

SOCRAT-BN INTEGRAL CODE: DEVELOPMENT, VALIDATION AND CURRENT STATUS

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Integral computer codes SOCRAT-BN have been developed at the Nuclear Safety Institute of the Russian Academy of Sciences (IBRAE RAN) in the frame of the Federal Target Program «New-Generation Nuclear Power Technologies for the Period 2010–2015 and up to 2020». The first version SOCRAT-BN/V1 was developed for the period 2010-2014 to simulate design basis (DBA) and beyond design basis accident (DBDA) at a nuclear power plant with sodium fast reactor (SFR). In 2016, the first version of the code was certified by “Scientific and Engineering Centre for Nuclear and Radiation Safety”(SEC NRS). For 2014-2017, the second version of the code, SOCRAT-BN/V2, was developed. It had extended the first version to severe accident with core melting. The second version of the code was certified in 2019.

Currently, SOCRAT-BN is used for safety assessment of operating and projected SFR for Russian power plants. Also, it is planned to use SOCRAT-BN for supporting projects to be constructed abroad.

The physical models of the SOCRAT-BN are divided into two blocks: a steady state and a transient one. The steady state block is applied to simulate the accumulation of fission products and the state of the fuel elements for the period of time that the reactor operates before an emergency event. The transient block is applied to simulate the temperature state of the reactor, the transfer of fission products before release to the environment, deformation of fuel and cladding, neutronics processes during the destruction of the core, melting and movement of fuel.

The report represents description of the basic code physical models, its validation and the current state of the code.

Country/Int. organization

Russian Federation

Author: Mr CHALYY, Ruslan (IBRAE RAS)

Co-authors: Mr FOKIN , Aleksey (IBRAE RAS); Mr BUTOV, Anton (NSI RAS); Mr TARASOV, Artem (IBRAE RAS); USOV, Eduard; Mr KUDASHOV, Ivan (NSI RAS); Mr PHILLIPPOV, Michail (IBRAE RAS); PRIBATURIN, Nikolay (IBRAE RAS, IT SB RAS); Mr RYZHOV, Nikolay (IBRAE RAS); Dr TSAUN, Sergey (NSI RAS); Mr SEMENOV, Vladimir (IBRAE RAS)

Presenter: Mr CHALYY, Ruslan (IBRAE RAS)

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