71-6206

B&W FUEL COMPANY

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December 1, 1995

William D. Travers, Director
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards, NMSS
US Nuclear Regulatory Commission
Washington, D. C. 20555-001

Dear Mr. Travers:

REFERENCE: Docket 71-6206, USA/6206/AF

On October 27, 1995, B&W Fuel Company (BWFC) provided NRC additional information to support an amendment request for our Model B fresh fuel shipping container. In response to item number 3, we requested that the information be handled as propriety under the provisions of 10 CFR 2.790. In accordance with 10 CFR 2.790 (b)(1), this transmittal provides an affidavit and copy of the response that does not contain the proprietary information.

I may be reached at (804) 832-5202 if you should require any additional information.

Sincerely,

B&W FUEL COMPANY
Commercial Nuclear Fuel Plant

Kathryn S. Knapp

Kathryn S. Knapp
Manager, Safety & Licensing

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delete: LA

AFFIDAVIT

State of Virginia
County of Campbell

Before the undersigned authority personally appeared C. W. Carr, who on oath says that he is Vice President, Manufacturing and Services of the B&W Fuel Company (BWFC), a general partnership in Campbell County, Virginia.

Affiant further says that the documentation submitted to the NRC in support of the amendment request for the Model B fresh fuel shipping container that provides the minimum clad thickness for each assembly design and guide tube and instrument tube specifications for each assembly design (i.e., minimum tube thickness, minimum tube outer diameter, number of each type of tube) is proprietary to the B&W Fuel Company and should not be disclosed to the general public. BWFC regards the dimensional data as proprietary fuel design information and should not be accessible to our competitor's.

Sworn to and subscribed before me this 1st day of December, 1995.

C. W. Carr, Vice President,
Manufacturing & Services,
B&W Fuel Company

Kathleen A. Bennett
Notary Public

My Commission expires August 31, 1999

3. Revise Table 1.2 of the application to include:

   a. the minimum clad thickness for each assembly design; and

   b. Guide tube and instrument tube specifications for each assembly design (i.e., minimum tube thickness, minimum tube outer diameter, number of each type of tube).

RESPONSE NOTE: The propeitary information has been removed from Table 3 of this response and is indicated by "xxxxx".

The revised table is listed in Table 3 and includes the requested information. The minimum cladding thickness for a rod, guide tube, or instrument tube is determined as $(OD_{min} - ID_{max})/2$. This is a very conservative treatment of the minimum cladding thickness for various components because the actual minimum cladding thicknesses allowed are larger and displace more moderator reducing K-maximum. The conservative Table 3 dimensions were used in all appropriate assembly models in KENO-IV. Any model of the guide tube or instrument tube that preserves the net area of cladding in a unit cell for an assembly type will preserve K-maximum since the water area (and volume) is preserved and Zircalloy is essentially transparent to neutrons. For Design 4 the guide tubes have two different sets of dimensions. To avoid modeling difficulties in KENO-IV and to ensure conservatism Design 4 was rerun with no guide tubes (water filled holes) but with the instrument tube modeled as before. The resultant K-maximum is 0.94360 (microfiche b18126) and is less than the 0.95 limit. The original K-maximum was 0.93855 and indicates the water displacement and neutron absorption in the guide tubes is worth approximately 0.94360 - 0.93855 = 0.005 Δk. Therefore, minor changes in the guide tube dimensions due to tolerances result in only a small fraction of the total guide tube worth.

To examine guide tube tolerance effects and water in the pellet-cladding region further CASMO-3 calculations were performed since KENO-IV does not have the ability to resolve such small reactivity differences. Table 4 shows the K-infinity results from the CASMO-3 analysis for each assembly design type. The "Base Case" is defined by using the dimensions in the KENO-IV analysis which consist of the maximum cladding ID and the minimum cladding OD (the thickness is analytically derived). The second line entitled "Mod in Pel gap" is the CASMO-3 result modeling water in the pellet-cladding gap with the guide tubes and instrument tube modeled as in the base case. The row entitled "Nom UR" are the results using nominal guide tube upper region dimensions. Note that only Design 4 has guide tubes with non-uniform dimensions along the axial length and

LR stands for "lower region". The row entitled "Min UR" are results using the minimum cladding ID together with the minimum cladding thickness (the cladding OD is thus determined analytically) for the upper region.

To obtain additional information relevant to question #2 water was added to the region between the pellet and cladding in all fuel rods. Examination of Table 4 results indicates that adding water to the pellet-cladding gap adds 0.00101 Δk for the worst assembly type (Design 4). This reactivity increase is consistent with differences observed with KENO-IV and is negligible compared with the reactivity decrease associated with the single package assumption.

The reactivity differences between the base case (which is how KENO-IV was run) and other dimensions and definitions are all negative including the lower region for Design 4. These results indicate that using the maximum cladding ID with the minimum cladding OD always allowed more water in the assembly resulting in a conservative guide tube, rod, and instrument tube model in nearly all cases examined. For the Design 4 the lower region guide tube dimensions are 0.00009 Δk more reactive than the upper tube dimensions. However, this difference is so small it can be neglected and Design 4 has a K-maximum of 0.93855. Table 4 results also indicate that the reactivity differences due to guide tube modeling are very small and need not be considered in future calculations (largest absolute calculated delta k value about 0.95 was 0.00012 for Designs 3 and 5) considering the KENO-IV uncertainty.

Table 3. Fuel Assembly Specifications

Assm Parameter	Design 1	Design 2	Design 3	Design 4
Rod Matrix	15x15	15x15	15x15	17x17
No. of fuel rods	208	208	208	264
No. of guide tubes/ inst. tubes	16/ 1	16/ 1	16/ 1	24/ 1
Fuel rod pitch (in.)	0.568	0.568	0.568	0.496
Max. Fuel pellet OD, in.	0.3707	0.3742	0.3622	0.3232
Max. fuel rod Cladding ID, in.	xxxxx	xxxxx	xxxxx	xxxxx
Min. fuel rod Cladding OD, in.	xxxxx	xxxxx	xxxxx	xxxxx
Max. guide tube ID, in.	xxxxx	xxxxx	xxxxx	xxxxx/ xxxxx [A]
Min. guide tube OD, in.	xxxxx	xxxxx	xxxxx	xxxxx/ xxxxx [A]
Max. instrument tube ID, in.	xxxxx	xxxxx	xxxxx	xxxxx
Min. instrument tube OD, in.	xxxxx	xxxxx	xxxxx	xxxxx
Tube material	Zr	Zr	Zr	Zr
Max. active fuel length, in.	144	144	144	144
Max. U^{235} Enrichment (wt%)	5.05	5.05	4.98	5.05
Max. U^{235} Loading, Kg	25.1978	25.6758	23.7220	24.3108

[A] For Design 4 the larger guide tube dimensions extend for 120 inches while the smaller guide tube dimensions extend for approximately 24 inches.

Table 3. Fuel Assembly Specifications (Cont.)

Assm Parameter	Design 5	Design 6		
Rod Matrix	17x17	15x15		
No. of fuel rods	264	204		
No. of guide tubes/ inst. tubes	24/ 1	20/ 1		
Fuel rod pitch (in.)	0.502	0.563		
Max. Fuel pellet OD, in.	0.3252	0.3671		
Min. fuel rod Cladding OD, in.	xxxxx	xxxxx		
Max. fuel rod Cladding ID, in.	xxxxx	xxxxx		
Max. guide tube ID, in.	xxxxx	xxxxx		
Min. guide tube OD, in.	xxxxx	xxxxx		
Max. instrument tube ID, in.	xxxxx	xxxxx		
Min. instrument tube OD, in.	xxxxx	xxxxx		
Tube material	Zr	Zr		
Max. active fuel length, in.	144	144		
Max. U^{235} Enrichment (wt%)	5.05	5.05		
Max. U^{235} Loading, Kg	24.6126	24.2355		