

ATTACHMENT 6

Browns Ferry Nuclear Plant (BFN)  
Unit 1

Response to NRC Request for Supplemental Information Regarding  
Technical Specification Change TS-467 - Utilization of AREVA Fuel and Associated  
Analysis Methodologies

GE14 Fuel Thermal Mechanical Information  
(Non-Proprietary)

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Attached is the non-proprietary version of the GE14 Fuel Thermal Mechanical  
Information, GNF 0000-0111-8036-R0-NP, dated January 2010.



**Global Nuclear Fuel**

A Joint Venture of GE, Toshiba, & Hitachi

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*Non-Proprietary Information*

## **GE14 Fuel Thermal-Mechanical Information**

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This is a non-proprietary version of the document GNF 0000-0111-8036-R0-P, from which the proprietary information has been removed. Portions of the document that have been removed are identified by white space within double square brackets, as shown here [[ ]].

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**Section 1**  
**GE14 Surface Heat Flux Limits for Fast Transients**

**1. Introduction**

[[

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[[

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The purpose of the work summarized in this letter is to transmit steady-state limits and establish [[  
]] limits for the AREVA equivalent [[  
]], as well as a [[  
]] for the case when either the steady-state or SHF limit is violated. These limits will ensure compliance with the (no) fuel melting and cladding plastic strain licensing limits when applied in conjunction with the AREVA transient code for GE14 fuel in Browns Ferry Unit 1.

**2. Analysis**

[[

]] TOP and MOP are defined schematically in Figure 1.

The approach used to define [[  
]] limits for the AREVA transient code (denoted as AREVA-T below) [[  
]]. A spectrum of transients was analyzed with AREVA-T. Results were summarized in terms of [[

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]] values and transmitted to GNF, together with the internal power generation rates versus time for the transients. The internal power generation rates were used [[

]]

These analyses were performed using standard GNF procedures. [[

]] Both rated and off-rated conditions were analyzed.

[[

]]

**Figure 1 Schematic of Thermal and Mechanical Overpowers**

### 3. GE14 Results

#### Rated and Off-rated Conditions

Internal power generation rates and corresponding AREVA-T TOP and MOP results were provided for 8 FWCF transients and 9 LRNB transients. The equations governing the LHGRFAC calculation are shown below. The limits to be used with these equations are shown in Table 1. [[

]]

**Table 1 SHF Limits for Use With AREVA-T for GE14 in ER1**

[[		
		]]

[[

]]

RWE MOP Limit for Off-Rated Transients

[[

]]

[8]

[[

]]

**Figure 2 FWCF TOP Correlation**

[[

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**Figure 3 LRNB TOP Correlation**

[[

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**Figure 4 FWCF MOP Correlation**

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**Figure 5 LRNB MOP Correlation**

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**Figure 6 Comparison of TOP LHGRFAC based on AREVA-T and CHT**

[[

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**Figure 7 Comparison of MOP LHGRFAC based on AREVA-T and CHT**

#### 4. Summary

TVA has provided GNF with [[ ]], as calculated by a specific AREVA transient code (AREVA-T), for a spectrum of fast transients. TVA has also provided internal heat generation versus time histories for each transient. GNF has applied its standard methodology to determine [[ ]]. Based upon [[ ]] AREVA and GSTRM results, GNF defined [[ ]], these limits assure that when AREVA-T is applied to GE14 fuel in Browns Ferry Unit 1 that fuel melting and cladding plastic strain licensing limits are satisfied. Use of GNF [[ ]] licensing limits are satisfied for GE14 fuel in Browns Ferry Unit 1. For transients that [[ ]] as defined in Section 4 must be applied to assure compliance with licensing limits. Steady state limits are also [[ ]] with AREVA-T for short duration transients ( $\leq 60$  seconds).

**Section 2**  
**Revised GE14 LHGR Limits for BF1**

**Table 1. Revised T-M LHGR limits for GE14 UO<sub>2</sub>**

UO <sub>2</sub>	
PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)
[[	

]]

**Table 2. Revised T-M LHGR limits for GE14 Gad rods**

1% Gad		2% Gad		3% Gad		4% Gad	
PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)	PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)	PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)	PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)
[[							

]]

5% Gad		6% Gad		7% Gad		8% Gad	
PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)	PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)	PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)	PPEXPOS (GWd/MTU)	PP LHGR (kW/ft)
[[							

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**Figure 8. Revised T-M LHGR limits for GE14**

[[

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