RAIs

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By letter dated December 31, 2003, TVA submitted, for NRC review, an application pursuant to 10 CFR 54, to renew the operating licenses for the Browns Ferry Nuclear Plant, Units 1, 2, and 3. As part of its review of TVA's previous license renewal letters, the NRC staff, through an informal request on February 11, 2005, identified additional clarification questions for Section 3.3 RAIs. The questions concentrate on elastomer and polymer components, galvanic corrosion of potable water, and not properly referencing a selective leaching program in portions of the section 3.3 tables.

The following contains the corresponding TVA response to the specific NRC requests for additional information.

NRC Request for Clarification #1 of Section 3.3 AMR items returned from audit team:

1. Clarification – aging effects requiring management (AERMs) for elastomer and polymer components depending on the specific elastomer or polymer, and the environmental conditions such as temperature, ultraviolet radiation, and aggressive chemicals, there is the potential for polymers to experience aging effects and require aging management. Clarify the type of elastomer or polymer, its environment, and your justification that there are no AERMs for the elastomer or polymer components in the residual heat removal service water system, raw water cooling water system, heating, ventilation, and air conditioning system, sampling and water quality system, standby liquid control system, radioactive waste treatment system, diesel generator starting air system, and radiation monitoring system. (Similar to RAI 3.3.2.8-1, 3.3.2.8-2, 3.3.2.9-1, 3.2-4, 3.2-6, and 3.4-7.)

TVA Response for Clarification #1 of Section 3.3 AMR items returned from audit team:

Residual Heat Removal Service Water System (System 23):

Polymer (Delrin) fittings in treated water and inside air environments.

Polymer fittings in Table 3.3.2.3 within the Residual Heat Removal Service Water System (System 23) are used as the insulating couplings between dissimilar threaded piping. Acetal (the generic name for a family of polymer products that includes Delrin) provides high strength and stiffness along with increased dimensional stability and ease of machining. A review of available information did not identify any aging effects for Delrin that would be applicable to the treated water (internal) environment or the inside air (external) environment. Please note that the Delrin fittings have been previously addressed and deemed acceptable in a response to RAI 3.4-7.

Raw Cooling Water System (System 24):

A) Elastomer

Elastomer (fabric reinforced rubber) expansion joints in raw water and inside air environments.

Garlock Style 204 is identified for the expansion joints used in the Raw Cooling Water System. The body is made of chlorobutyl/polyester material which resists cracking due to high temperature, weathering, oxidation, and chemicals. The chlorobutyl coating cover resists weathering and oxidation.

Rubber is decomposed by exposure to ultraviolet radiation. Ultraviolet radiation includes solar radiation and ultraviolet or fluorescent lamps. The ultraviolet radiation to the fabric reinforced rubber expansion joints internally is negligible, and the component is protected by the coating cover externally; therefore, degradation from this mechanism is not significant.

Elastomers are tested for short-term and long-term temperature durability. Maximum temperature rating for rubber is 130°F. In general, if the ambient temperature is less than about 95°F; then, thermal aging may be considered not significant for the period of extended operation (EPRI TR-114881). During normal operation, the temperature of the components within the raw Cooling Water System is significantly less than 130°F. Therefore, thermal aging is considered not significant for the period of extended operation.

Ionizing radiation can profoundly alter the molecular structure and macroscopic properties of elastomers. Effects of radiation-induced degradation of elastomers may include embrittlement, cracking or crazing, swelling, discoloration, and melting. Rubber ultimately becomes harder, stiffer and eventually brittle when exposed to radiation. The lowest reported dose threshold for radiation degradation of rubber is 10^6 rads. The ionizing radiation the expansion joints receive in the Raw Cooling Water System is negligible; therefore, degradation from this mechanism is not significant.

B) Polymer

Polymer (molded plastic) fittings and piping in air/gas, and inside air environments.

Unlike metals, thermoplastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. The plastic is either completely resistant to the environment or it deteriorates. Therefore, acceptability for the use of thermoplastics is a design driven criteria. Once the appropriate material is chosen, the system will have no aging effects (EPRI 1003056).

Plant operating experience has demonstrated that the appropriate plastic materials were selected for the identified applications. However, to address the NRC concerns, these polymers will be included in the System Monitoring Program. Table 3.3.2.4, line items 18 and 30, will be revised to reflect aging as follows:

Fittings	FR,PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	VII.I.1-b	None	F, 3,4

Piping	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	VII.I.1-b	None	F, 3

Heating Ventilation and Air Conditioning System (System 31):

A) Elastomers

Elastomer ductwork, fittings, and flexible connectors in air/gas, inside air, and outside air environments.

The elastomer ductwork, fittings, and flexible connectors in air/gas, inside air, and outside air environments as shown in Table 3.3.2.9 include silicone compounds, neoprene compounds, and neoprene coated glass fabric (Dupont's Ventglass) materials. These materials do not have aging effects requiring management as described below:

Cracking due to ultraviolet radiation and ozone is not an applicable effect for neoprene and silicone compounds per industry guidance (EPRI TR-114881) and review of the industry operating experience; therefore, degradation from ultraviolet radiation is not identified as an aging mechanism requiring management for the period of extended operation. Also see response to RAI 3.3.2.1.9-1.

Maximum temperature rating for neoprene is 160°F, silicone rubber is 275°F, and neoprene coated glass fabric (Ventglass) is 200°F. During normal operation, the temperature of the components within Heating, Ventilation, and Air Conditioning System is significantly less than 160°F; therefore, degradation from thermal exposure is not identified as an aging mechanism requiring management for the period of extended operation.

The lowest reported dose threshold for radiation degradation of neoprene and silicone rubber is 10^6 rads (EPRI TR-114881). The ionizing radiation the components will receive in the Heating, Ventilation, and Air Conditioning System is negligible (much less than 10^6 rads); therefore, degradation from ionizing radiation is not identified as an aging mechanism requiring management for the period of extended operation.

B) Polymers

Polymer (molded nylon) fittings in air/gas and inside air environments.

Polymer (Hypalon coated Nylon) flexible connectors in air/gas and inside air environments.

Polymer (Nycoa Nylon 589) tubing in air/gas and inside air environments.

Polymer (molded plastic) valves in air/gas and inside air environments.

Unlike metals, thermoplastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. The plastic is either completely resistant to the environment or it deteriorates. Therefore, acceptability for the use of thermoplastics is a design driven criteria. Once the appropriate material is chosen, the system will have no aging effects (EPRI 1003056).

Plant operating experience has demonstrated that the appropriate plastic materials were selected for the identified applications. However, to address the NRC concerns, these polymers will be included in the System Monitoring Program. Table 3.3.2.9, line items 78, 93, 215, and 245, will be revised to reflect aging as follows:

Fittings	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	VII.I.1-b	None	F, 4

Flexible Connectors	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	VII.I.1-b	None	F, 4

Tubing	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	VII.I.1-b	None	F, 4

Valves	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	VII.I.1-b	None	F, 4

Sampling and Water Quality System (System 43):

Polymer (Teflon) fittings in treated water, air/gas, and inside air environments.

Polymer strainers in treated water and inside air environments. Polymer tubing and valves in treated water, air/gas, and inside air environments.

Unlike metals, thermoplastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. The plastic is either completely resistant to the environment or it deteriorates. Therefore, acceptability for the use of thermoplastics is a design driven criteria. Once the appropriate material is chosen, the system will have no aging effects (EPRI 1003056). Plant operating experience has demonstrated that the appropriate plastic materials were selected for the identified applications. However, to address the NRC concerns, these polymers will be included in the System Monitoring Program. Table 3.3.2.14, line items 22, 73, 87, and 106, will be revised to reflect aging as follows:

Fittings	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	V.E.1-b	None	F, 4
Strainers	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	V.E.1-b	None	F, 4
Tubing	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	V.E.1-b	None	F, 4
Valves	PB	Polymer	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	V.E.1-b	None	F, 4

Standby Liquid Control System (System 63):

Polymer (Delrin) in treated water and inside air environments.

Polymer fittings in Table 3.3.2.18 within the Standby Liquid Control System (System 63) are used as insulating flanges (fittings) utilized to connect the aluminum piping to the stainless steel piping for galvanic corrosion protection in treated water and inside air environments. Acetal (the generic name for a family of polymer products that includes Delrin) provides high strength and stiffness along with increased dimensional stability and ease of machining. A review of available information did not identify any aging effects for Delrin that would be applicable to the treated water (internal) environment or the inside air (external) environment. Please note that the Delrin fittings have been previously addressed and deemed acceptable in a response to RAI 3.4-7.

Radwaste System (System 77):

Elastomer (silicon sealant and neoprene) fittings in air/gas, and inside air environments.

Cracking due to ultraviolet radiation and ozone is not an applicable effect for neoprene and silicone compounds per industry guidance (EPRI TR-114881) and industry operating experience; therefore, degradation from ultraviolet radiation is not identified as an aging mechanism requiring management for the period of extended operation. Also, see response to RAI 3.3.2.1.9-1.

Maximum temperature rating for neoprene is 160°F and for silicone is 275°F. During normal operation, the temperature of the components within the Radwaste System is significantly less than 160°F; therefore, degradation from thermal exposure is not identified as an aging mechanism requiring management for the period of extended operation.

The lowest reported dose threshold for radiation degradation of neoprene and silicone is 10^6 rads (EPRI TR-114881). The ionizing radiation the components will receive in the Radwaste System is negligible (much less than 10^6 rads); therefore, degradation from ionizing radiation is not identified as an aging mechanism requiring management for the period of extended operation.

Diesel Generator System (System 82):

Elastomer (Hypalon coated fiber glass cloth and rubber) flexible connectors in treated water, air/gas, and inside air environments.

Table 3.3.2.28 lines 26 thru 29 show aging effects for elastomer flexible connectors in treated water, air/gas, and inside air environments.

Rubber is exposed to a treated water environment in the cooling water system flexible hoses. For treated water and inside air environments, the aging effect requiring management on Table 3.3.2.28 line 26 (line 27 for air/gas environment) is shown as elastomer degradation due to thermal exposure. Line 29 for the inside air environment show degradation due to thermal exposure and ultraviolet radiation. However, aging effects due to ultraviolet radiation in internal environments and, due to ionizing radiation internally and externally, is not considered for the following reasons:

The ultraviolet radiation of the internal surfaces of the flexible connectors is negligible and degradation from this mechanism is not significant.

Ionizing radiation can profoundly alter the molecular structure and macroscopic properties of elastomers. Effects of radiation-induced degradation of elastomers may include embrittlement, cracking or crazing, swelling, discoloration, and melting. Rubber and silicone rubber ultimately become harder, stiffer, and eventually brittle when exposed to radiation. The lowest reported dose threshold for radiation degradation of rubber is 10^7 rads and silicone rubber is 10^6 rads (EPRI TR-114881). The ionizing radiation the components will receive in the Diesel Generator System is negligible (much less than 10^6 rads); therefore, degradation from this mechanism is not significant.

Radiation Monitoring System (System 90):

Polymer (Tygon) tubing in air/gas and inside air environments.

Unlike metals, thermoplastics do not display corrosion rates. Rather than depending on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed. The plastic is either completely resistant to the environment or it deteriorates. Therefore, acceptability for the use of thermoplastics is a design driven criteria. Once the appropriate material is chosen, the system will have no aging effects (EPRI 1003056).

Plant operating experience has demonstrated that the appropriate plastic materials were selected for the identified applications. However, to address NRC concerns, these polymers will be included in the System Monitoring Program. Table 3.3.2.31, line item 47, will be revised to reflect aging as follows:

Tubing	PB	Polymer –Tygon Tubing)	Inside Air (external)	Hardening and loss of strength due to polymer degradation	System Monitoring Program (**B.2.1.39**)	V.E.1-b	None	F, 3

NRC Request for Clarification #2 of Section 3.3 AMR items returned from audit team:

2. Clarification - galvanic corrosion of potable water system valves.

The staff notes that for the carbon and low alloy exposed to raw water, galvanic corrosion is identified as a potential aging effect for the fittings and piping, but not for the valves. Explain why galvanic corrosion is not expected for the valves in this system.

TVA Response for Clarification #2 of Section 3.3 AMR items returned from audit team:

Loss of material due to galvanic corrosion occurs when materials with different electrochemical potentials are in contact in the presence of a corrosive environment.

Carbon steels and low-alloy steels that are in contact with more cathodic materials such as copper alloys, stainless, or nickel-based alloys and are subjected to raw water may be susceptible to galvanic corrosion.

In the potable water system, carbon steel valves are not connected to more cathodic materials; therefore, galvanic corrosion is not identified for carbon steel valves.

NRC Request for Clarification #3 of Section 3.3 AMR items returned from audit team:

Clarification Question #3 was withdrawn after discussions with NRC on March 1, 2005.

NRC Request for Clarification #4 of Section 3.3 AMR items returned from audit team:

4. Clarification - use of one-time inspection AMP instead of selective leaching AMP.

For the heating, ventilation, and air conditioning system cast iron/cast iron alloy heat exchanger in raw (potable) water, LRA Table 3.3.2.9 indicates that the One-Time Inspection Program will be used to manage the loss of material due to selective leaching. Explain why the Selective Leaching AMP is not used here, as it is for other components.

TVA Response for Clarification #4 of Section 3.3 AMR items returned from audit team:

One-Time Inspection Program was inadvertently identified to manage the loss of material due to selective leaching in line item 121. The correct aging management program is the Selective Leaching Program. Note that the Selective Leaching Program was correctly identified for the other 22 line items for selective leaching aging effects as shown in Table 3.3.2.9. Table 3.3.2.9, line item 121 is revised as follows:

Heat Exchangers	HT, PB	Cast Iron and Cast Iron Alloy	Raw Water (internal) Potable Water	Loss of material due to selective leaching.	Selective Leaching of Materials Program (**B.2.1.30**)	VII.F4.2-a	None	G, 6

NRC Request for Clarification #5 of Section 3.3 AMR items returned from audit team:

5. Clarification - use of One-Time Inspection Program (Note that the audit team looked at these from the AMP side, so they should be consulted on this.)

The One-Time Inspection Program is typically used for places where AERMs are not expected or to verify the effectiveness of a preventive-type program, such as the Chemistry Control Program. While there is a degree of control of the impurities in the raw water (potable water), this is not comparable to a Chemistry Control Program. For the raw water, there is no preventive program. Please describe how the One-Time Inspection Program will be used for the loss of material in carbon and low alloy steel, cast iron and iron alloy components exposed to raw water (potable water) in the raw service water system and the heating, ventilation, and air conditioning system, and the loss of material in the carbon and low alloy steel and cast iron and cast iron alloy components exposed to raw water in the heating, ventilation, and air conditioning system and the radioactive waste treatment system.

TVA Response for Clarification #5 of Section 3.3 AMR items returned from audit team:

The raw water referred to in the related line items is actually potable (city) water. The actual chemistry of the potable water is much milder than expected for raw water. Therefore, loss of material and fouling potentially effecting component operability during the period of extended operation is not expected. The One-Time Inspection Program will verify this by performing a sampling inspection. If corrosion or fouling is detected that indicates that operation during the period of extended operations may be effected, then additional inspections and corrective actions are required by the One-Time Inspection Program.

Please note that this response for potable raw water environment in the Heating, Ventilation, and Air Conditioning System and Radioactive Waste Treatment System was previously submitted in response to Question 436 and Question 442 of the NRC's Consistent with GALL Audit (Browns Ferry Nuclear Plant (BFN) - Units 1, 2, and 3 License Renewal Application – Response to NRC Request for Additional Information (RAI) Developed During the License Renewal Audit Inspections for Comparison to Generic Aging Lessons Learned (GALL) During The Weeks of June 21, 2004 and July 26, 2004, dated October 8, 2004).