

Comprehensive PWR Fuel Engineering Services



Diverse Capabilities and Field-Proven Experience

AREVA offers a wide range of analytical capabilities and technology tailored to its specific customers' needs. With more than **35 years of experience**, our global team provides responsive, reliable solutions. We offer a full scope of engineering design, licensing, and operational support for reload cores. AREVA maintains and develops codes and methods for design and analysis of Light Water Reactor (LWR) fuel. NRC-approved codes are employed to develop innovative incore fuel management plans to perform reload safety evaluations and related analyses that support licensing. Support is provided for reactor operating cycle lengths ranging from 12 to 24 months as well as extended power uprates.

Criticality Analyses

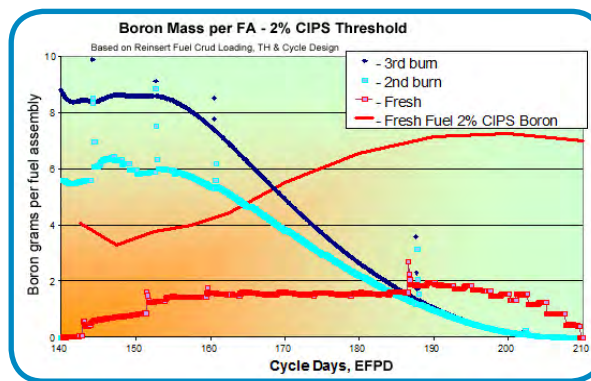
Our proven tools and methods have been extensively tested and benchmarked to current standards required for criticality analysis, including burnup credit.

Fuel Storage Racks – Using a company-wide network of criticality experts, we bring broad experience to unique and challenging licensing efforts for existing fuel storage racks that support design, analysis, and licensing.

Fuel Storage and/or Shipping Containers & Casks – AREVA supports licensing for a variety of fuel storage casks and shipping containers. Applications range from LWR fuel shipping containers and on-site storage casks to shipping containers for highly enriched fuel rods.

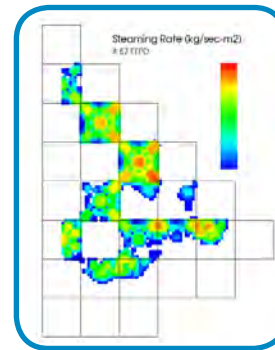
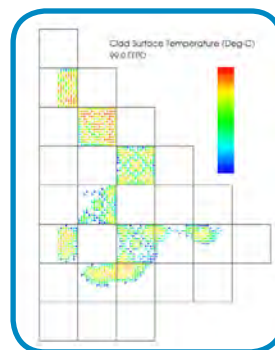
Chemistry & Crud Risk Assessment Tools

AREVA addresses Crud Induced Power Shift (CIPS) and Crud Induced Localized Corrosion (CILC) risks through the use of a four tier risk assessment program such as the one suggested by EPRI's Crud and Corrosion Guidelines. AREVA's COBRA-FLX thermal-hydraulic subchannel code, in concert with a chemistry crud deposit modeling technology known as FDIC (Fuel Deposit Interactive with Chemistry) are at the heart of these methods.



For complex analyses, the CILC results include the effects of crud thickness, cladding temperature under deposit, evolution of CILC bearing species and Lithium concentration in the Zirconium Oxide layer. The CIPS results are generated for Boron loading and amount of insoluble iron-nickel-borates.

AREVA's Level 3 and 4 evaluations consider both "risk" and "margin" to the fuel performance impact caused by crud deposits.



1/8 core simulation of subchannel condition characterization

Structural and Seismic Analyses

AREVA structural engineers apply their expertise in a wide range of products — from detailed stress analysis of new fuel components to complete structural/seismic analysis reports for spent fuel storage racks and pools. Our broad range of analytical capabilities features a variety of in-house computer codes, as well as commercial codes such as ANSYS, LS-DYNA and Pro/Engineer or Creo Elements/Pro.

Areas of Expertise

Structural Analysis — including elastic, plastic, and buckling analyses; fatigue and fracture analyses; mechanical and thermal creep; large deflection and thermal analyses.

Seismic & Dynamic Analysis — features response spectra; time histories; 2D and 3D linear and nonlinear models; shock and vibration, including component drop analysis; pressure transients and jet impingement analyses; model analysis; flow-induced vibration, including Fast Fourier Transform (FFT) analysis.

Component Design & Structural Analysis — for fuel assemblies, control components, spent fuel storage racks or containers, incore detectors, plus fuel handling and field service equipment.

Special Applications — such as ASME Code Section III stress analysis; solving structural-fluid interaction problems; evaluating and implementing wear-enhancement materials and treatments; on-site or off-site flow-induced vibration (FIV) design verification testing and structural component testing.

Reactor Engineering Analysis and On-Site Support

Startup Physics Testing — AREVA engineers support on-site startup physics testing by performing the tests on our state-of-the-art reactimeter systems. Our experience spans a variety of PWRs across the globe. We combine the proven success of over 250 reload startups with innovative consultation resulting in reduced testing time, accurate test results, and cost savings for our customers.

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Core Monitoring — Backed by the strength of world-wide core monitoring experts, our methods support monitoring PWR cores that utilize either fixed or moveable in-core detectors. The flexible design of our codes allows different neutronic engines and customization of surveillance modules to meet specific utility needs. The on-line tools provide greater accuracy and responsiveness to reactivity management issues by implementing state-of-the-art codes. Predictive modules help plan for future maneuvers in the safest and most economical manner.

Technology Transfer & Training — Most of our fuel-related analysis technology is available to utilities that wish to develop or enhance their own in-house capabilities. We can tailor technology transfer packages to meet the specific needs of any customer.

- **Site Engineering Services:** AREVA can verify compliance with monitoring requirements related to Limiting Conditions for Operation (LCO) such as core power distribution, Estimated Critical Position (ECP), and Nuclear Instrumentation (NI) calibration — for efficient cycle startup/operation and plant maneuvers.
- **Computer Codes:** AREVA computer codes can be accessed through local installation or remote access to machines maintained at AREVA.
- **Technical Training:** Provided on Reload Design and Analysis, Reactor Engineering, and Computer Codes.

Features and Benefits

- The global resources of a world leader in nuclear energy
- Utilization of the latest approved code systems for analyses
- Licensing support for fuel storage racks
- A broad range of structural, thermal, and nuclear engineering capabilities
- Technology transfer packages tailored to specific customers' needs
- Startup physics consultation saving both time and money

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