

Powering Smarter Nuclear Fuel Management with CMS5

How utilities are gaining greater accuracy, flexibility, and confidence across the nuclear fuel lifecycle

For nuclear power operators, the challenge is no longer simply running a reliable plant. Today's utilities must optimize fuel investments, manage evolving reactor designs, meet regulatory requirements, and respond quickly to changing operating conditions.



Studsvik's **Core Management System 5 (CMS5)** was developed to help utilities meet those challenges.

Built on more than four decades of industry experience, CMS5 combines the advanced capabilities of **CASMO5** and **SIMULATE5** to provide a comprehensive platform for core design, analysis, and fuel management. The result is a powerful solution that enables engineering organizations to perform sophisticated reactor analyses with greater efficiency and accuracy while maintaining independence from fuel and reactor vendors.

Built on Proven Experience

CMS5 traces its heritage to technologies that have been used in more than 200 light water reactors worldwide. The platform incorporates lessons learned from decades of commercial reactor operations, allowing engineers to model complex reactor behavior with a high degree of confidence.

Unlike approaches that require specialized computing infrastructure, CMS5 leverages modern computational methods to deliver high-fidelity results while remaining practical for day-to-day engineering workflows.

Key Benefits

Greater Accuracy

- High-fidelity core modeling and analysis
- Pin-by-pin reconstruction capabilities
- Precise fuel cycle performance predictions

Improved Engineering Efficiency

- Rapid evaluation of design alternatives
- Support for both routine and unplanned analyses
- Streamlined workflows across engineering teams

Vendor Independence

- Independent assessment of fuel suppliers
- Greater control over fuel strategy and core design
- Increased flexibility for procurement and planning decisions

Supporting Today's Nuclear Fleet and Tomorrow's

CMS5 supports a broad range of commercial light water reactor designs, including Pressurized Water Reactors (PWRs), Boiling Water Reactors (BWRs), Water-Water Energetic Reactor (VVERs), and Small Modular Reactors (SMRs). As the industry evolves, CMS5 evolves alongside it. New fuel technologies and operating strategies are incorporated into the platform, helping utilities stay prepared for future reactor and fuel developments.

A Complete Ecosystem for Advanced Core Analysis

CMS5 brings together a suite of integrated tools designed to support every stage of reactor core management with the flagship products of CASMO5 and SIMULATE5.

CASMO5



Advanced Lattice Physics Modeling

CASMO5 serves as the foundation for accurate fuel modeling and cross-section generation. Its advanced transport solutions and modern nuclear data libraries support critical applications such as:

- Fuel management
- Reload design
- Core follow activities
- Plant operations
- Spent fuel management

SIMULATE5



High-Fidelity Core Analysis

SIMULATE5 provides three-dimensional steady-state core analysis for light water reactors. Designed specifically for reactor engineers and core designers, it supports:

- Loading pattern evaluation
- Startup physics testing
- Thermal limit assessments
- Shutdown margin calculations
- Fuel cycle optimization

By validating and assessing fuel performance across the operating cycle, utilities can maximize the value of every fuel investment.

Extending the capabilities of CMS5, Studsvik provides additional integrated software solutions including – SIMULATE5-K, CMSBuilder, COPERNICUS, GARDEL, S3R, CASKLOAD, SNF, MARLA and CONCORS.

Partnership Beyond Software

Technology is only part of the equation.

Studsvik supports users with:

- Rapid technical response
- Online support resources
- Access to technical documentation
- User communities and knowledge sharing
- Expert guidance from experienced nuclear professionals

As utilities seek higher performance, greater operational flexibility, and long-term fuel strategy confidence, CMS5 provides a proven platform for informed decision-making across the entire nuclear fuel lifecycle.

CMS5 Advances Support for Next-Generation Nuclear Technologies

In 2026, Studsvik achieved a significant regulatory milestone when the U.S. Nuclear Regulatory Commission (NRC) approved Supplement 1 to the CMS5 Generic PWR Topical Report. The approval expands CMS5 applicability beyond today's operating reactor fleet to support emerging nuclear technologies and advanced reactor programs.

The NRC-approved enhancement supports:

- Higher fuel enrichment levels
- Increased fuel burnup strategies
- Light water reactor-based Small Modular Reactor (SMR) designs
- Plant life extension initiatives
- Licensing and development activities for next-generation nuclear reactors

For utilities, reactor developers, and engineering organizations, this approval provides additional confidence that CMS5 can serve as a long-term platform supporting both current operational needs and future reactor innovation.

Why It Matters

As the nuclear industry increasingly focuses on life extension programs, advanced fuels, and SMR deployment, engineering teams require analysis tools that have both technical sophistication and regulatory credibility. The NRC approval demonstrates CMS5's readiness to support the evolving demands of the nuclear sector, helping bridge the gap between today's commercial reactors and tomorrow's clean energy technologies.

Expanding Advanced Analysis Capabilities with Peacock and Nighthawk

Next-Generation Monte Carlo Simulation for Advanced Reactors



Complementing the CMS5 platform, Studsvik developed **Peacock**, a next-generation Monte Carlo analysis code designed to support both today's operating reactors and emerging advanced reactor technologies. Peacock combines continuous-energy neutron transport, generalized 3D geometry modeling, and built-in depletion capabilities in a modern, user-friendly environment.



Key features include:

- Continuous-energy Monte Carlo simulation
- Flexible 3D geometry modeling for advanced fuel and reactor designs
- Integrated depletion and isotope transmutation calculations
- Simplified YAML-based user inputs
- NQA-1 quality assurance and 10 CFR 50 Appendix B compliance objectives
- Support for advanced reactors, SMRs, and conventional LWR applications



Nighthawk, Studsvik's new 3D Diffusion Nodal simulator, is advancing the future of reactor modeling and simulation. Already benchmarked against a Fast-Spectrum reactor benchmark and featured in a publication presented at PHYSOR 2026, Nighthawk delivers proven capabilities for next-generation analysis. Together, Peacock and Nighthawk are building the foundation for a new era of high-fidelity nuclear modeling and simulation.

Collectively, CMS5, Peacock and Nighthawk provide a powerful combination of production-proven core analysis and next-generation high-fidelity simulation capabilities, helping nuclear organizations prepare for the future of reactor innovation.

Learn more: www.studsvik.com

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Studsvik – a global leader in the nuclear power lifecycle

At Studsvik, we drive nuclear technological innovation, medical advancement, and access to clean energy — every day. For over 75 years, we continue to deliver innovative and more sustainable solutions — making a real difference.

As an independent partner rooted in the global nuclear industry, we support new build and long-term operation of nuclear power plants by providing expertise in material testing, fuel optimisation, waste management, decommissioning and radiation protection services — from new construction to final disposal.

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