framatome

ATRIUM™ 10 Fuel Assembly

Reliable Quality With Increasing Burnup

Close to 75,000 BWR fuel assemblies have been delivered by Framatome to all the BWR plant OEMs (GE, Siemens-KWU, and ABB Atom). The ATRIUM™ design with a characteristic internal square channel represents more than half of the BWR fuel assemblies delivered to date. More than 27,000 fuel assemblies of our ATRIUM 10 design have been used in 32 reactors since being introduced in 1992. To date, a maximum burnup of 71 GWd/mtU has been achieved for lead assemblies — a reliable step on the road toward the target figure of 70 GWd/mtU for reload batches. Framatome's commitment to Zero Tolerance for Failure drives identification and comprehensive remedies for all fuel rod failures, enhancing fuel reliability.

A Comprehensive Worldwide Fuel Organization

With a workforce of over 3,600 people, the fuel business group within Framatome is a world leader in both BWR and PWR markets. It provides a wide range of high-performance fuel as well as a variety of engineering and on-site services. Fuel assemblies can be manufactured with enriched natural uranium and also with Enriched Reprocessed Uranium (ERU) or Mixed-Oxide (MOX) fuel. Synergy among engineering and manufacturing resources in Europe and the USA also benefits our customers.

The Center of Our Fuel Assembly Technology: Reliability

Framatome's ATRIUM fuel is engineered for reliability, based on:

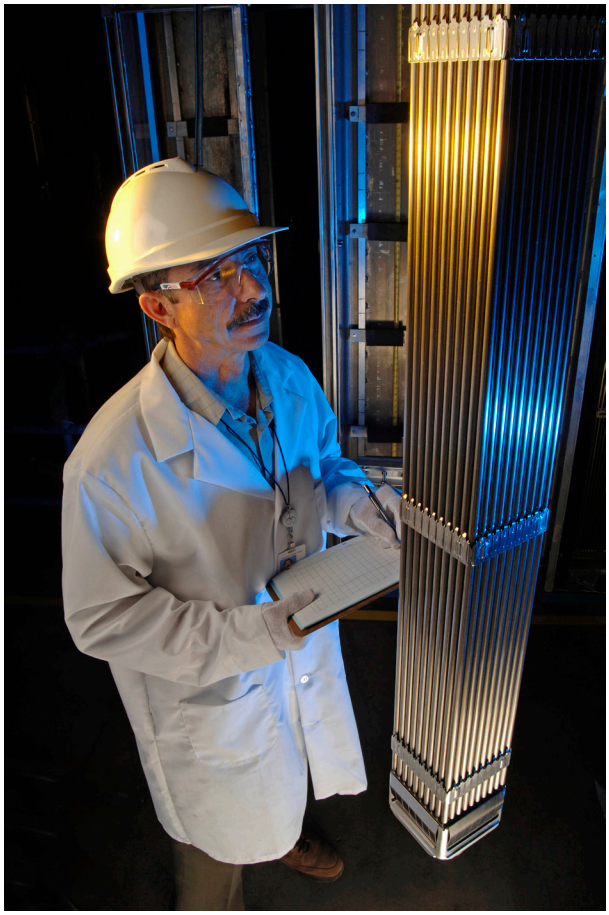
- Material development and comprehensive irradiation experience.
- A modern design program used to conduct core analyses at the request of our customers.
- In-core fuel management and advanced low-leakage loading/core design with short-term and two-year cycles.
- Mechanical and thermal-hydraulic test methods

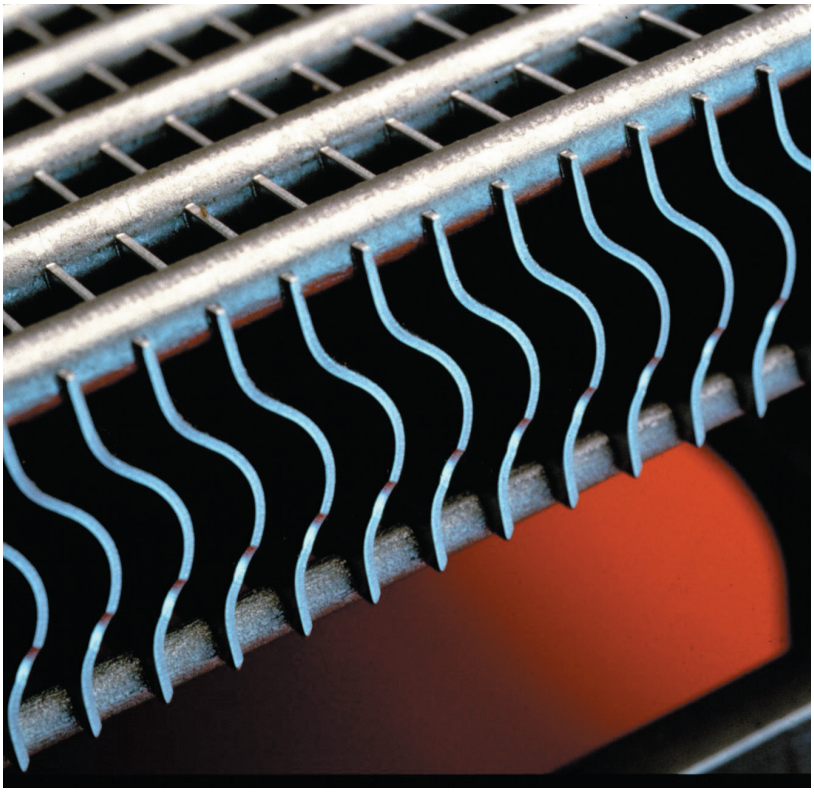
More than 27,000 ATRIUM 10 fuel assemblies have been used in 32 reactors since 1992.

Features and Benefits

- Increased and more uniform moderation ensure dependable performance.
- More even power distribution across the fuel assembly enhances reliability.
- A more homogenous distribution of 235U enrichment in the fuel rods enhances fuel utilization.
- The assembly's large hot-to-cold reactivity window is ideal for long cycles.
- A less negative-void reactivity coefficient enhances both the transient and steady-state behaviors of the core.
- ULTRAFLOW™ spacers with swirl vanes significantly increase the achievable critical power level.
- Cladding with Fe-enhanced zirconium liner on the inner surface provides additional protection against Pellet-to-Clad Interaction (PCI).
- Special low-temperature annealing processes used during manufacturing increase the resistance to both nodular and uniform corrosion.

Your performance
is **our** everyday **commitment**

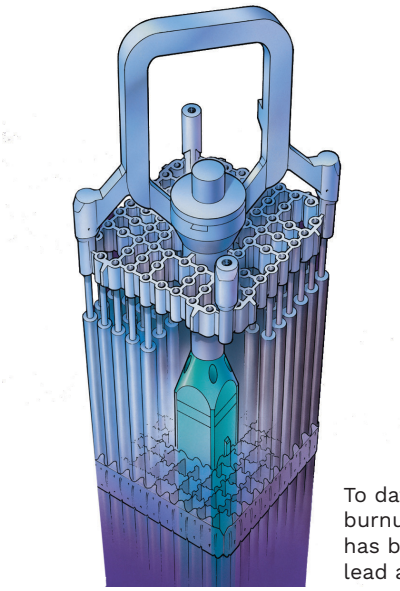




FUELGUARD™ blocks most debris, mitigating fretting damage to fuel rods.

An Optimum Synthesis of Technical Features

- ATRIUM features favorable neutronic, thermal hydraulic, and structural characteristics.
- An internal square water channel displaces a 3x3 array of rods.
- The spacer design is bimetallic, with zircaloy strips and Alloy 718 springs. Innovative design and fabrication methods maintain a low pressure drop, high thermal hydraulic stability, and excellent critical power performance.
- Cladding is available with or without an Fe-enhanced zirconium liner.
- Cladding is manufactured to achieve an optimized combination of grain texture and grain size, enhancing resistance to Pellet-to-Clad Interaction (PCI).
- Advanced fuel channels have a reinforced corner design and reduced channel-wall thickness - all to improve fuel utilization without sacrificing functional strength or resistance to channel bowing.
- Innovative structure isolates fuel rods from all handling loads — mechanical attachment of upper tie plate allows rapid in-service access to all fuel rods with no loose parts.



To date, a maximum burnup of 71 GWd/mtU has been achieved for lead assemblies.

Contact:
sales-fuel@framatome.com

www.framatome.com

framatome