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July 22, 1988
Fort St. Vrain
Unit No. 1
P-88224

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

Attention: Mr. Jose A. Calvo
Director, Project Directorate IV

Docket No. 50-267

SUBJECT: Submittal of FAN3D
Validation Report

Dear Mr. Calvo:

On April 17, 1988, PSC discussed the FAN3D (Fuel Accountability Nodal, 3 Dimensional) effort with you and Mr. Dan Fieno. FAN3D is a system of computer programs that produces three dimensional flux, power, and fuel accountability information for the Fort St. Vrain nuclear core. Previously, the GATT system of codes was utilized to provide this information. Based on the conversations with NRC to date, PSC currently intends to use the FAN3D code for the next semi-annual fuel accountability report per the requirements of 10CFR74.13. At present, PSC is preparing internal engineering guidelines and procedures for the use of the FAN3D code package. Once NRC approval is obtained, PSC plans to use the code for safety-related analysis and design.

NRC requested during the April 17 discussion that PSC provide additional information on the history, overall scope, and objectives of the FAN3D program. In addition, NRC requested that PSC provide a description of the anticipated uses that this system of codes will have for FSV applications. This information is provided in Attachment 1. Attachment 2 (General Atomics (GA) Report No. 909436) is the final product of the joint PSC/GA program under which the FAN3D system of codes was developed.

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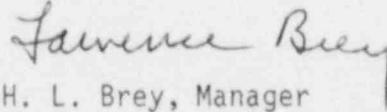
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PSC requests that NRC review the enclosed material. We would like to have NRC approval to use FAN3D for safety related design and analysis by December 31, 1988. In the meantime, PSC will use the code only for monitoring and informational purposes and for providing fuel accountability information.

PSC is currently reviewing our in-house controls for the use of this code package. As a result of this review, the proper PSC software controls will be implemented along with the appropriate user guidelines for the code package. PSC intends to implement these controls prior to any official use of the code package.

If you have any questions concerning this submittal or our plans, please contact Mr. M. H. Holmes at (303) 480-6960.

Very truly yours,



H. L. Brey, Manager
Nuclear Licensing and Resource Management

HLB/SEF:pa

Attachments

ATTACHMENT 1
DESCRIPTION OF CORE PHYSICS COMPUTER CODES

BACKGROUND

In the fall of 1985, PSC commenced negotiations with GA concerning the cooperative development of a new three dimensional core physics analysis program. PSC was interested in obtaining three dimensional core physics capability for in-house use. PSC had long been capable of performing in-house two dimensional analysis (with the GAUGE code) since 1983. The tool for performing three dimensional analysis for Fort St. Vrain involved the use of the GATT system of codes. This system of codes principally consisted of the POKEGT, GZINT, GATMAC, GATT, and BUGATT codes (See Section 5 of Attachment (2) for code description). In addition, there were a number of other data editing and data transfer codes that were utilized in tandem with the principal codes. The GATT code itself performed the three dimensional diffusion calculation for FSV and was written specifically for the GA UNIVAC mainframe. It was GA's opinion that this code was, for all practical purposes, not transferrable to another machine. In addition, this code can take as long as 1 CPU hour of time to run. The other codes in the GATT system were amenable to adaptation on another computer system. At that time, nodal methodology (in addition to standard finite difference) for hexagonal geometry was available to users in the form of the DIF3D code (See Attachment (2), Sections 1 and 5 for description).

To address these issues, PSC and GA decided to enter into a cooperative program to adapt the DIF3D code for Fort St. Vrain applications. A letter of agreement was signed by both parties (dated January 14, 1986). In the first part of the program, the DIF3D code was "spliced" into the GATT system of codes by PSC to perform the diffusion calculation. The basic cross-section and burnup methodology were unchanged. PSC would first convert the codes and models to PSC's inhouse IBM machine (utilizing a FORTRAN 77 compiler). After testing on the PSC IBM machine, GA utilized a CRAY machine to run the converted package of codes over a significant amount of burnup history. The results of these analyses were benchmarked against the result of GATT analyses to validate the new code package.

It was decided to name the entire package of codes FAN3D (Fuel Accountability Nodal, 3 Dimensions). In essence, the technology and experience gained from the program as well as the final product would be shared between the two companies. The final product would include a validation report that documents the suitability of using the FAN3D system of codes for Fort St. Vrain applications.

APPLICATIONS

The GATT system of codes has been traditionally used for a number of applications. It is used to perform three dimensional fuel accountability calculations for Fort St. Vrain. In addition, it is the tool with which three dimensional power distributions are calculated. It is a principal source of axial power distribution information for both fuel design applications and core follow-on analysis. In addition, neutron leakage, core reactivity, and radial power distributions can be determined from the GATT results. However, due to the great expense and complexity associated with running the GATT system of codes, it is only used when absolutely necessary.

In general, most of the core analysis is performed using the two dimensional (radial) GAUGE code (See Attachment (2), Section 5). However, when a new reload segment is designed, the GATT system of codes is used as a final check of the axial power shape of the core throughout the cycle for technical specification compliance verification.

The FAN3D system will be used to perform the same applications as identified above for the GATT system. The nodal solution is roughly an order of magnitude faster than the GATT solution. In addition, it is generally accepted that the one node per block nodal solution used in the FAN3D code system is significantly more accurate than the standard radial seven points/hex finite difference solution currently used in both the GATT and GAUGE codes for Fort St. Vrain. These features make the nodal option very attractive for performing three dimensional (or two dimensional) analysis for Fort St. Vrain. It is likely that the three dimensional tool will be run more often to take advantage of these features.