

Integral code COMPLEX for radiation safety assessment of reactor and nuclear fuel cycle facilities

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The computational code COMPLEX for radiation safety assessment of reactor and nuclear fuel cycle facilities is a set of programs (modules) combined by exchange data files and a pre- and post-processing system. The code is being developed in the “Codes of new generation” subproject of the “Proryv” project. The code includes the following modules:

- reactor core calculation modules based on Monte Carlo method (MCU-FR), diffusion approximation (DOLCE VITA) and discrete ordinates method (CORNER);
- nuclide kinetics module (BPSD);
- radiation sources calculation module (RASTAS_M);
- radiation shielding calculation modules based on Monte Carlo method (MCU-FR) and finite element method (ODETTA);
- group constants system (CONSYST/ABBN-RF).

Almost all separate modules (except for RASTAS_M) are certified or are completing certification in Rostech-nadzor.

The application area of the COMPLEX includes storage and transportation units for fresh and spent fuel assemblies, reactor core, reactor plant, NPP equipment and premises, closed nuclear fuel cycle facilities.

The calculating scenario of the COMPLEX code, in which all modules are used, consists of the following stages:

1. At the first stage, the assembly campaign is simulated (fuel assembly, control rod or other core elements), the neutron flux is calculated;
2. At the second stage, burnup calculations of the fuel, absorber and activation of structural materials are carried out; the call of the modules can be iterative (by burnup steps);
3. At the third stage, the calculation of ionizing radiation sources is carried out for specific materials, assemblies or sets of assemblies;
4. At the fourth stage, the neutron, gamma or coupled neutron-gamma transport problem is solved and the dose equivalent rate is calculated at the detection points.

Thus, due to a wide application area the code COMPLEX is an important and relevant tool for radiation safety assessment of liquid metal fast reactors and closed nuclear fuel cycle facilities

Country/Int. organization

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