

# RELAP5 Analysis Services

## Background

The Reactor Excursion and Leak Analysis Program (RELAP) is a U.S. Nuclear Regulatory Commission-developed tool for analyzing loss of coolant accidents (LOCAs) and system transients in pressurized water reactors (PWRs) or boiling water reactors (BWRs). It is a suite of codes for analyzing thermal hydraulic events using state-of-the-art two-phase flow models, which has broad capabilities in both nuclear and non-nuclear systems. RELAP5 is widely used worldwide in transient analyses for light water reactors (LWRs).

## Description

Westinghouse has a strong commitment to the RELAP5 suite of codes and currently uses RELAP5 for various applications. RELAP5 has extensive capabilities to support customer needs for analyzing thermal hydraulic transients. Westinghouse performs RELAP5 analyses using MOD3.1, MOD3.2 and MOD3.3 (latest version) for various thermal-hydraulic events such as small break LOCA transients, operational transients and piping force evaluations. Over the years, Westinghouse has developed an expert understanding of RELAP5 and developed efficient automated methods for input preparation, run execution and post-processing of results to consistently provide cost-effective solutions for customer needs in a timely manner.

Some examples of analyses that Westinghouse has performed using RELAP5 are:

- **Water Hammer Study** – Solves the phenomenon associated with blow-down from a pressurized system, propagation of one-dimensional acoustic waves, homogeneous column separation and collapse, and dynamic motion of valve
- **Used Fuel Pool Analysis** – Performs analysis to establish the used fuel pool instrumentation requirements applicable to a specific site
- **Fluid Dynamic Experiment Design** – Validates the sonic velocity for acoustic experiments that analyze the effect of vortex shedding that results in unwanted acoustic resonance. These experiments are used to develop mitigation approaches, from changing flow fields to directly addressing the resonance
- **Small Break LOCA Analysis** – Performs analyses and evaluations covering LOCA-related areas such as fast and slow transients, and LOCA and containment analysis
- **Containment Analysis** – Determines the temperature transients of compartments outside containment (used for equipment environmental qualification)
- PWR and BWR operational transient analysis such as shutdown transients
- PWR and BWR design analysis such as AP1000® reactor and Advanced BWR transients

## Benefits

Westinghouse has more than 40 years of experience in performing nuclear plant analyses, developing and licensing analysis codes, and effectively using industry codes such as RELAP5 to provide solutions for a number of issues at nuclear plants. The benefits of solutions include:

- Improving peak temperature and pressure by performing more accurate event analysis
- Minimizing the need for design/hardware changes through better transient predictions
- Relieving environmental qualification requirements by performing more accurate analysis
- Enabling lower pressure for containment leak testing through better transient predictions

Westinghouse has the following advantages when providing and supporting RELAP5 analyses:

- **Global capabilities** – Expertise and local support from several locations worldwide
- **Streamlined analysis** – Use of latest technology in support of processes to streamline analysis
- **Start-to-finish analysis** – Capability to perform all analysis steps, such as pre- and post-processing
- **Regulatory experience** – Successful history of using RELAP5 to address regulatory questions and requirements

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