Attachment II to JPN-94-060

# Atrium 10A Fuel Bundle Design Description Report

for

New York Power Authority

James A. FitzPatrick Nuclear Power Plant

Reload 11/Cycle 12

**(Non-Proprietary Version)**

James A. Fitzpatrick ATRIUM-10A Design Description

The ATRIUM-10A fuel assembly consists of a lower tie plate and upper tie plate, 91 fuel rods, spacer grids, a central water channel, and miscellaneous assembly hardware. The structural members of the fuel assembly include the tie plates, spacer grids, water channel and connecting hardware. The ATRIUM-10A has a 10x10 fuel rod array with a total of 91 fuel rods. A central, square water channel occupies the equivalent of nine fuel rod positions in the array.

The fuel rods are fabricated with cladding which has an internal zirconium liner. of the 91 fuel rods are part-length fuel rods which have a length of approximately of a full-length rod. The spacer grids are of the ULTRAFLOW™* configuration.

Table 1 summarizes the features of the fuel assembly. Figure 1 shows the fuel assembly design features. Figure 2 presents the axial zoning scheme for the assembly U235 enrichment and Figures 3, 4, 5 and 6 show the individual pin enrichments for each nuclear lattice type.

All of the design features of the James A. FitzPatrick ATRIUM-10A LFAs have been under irradiation on reload or lead assemblies at other reactors.

There are three design features on the James A. FitzPatrick LFAs which have not previously appeared on SPC fuel assemblies irradiated in the U.S.; these are:

- 10x10 fuel rod lattice configuration
- Partial length fuel rods
-

10x10 fuel rod lattice configuration: The ATRIUM-10A has a 10x10 fuel rod array with a total of 91 fuel rods. A central, square water channel occupies the equivalent of nine fuel rod positions in the array. The 10x10 array allows for operation at lower average linear heat generation rates, and thus results in less fission gas release, as compared to 8x8 and 9x9 lattice arrays.

Partial length fuel rods: of the 91 fuel rods are part-length fuel rods which have a length of approximately of a full-length rod. The partial length rods reduce the total and two-phase pressure drop in the ATRIUM-10A assembly, thus improving the stability performance.

*ULTRAFLOW is a trademark of Siemens.

Table 1

Fuel Assembly Characteristics

| Characteristic Material | Value |
|---|---|
| Fuel Assembly | |
| Array | |
| Number of fuel rods | |
| Full-length rods | |
| Part-length rods | |
| Number of inert rods | |
| Overall length, inches (mm) | |
| Number of spacers | |
| Fuel rod pitch, inch (mm) | |
| Fuel rod to fuel rod spacing, inch (mm) | |
| Spacer Grid | |
| Envelope, inch (mm) | |
| Height, inch (mm) | |
| Water Channel | |
| Outside dimension, inch (mm) | |
| Channel wall thickness, inch (mm) | |
| Channel length, inch (mm) | |
| Lower Tie Plate | |
| Envelope, inch (mm) | |
| Height, inch (mm) | |
| Seal spring thickness, inch (mm) | |
| Upper Tie Plate | |
| Envelope, inch (mm) | |
| Height, inch (mm) | |
| Upper Tie Plate Locking Hardware | |
| Bayonet bolt | |

Table 1

Fuel Assembly Characteristics (Continued)

| Characteristic Material | Value |
|---|---|
| Fuel Rod Cladding | |
| Cladding outside diameter, inch (mm) | |
| Cladding inside diameter, inch (mm) | |
| Overall length (from lower tie plate), inch (mm) | |
| Full-length rod | |
| Part-length rod | |
| Fuel column | |
| Pellet outside diameter, inch (mm) | |
| Active length, inch (mm) | |
| Full-length rod | |
| Part-length rod | |
| Lower natural enrichment length, inch (mm) | |
| Full-length rod | |
| Part-length rod | |
| Upper natural enrichment length, inch (mm) | |
| Full-length rod | |
| Part-length rod | |
| Percent theoretical density | |
| Fill gas pressure, psia (kPa) | |
| Plenum spring | |
| Fuel Channel | |
| Inside dimension, inch (mm) | |
| Wall thickness (variable), inch (mm) | |
| Corners | |
| Mid-wall at bottom | |
| Mid-wall at top | |
| Inside corner radius, inch (mm) | |
| Overall length, inch (mm) | |

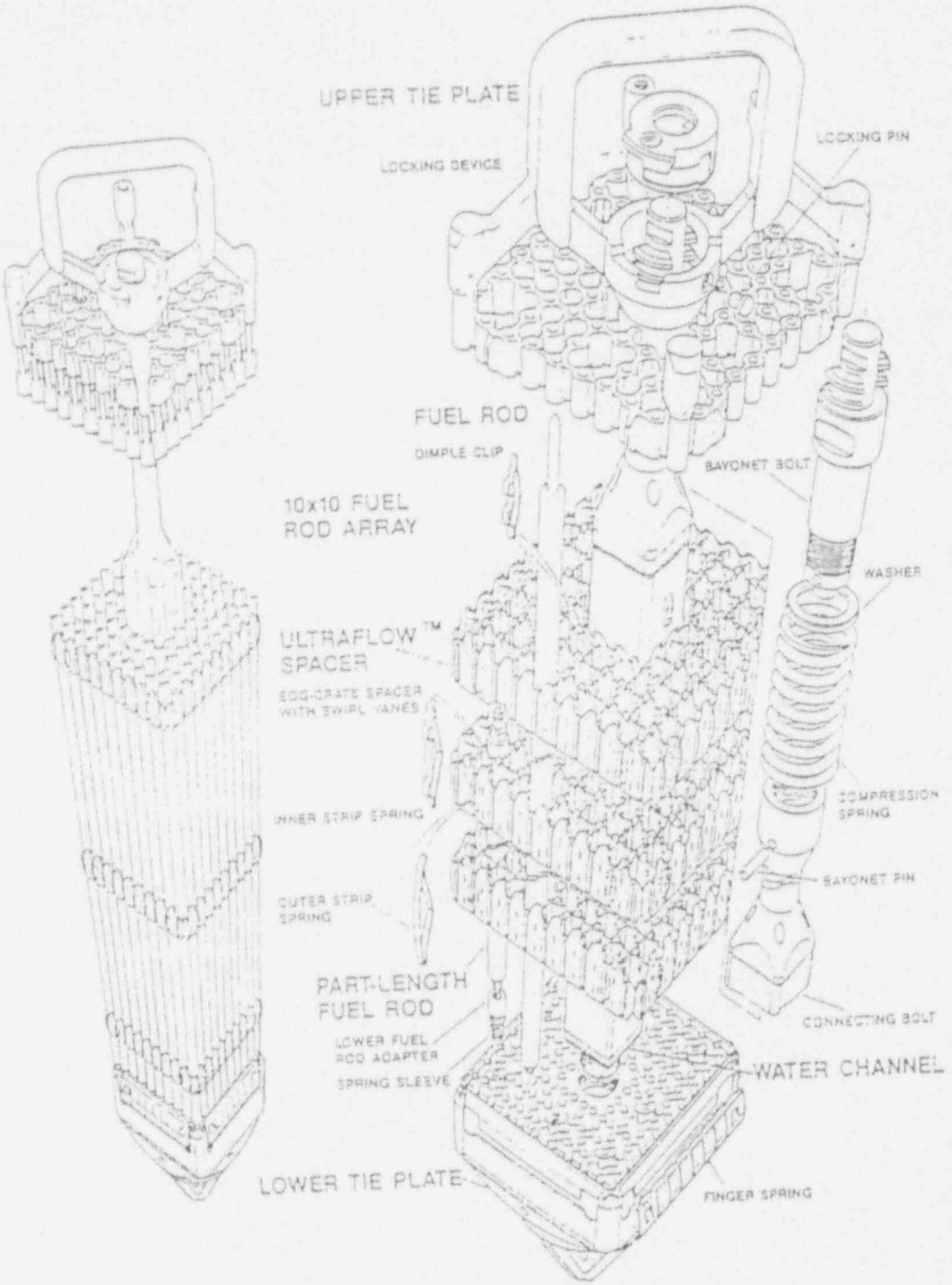


Figure 1
ATRIUM™ 10A Fuel Assembly for Boiling Water Reactors

Figure 2
James A. FitzPatrick ATRIUM-10A LFA Elevation View

Figure 3

James A. FitzPatrick ATRIUM-10A BOT Lattice Enrichment Distribution

Figure 4

James A. FitzPatrick ATRIUM-10A DOM Lattice Enrichment Distribution

Figure 5

James A. FitzPatrick ATRIUM-10A SDM Lattice Enrichment Distribution

Figure 6

James A. FitzPatrick ATRIUM-10A TOP Lattice Enrichment Distribution