Westinghouse NGF Design

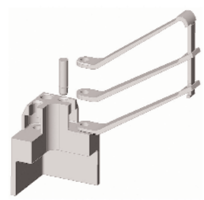
Fuel Engineering

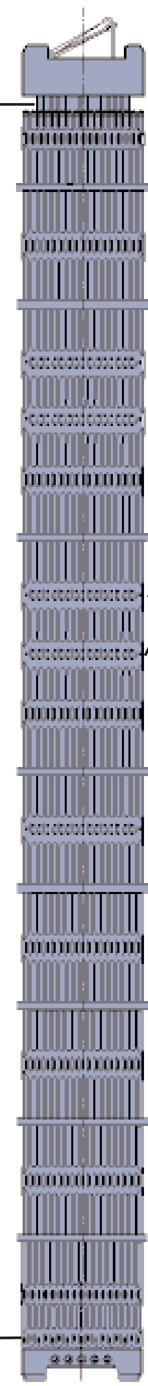
Benefits

The Next Generation Fuel (NGF) design is built on the proven experience and world-class leadership of Westinghouse in the design and manufacture of nuclear fuel. The NGF design provides:

- Stiff structure for margin against fuel assembly distortion
- High-contact-area mid grids for significantly increased margins to fuel rod fretting
- Five IFMs that provide significant DNB margin
- High-performance mixing vane grids
- High-burnup advanced materials-Optimized ZIRLO
- Multiple layers of defense against debris
- Industry's best IFBA
- Axial blankets for optimum fuel cycle economics

Westinghouse





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For more information, call your local Westinghouse Electric Company sales representative.

Westinghouse NGF Design Features

Fretting Margin

Increased contact area of the grid with the rod significantly improves grid-to-rod fretting performance. The NGF mid grid uses a vertical I-spring and large dimples to enhance grid-to-rod interface. In addition, the springs are less stiff to reduce static and dynamic loads, and the edge geometry of the dimples is optimized to reduce edge hardness. Endurance testing has shown that the NGF mid grid improves grid-to-rod fretting performance significantly over previous Westinghouse designs.

Heat Transfer Improvements

The NGF mid grid incorporates a high-performance mixing vane to optimize coolant mixing. This enhanced mixing improves departure from nucleate boiling (DNB) performance and reduces fuel rod hot spots, which are known to contribute to crud buildup on fuel rods and power shifts in the core. The use of five high-performance IFMs, further enhances heat transfer by providing additional coolant mixing, improving thermal margin, and reducing fuel rod surface temperatures for reduced oxidation and crud deposition.

WIN Nozzle

The Westinghouse integral nozzle (WIN) is an industry leading design, and has been used successfully in Europe since the early 1990s. Spring reactive loads are restrained completely by the nozzle castings - there are no screws, ensuring trouble-free operation.

Optimized ZIRLO

The use of Optimized ZIRLO improves corrosion margin for higher duty. NGF fuel rod cladding, thimble tubes, mid-grids, and IFM grids are all fabricated from Optimized ZIRLO.

Fuel Rod Spring Clips

NGF fuel rod features spring clips to improve rod internal pressure (RIP) margins. The spring clips replace the coil springs used in the rod plenum, which occupies less of the plenum volume. The additional plenum volume accommodates additional fission gasses generated during irradiation.

ZrB_2 IFBAs

Westinghouse's ZrB_2 IFBA is a key element to achieving superior fuel cycle costs (FCCs). ZrB_2 allows utilities to achieve optimum uranium utilization over a multitude of loading patterns and operating schemes. IFBA rods enhance power distribution with no residual poison penalty, resulting in increased neutron economy and flexibility, increased margins-to-peaking-factor limits, and lower FCCs and spent fuel costs. No burnable absorber worldwide offers the superior predictability and economics of the Westinghouse ZrB_2 IFBA.

Enhanced Debris Mitigation

NGF fuel design uses three layers of debris protection:

- Debris filter bottom nozzle (DFBN) designed to mitigate debris-induced fuel rod fretting failures
- Protective grid (P-grid) traps any debris that passes through the DFBN against the elongated solid-fuel-rod-bottom end plug, resulting in increased fuel reliability.
- Oxide coating shields the bottom six inches of each fuel rod, thus increasing wear resistance over uncoated cladding.

Axial Blankets

Axial blankets provide improved fuel cycle economics by reducing neutron leakage from the core. The enhanced neutron economy of the blankets means that more neutrons are available to support longer cycle lengths (18 to 24 months). The use of 6- to 8-inch axial blankets at the top and bottom of the fuel stack provides an optimum uranium resource benefit that satisfies a broad range of operating conditions.

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