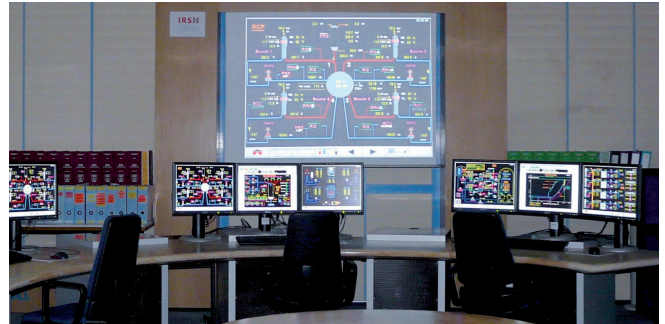


The pressurized water reactor simulator: a high-performance tool in support for safety

(P. Dufeil)

Among the means available to carry out its safety assessment mission, the Institute owns a simulator capable of representing the behaviour of a pressurized water reactor (PWR) in normal, incident and accident conditions. It enables the IRSN to perform studies in the framework of its expertise missions on PWRs, improve its assessment quality, prepare crisis exercises and train its employees and external staff.

The new simulator, progressively installed for the different types of power reactors in operation in France, replaces the previous generation equipment used by the IRSN since 1992, with much more efficient functionalities.



An engineering simulator is a computer system which allows real time calculations and ongoing monitoring of the evolution of physical parameters. It is used to simulate equipment failures and operators' actions and makes it possible to stop a calculation to examine the state of the installation at a given time and go back in order to modify the scenario. All its actions are conducted via a human-machine interface consisting of several screens.

Thanks to its software package, the IRSN simulator can adapt to the development of the EDF fleet and to the wide range of studies needed.

IRSN applications

Studies

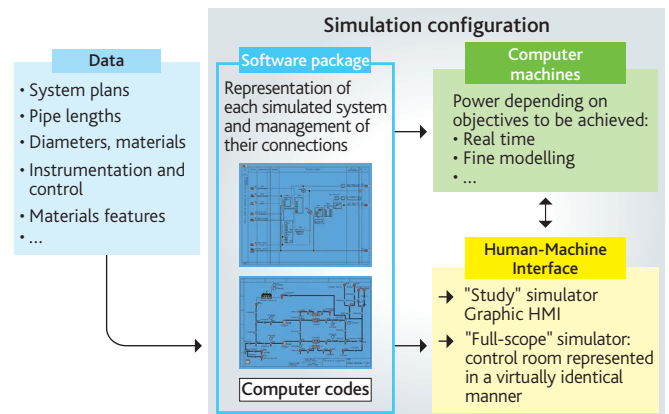
The studies carried out are intended to provide support for safety assessments, especially in terms of analysis of systems, incidents, operation in accident situation, probabilistic safety assessments.

Training

The simulator is a tool for training IRSN engineers or engineers from other French or foreign organizations on the operation of systems and circuits, as well as on safety and accident analysis. Over 400 trainees from beginner to expert level have been trained since 2000.

Crisis

The scenarios of national emergency drills organized by the IRSN are developed with the simulator and the data generated are used during exercises.



Upgrading of simulation tools

In order to perpetuate their simulation means and reduce maintenance costs, the IRSN and AREVA NP signed a cooperation agreement, in 2005, to entirely renovate their simulators. This agreement allows them to share the costs and competencies required to carry out such a project.

	SIPA2 SIMULATOR	SCAR SIMULATOR	RENOVATED SIMULATOR	
Reactor power in MWe	900 - 1300	900	900 - 1300 - 1450	
Thermal-hydraulic code	CATHARE-SIMU	CATHARE 2	TRACAS+	CATHARE 2
Simulation accuracy	about 200 meshes	870 meshes	about 300 meshes	from 800 to 1000 meshes
Real time simulation ?	yes + accelerated	yes except in case of large break on the circuit	yes + accelerated	yes except in case of large break on the circuit
Possible simulation from 100% nominal power to:	cold shutdown (closed primary circuit)	cold shutdown for maintenance (open primary circuit)	cold shutdown (closed primary circuit)	cold shutdown for maintenance (open primary circuit)
Put into service in:	1992	2002	2006-2008	2009-2010