BWR

GE Nuclear Energy

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October 24, 1995

MFN 242-95
Docket No. 52-004

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington DC 20555-0001

Attention: Theodore E. Quay, Director
Standardization Project Directorate

Subject: SBWR - Non-Proprietary Version of RAI Responses Submitted October 25, 1993

Reference: 1. Letter from Dino C. Scaletti (NRC) to Mr. James E.Quinn (GE), Request for Withholding Information From Public Disclosure, General Electric (GE) Responses to Request for Additional Information (RAI) Dated October 25, 1993.

2. Letter MFN 174-93 from J.F. Quirk (GE) to Richard W. Borchardt, NRC Requests for Additional Information (RAIs) on the Simplified Boiling Water Reactor (SBWR) Design, dated October 25, 1993.

In response to the NRC's Reference 1 request, GE is providing the attached non-proprietary version of Reference 2.

Sincerely,

James E. Quinn

cc: P. A. Boehnert (NRC/ACRS) (2 paper copies plus E-Mail)
I. Catton (ACRS) (1 paper copy plus E-Mail)
A. Drozd (NRC) (1 paper copy plus E-Mail)
S. Q. Ninh (NRC) (2 paper copies plus E-Mail)
D. C. Scaletti (NRC) (1 paper copy plus E-Mail)
J. H. Wilson (NRC) (1 paper copy plus E-Mail)

D040

RAI Number: 440.1

Question:

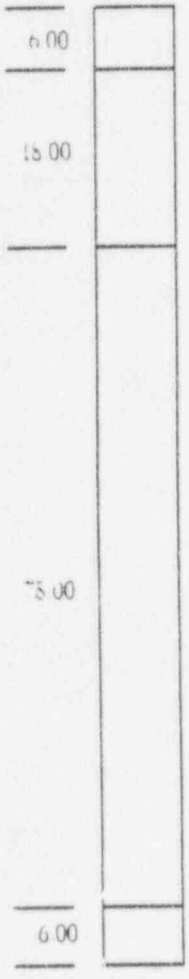
Describe where the four fuel lattice types in GE's May 21, 1993, le[illegible] are loaded axially into each bundle type in the core (i.e., axial fuel loading map).

GE Response:

Axial loading map attached (Figures 3.1 & 3.2 NON-proprietary)

3.1 Nuclear Data Summary for SBWR-8x8-E378-10GZ-80M-108

SBWR-8x8-E378-10GZ-80M-108



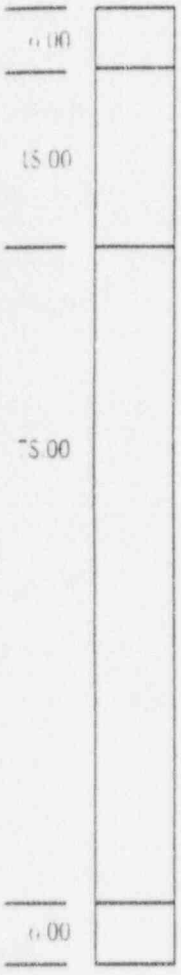
Heavy Metal Enrichment	Heavy Metal Mass KG
4.85	38.486
4.40	15.394
4.20	15.395
3.95	21.733
3.40	15.395
2.40	7.697
0.71	14.433

Bundle Average Enrichment	= 3.781 w/o
Mass of Heavy Metal	= 128.53 KG
Channel Thickness	= 0.08 inches
Pellet Outside Diameter	= 0.411 inches
Active Fuel Length	= 108.0 inches

Figure 3.2 SBWR High Reactivity Bundle Nuclear Design

3.2 Nuclear Data Summary for SBWR-8x8-E378-12GZ-80M-108

SBWR-8x8-E378-12GZ-80M-108



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8x8-E417-12G4.0-80M

8x8-E417-8G6.0/4G5.0-80M

8x8-E071-NOG-80M

Heavy Metal Enrichment	Heavy Metal Mass KG
4.85	38.486
4.40	15.394
4.20	15.395
3.95	21.493
3.40	15.395
2.40	7.697
0.71	14.433

Bundle Average Enrichment	= 3.781 w/o
Mass of Heavy Metal	= 128.29 KG
Channel Thickness	= 0.08 inches
Pellet Outside Diameter	= 0.411 inches
Active Fuel Length	= 108.0 inches

Figure 3.15 SBWR Low Reactivity Bundle Nuclear Design

RAI Number: 440.2

Question:

Provide the location of each bundle type in the core (i.e., radial fuel loading map).

GE Response:

Radial loading map attached (Figures 4.7 & 4.8 NON-proprietary)

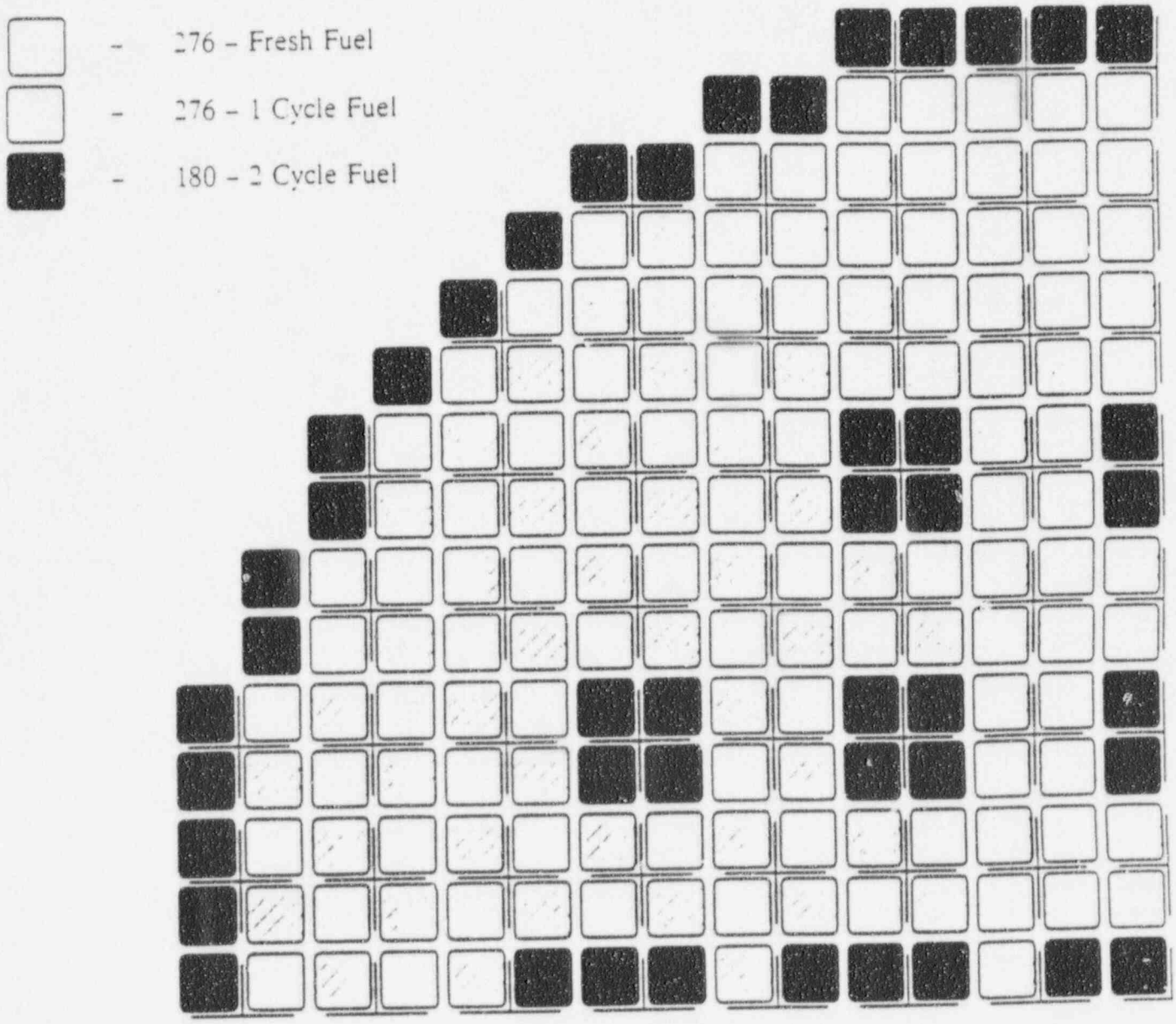

Figure 4.7 SBWR 24 Month Equilibrium Cycle Loading Map

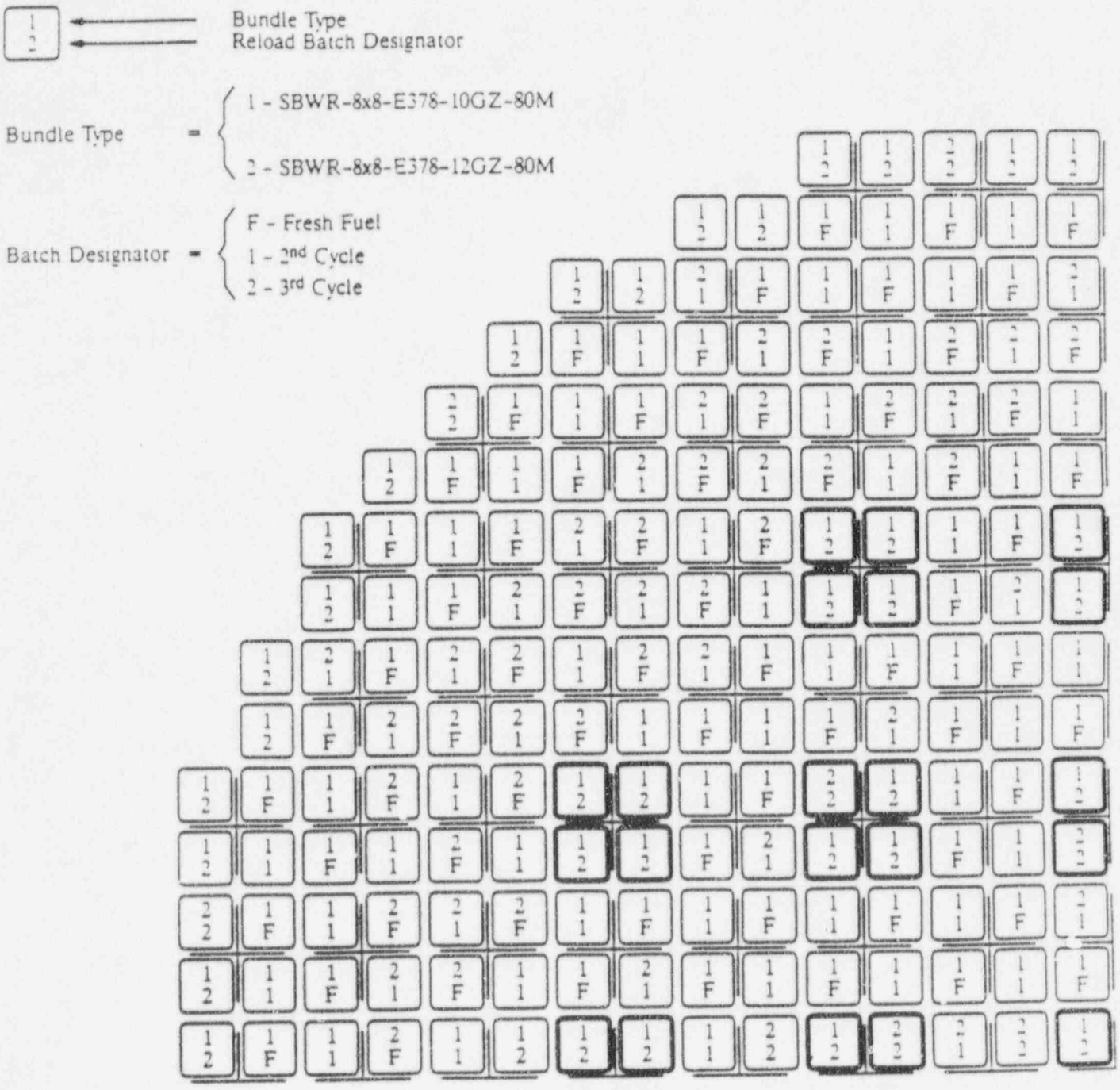

Figure 4.8 SBWR 24 Month Equilibrium Cycle Loading Map

RAI Number: 440.3

Question:

Provide the 3-D Exposure (Ex) and Void History (VH) distributions at beginning of life, middle of life, and end of life for the equilibrium core. If these cross sections are not for the equilibrium core, provide a discussion of their origin and purpose.

GE Response:

This information is PROPRIETARY and required a specific calculation with the 3-D core simulator (PANACEA). The TK50 tape attached to Reference 2* is in VMS BACKUP format and provides the requested data. The file cycle.lng is a PANACEA output edit, giving the 3-D exposure and void history distributions at 13 exposure points during the equilibrium cycle. The data is tabulated for each (I,J) bundle location, with a row entry for each axial node K.

The 3-D exposure distribution is EXPOSURE (METRIC).

The void history distribution information is contained in HISTORY DEPENDENT RELATIVE WATER DENSITY which is an exposure weighted water. It's computed as:

$$\frac{\text{Integral Relative Water density over exposure increments}}{\text{Integrated exposure}}$$

The relative water density is the density relative to .7375 gm/cc.

An example of these edits is PROPRIETARY and is provided in Reference 2*.

*Refers to Reference 2 of the transmittal letter to this non-proprietary version of these RAI responses.

RAI Number: 440.4

Question:

Provide another set of cross sections for the moderator at another temperature to establish its effect on the nuclear parameters.

GE Response:

This information is PROPRIETARY and required specific calculations with the 3-D core simulator (PANACEA). The TK50 attached to Reference 2 is in VMS BACKUP format and provides the requested data. The attached letter (R. M. Fawcett to Wayne Marquino 22-September-1993 describes the files on the tape related to this RAI.)

RAI Number: 440.5

Question:

For each lattice type, provide the variation in relative power required to determine the effect of xenon on the nuclear parameters.

GE Response:

This information is PROPRIETARY AND REQUIRED SPECIFIC CALCULATIONS WITH THE 3-d CORE SIMULATOR (panacea). The TK50 tape attached to Reference 2* is in VMS BACKUP format and provides the requested data. The attached letter (R. M. Fawcett to Wayne Marquino 22-September-1993 describes the files on the tape related to this RAI.)

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*Refers to Reference 2 of the transmittal letter to this non-proprietary version of these RAI responses.

GE Nuclear Energy

GE Company Proprietary

General Electric Company
175 Curtner Ave. M/C 151
San Jose, CA 95125

September 22, 1993

cc: S. P. Congdon

TO: Wayne Marquino
FROM: R. M. Fawcett
SUBJECT: SBWR Core Data Transmittal

This letter is to transmit the SBWR core and fuel data requested by NRC. All requested data can be found on the following directory,

VAX3::DISK06:[MARQUINO.RAMONA].

The FANACEA 3-D exposure and void history data are contained on file,

CYCLE.LNG.

Infinite lattice calculations were performed using TGBLA for each lattice in the SBWR equilibrium core design at several cold temperatures for each standard void history. The temperatures utilized were 100 °C, 160 °C, 220 °C and 286 °C (hot standby). The TGBLA output file names are structured as,

latid_cccCDv.SHT,

where,

latid = lattice I.D. such as SE110
ccc = temperature such as 160
v = void history at which isotopics were accumulated.

Infinite lattice calculations were also performed to determine the effect of xenon on the nuclear group constants. These calculations were performed at 3 power densities (25%, 50% and 75% of the average SBWR power density) at a void history of 40%. The following exposure points were analyzed,

200 MWd/st
5000 MWD/st
10000MWd/st
15000 MWd/st
25000 MWd/st
35000 MWd/st
55000 MWd/st.

For each exposure point, 3 TGBLA calculations were performed at the desired power density, where a small amount of exposure was accumulated so that equilibrium xenon concentrations at the desired power density could be attained. The third case at each exposure point should be representative of an equilibrium xenon concentration state. The TGBLA output file names are structured as,

latid_xxP.SHT

where

latid = lattice I.D.
xx = percent of average power density.

If there are any questions, please contact me.

R. M. Fawcett
Core and Fuel Advanced Design
x1087, m/c 151

Sub: List of files on tape for RAI

Listing of save set(s)

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