Studsvik

SIMULATE3-K

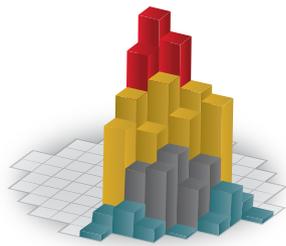**NUCLEAR FUEL ANALYSIS SOFTWARE**

Transient Nodal Code for Light Water Reactors

SIMULATE3-K is an advanced, two-group nodal code for transient analysis of both PWRs and BWRs. SIMULATE3-K delivers neutronic and thermal-hydraulic analysis with licensing-grade accuracy over a wide range of dynamic applications.

Proven Results

SIMULATE3-K is built on the solid foundation of SIMULATE3, the industry-leading steady-state nodal reactor analysis code.

By explicitly modeling the detailed assembly-by-assembly neutronic and thermal-hydraulic behavior of the reactor core, SIMULATE3-K can be used to analyze a variety of core transients.

SIMULATE3-K has been successfully used by clients for stability analysis, reactivity insertion analysis, dynamic rod worth calculations, and past operational events.

Originally designed as a best-estimate tool, SIMULATE3-K is licensed for several transient applications by the United States Nuclear Regulatory Commission.

Address Emerging Issues

SIMULATE3-K can help operating utilities address emerging regulatory issues like pin enthalpy and delta-CPR limits.

An explicit fuel pin conduction model explicitly tracks the complete radial distribution of fuel temperatures and enthalpies in every fuel pin in the core throughout a transient.

SIMULATE3-K is capable of evaluating margin to thermal limits (such as delta CPR) during plant transients, providing licensing-grade support to core designers.

Applications

With a robust neutronics engine and advanced thermal hydraulic capabilities, SIMULATE3-K is well-suited for transients with a strong neutronic/thermal-hydraulic coupling.

Its seamless linkage with SIMULATE3 makes it the perfect tool for the study of operational transients typically analyzed on a cycle-specific basis. Core designers simply generate the proposed core model, and direct SIMULATE3-K to evaluate the prescribed set of transients as part of the core reload design licensing process.
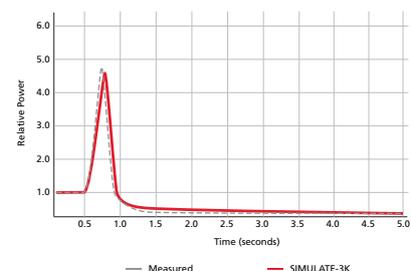
Peach Bottom Turbine Trip Benchmark

Whole-Plant Transients

SIMULATE3-K has been coupled with system codes like RELAP and RETRAN. The powerful neutronics engine inside SIMULATE3-K guarantees a high-fidelity, 3D core neutronic solution in whole-plant transient simulations.

PWR Applications

SIMULATE3-K can provide licensing-grade support for analyzing PWR-specific safety analyses, such as:

- Ejected rods and inadvertent bank withdrawals (RIA)
- Dropped rods
- Boron dilution accidents

BWR Applications

SIMULATE3-K can provide licensing-grade support for analyzing BWR-specific safety analyses, such as:

- Stability
- Dropped rods and inadvertent bank withdrawals (RIA)

SIMULATE3-K can also evaluate fast anticipated operational occurrences where the primary acceptance criteria are fuel rod integrity:

- Pressurizations created in the steam dome and/or the steam lines with valve control and actuation
- Coolant inventory or flow change transients using the two groups of pumps
- Coolant temperature changes and instabilities that occur during a flow decrease/temperature events

Ease of Use

The SIMULATE3-K input format is simple to use, allowing free-format input capable of modelling complex core transients.

With practical defaults for PWRs and BWRs, robust error checking, and seamless interfaces to other Studsvik core analysis software, SIMULATE3-K allows engineers to spend their time analyzing, not troubleshooting.

Methodology

SIMULATE3-K leverages the power of SIMULATE3, the industry standard in nodal reactor analysis. Including cutting-edge neutronic methods and advanced engineering features, SIMULATE3-K delivers unparalleled fidelity with production-level run times.

S3K solves the transient three-dimensional, two-group neutron diffusion equations, including a six-group model for delayed neutron precursors. Intranodal flux and power distributions within each node are used to compute the power, fuel temperatures, and enthalpies for every axial level of *every fuel pin* in the core during transients.

Each fuel assembly in the core is explicitly represented in the core thermal-hydraulics.

For BWR operational transients, vessel and steam line models are capable of simulating acoustic effects in the steam line due to sudden valve closures or openings.

Requirements For SIMULATE3-K

SIMULATE3-K is available for all standard computing platforms running most modern 32- and 64-bit operating systems. Linux, Windows, and UNIX architectures are all acceptable environments for SIMULATE3-K.
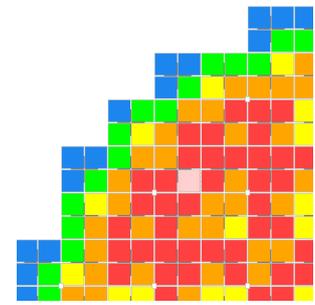
SIMULATE3-K accurately calculates margin to thermal limits during plant transients.

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