



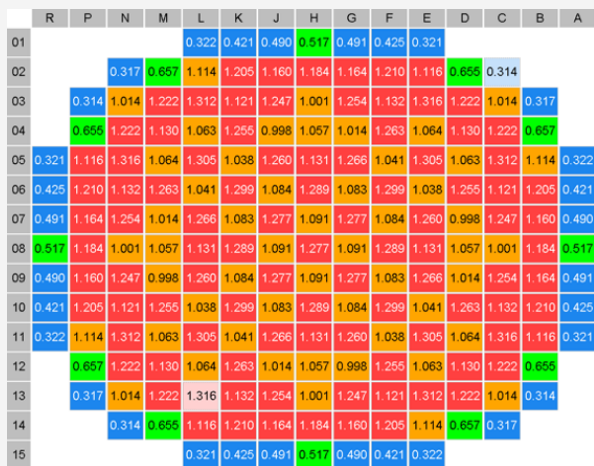
# ADVANCED CORE MONITORING AND REACTIVITY MANAGEMENT

GARDEL is a fuel supplier independent advanced live core monitoring application with built-in reactivity management tools. Combining Studsvik's state-of-the-art reactor analysis methods with efficient database technology and a customizable graphical user interface, GARDEL can help reduce uncertainties and conservatism that limit reactor operating efficiency.

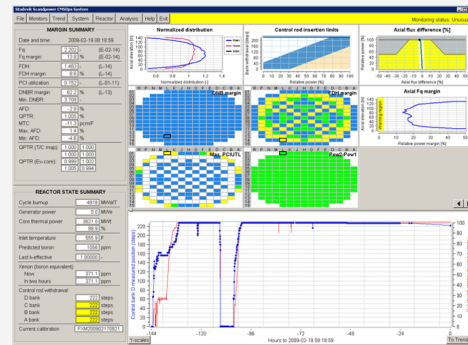
“ GARDEL enables utilities to seamlessly exchange information between reactor engineering and nuclear fuel groups for advanced reactivity management planning and rapid issue resolutions.”

## Benefits of Advanced Core Monitoring

- Increase speed of communication between operations, reactor engineering, and core design
- Save time resolving unexpected operation needs or issues
- Reduced training effort for nuclear engineers
- Intuitive and functional GUI
- Highly flexible, always available
- Enables ATF modeling and monitoring
- Common LWR platform provides resource flexibility and efficiency
- Fuel vendor independence
- Reduce switching cost for fuel vendors by using consistent methods during transition and beyond



Typical Core Map representation in GARDEL



Analyst view of an operating core in GARDEL

## Automated Calculations

- Reduce work required for engineering tasks
- Reduce human performance errors
- Define common procedures across the plant
- Enable complex operations for modern operational requirements such as load follow

Automated Calculations	
PWR	BWR
Axial shape guidance: projects power and controls assembly bank position to maintain ASI or AFD and meet boron requirements	Cold Critical Conditions High Worth Rod Critical CR Pattern Search
Coastdown Calculations	High Notch Worth Search
Common across PWRs and BWRs	
Estimated critical condition	
Re-analysis of past operational events	
Operation planning and predictions	
Shutdown margin	
Operation planning and predictions	
Re-analysis of past operational events	
Reactivity coefficients	

### High Reliability Core Monitoring

- GARDEL leverages the power of CASMO and SIMULATE to provide robust on-line core monitoring and operational support, using the same 3D core model generated by reactor engineers and core designers.
- GARDEL provides highly reliable thermal margin and PCI calculations based on the CASMO and SIMULATE models. Margin is gained from reduced uncertainties.

### Quickly Resolve Unexpected Operational Needs or Issues

With several powerful engineering features to analyze past conditions or plan for future operations, GARDEL enables rapid response to unexpected operational needs or events.

### Dissolve Organizational Boundaries

- Reduce human performance errors between reactor engineering and nuclear fuel teams.
- GARDEL can be deployed throughout the entire organization, allowing view-only displays for operators in the control room, while providing engineers with advanced operational planning functionality.
- The same SIMULATE model is shared for core design, core monitoring, and the training simulator.

### Highly Flexible, Always Available

Completely independent of fuel vendor, core vendor, and computing hardware, GARDEL can support any existing PWR and BWR and provides the flexibility to change fuel providers without sacrificing accuracy or having to learn new software. GARDEL standardizes the fleet.

### Real Data, Reliable Results

GARDEL's data acquisition methods can be implemented at any BWR or PWR plant. Using detailed, real-time signals from the plant process computer, GARDEL explicitly calculates global and local core surveillance quantities down to the pin level.

### Empower Reactor Engineering

- GARDEL empowers reactor engineers to easily perform accurate, reliable planning calculations.
- GARDEL offers enhanced reactivity management functions and can support site-wide operations.

### Cycle-Specific Simulator Support

The GARDEL-SIM extension conforms to cycle-specific training simulator performance objectives, standards, and regulations.

- Title 10 CFR 55.46
- SOER 96-02
- ANSI 3.5 Standard

### Cyber-Secure Solution

- GARDEL has built-in cybersecurity features
- Administrative controls that regulators worldwide have approved
- Customer implementation cases, operational experience, and recommendations available

### Report Generation

- Periodic, daily, and monthly core follow
- Isotopic reports
- Maneuver plans
- Training plans for load follow
- Maneuver plans for FPO

### Replace Spreadsheets and Core Data Books

With a commercially available software solution used worldwide, operators no longer must spend an FTE or more maintaining home-grown spreadsheets and out-of-date paper core data books.

### Software Platforms

GARDEL is supported in Windows and Linux platforms

### Unparalleled Customer Support

- Studsvik's technical support is built on putting the needs of its customers first.
- 24-hour response time
- Easy ticketing system
- On-line support portal
- Access to technical documents and papers
- Active and growing user community of practice

#### For further information please contact:

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