Einladung zum Seminar über „Nukleare Energieerzeugung“

Hybridveranstaltung

Zeit: Montag, 13. Dezember 2021, 11:00 Uhr

Ort: Karlsruher Institut für Technologie, Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen, INR, Bau 521, Kolloquiumsraum (R. 302),

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Referent: Herr Dr.-Ing. Fabrizio Gabrielli, Karlsruher Institut für Technologie, Campus Nord, INR

Titel: Evaluation of the Radiological Source Term in Severe Accident Scenarios for a generic KONVOI-1300 NPP by means of the ASTEC Code

Abstract:

Severe Accidents in nuclear power plants are generally triggered by a cooling failure within the reactor cooling system (RCS), which prevents proper removal of residual power from the core, and by multiple dysfunctions, arising from equipment and/or human error, including the failure of safety procedures. During the accident progression, large core degradation and the failure of the safety barriers may occur, leading to a massive release of fission products from the vessel to the containment and the environment.

The evaluation of the radiological consequences of severe accidents in current operating nuclear power plants as well as in the innovative designs is one of the milestones of the Nuclear Safety Research program (NUSAFE) of the Karlsruhe Institute of Technology (KIT). Such research activity plays a central role in supporting the decision making of the emergency and preparedness teams in case of occurrence of such abnormal events.

With this goal, a calculation strategy has been developed at KIT based on the assessment of a database of source term evaluations for different severe accident scenarios to be used by real-time program systems, i.e. Java Real-time On-line DecisiOn Support (JRODOS, KIT). In this framework, the Accident Source Term Evaluation Code (ASTEC), being developed by IRSN since 1996 and co-developed by KIT since 2019, is widely employed at INR to assess the database. ASTEC is nowadays the European reference integral code able to analyze the complete SA scenario from the initiating event until radioactive release from the containment in Gen. II and Gen. III water-cooled reactors. The assessment of the database aims at performing different kind of analyses. First of all, it is possible to evaluate the effect of the different severe accident initiators on the source term. Furthermore, since such accident events are still characterized by high uncertainties, uncertainty and sensitivity tools, i.e. the in-house Fast Source Term Code (FSTC), may be applied to the ASTEC results. This activity allows further extending the database and quantifying the effect of the uncertainties of the ASTEC physical models on the fission product release during the severe accident.
progression. Such database may be also employed as training data to perform source term prediction analyses by means of, e.g., the Monte Carlo-Bayes procedure (MOCABA) developed by Framatome and embedded into the KIT FSTC tool.

The first step the strategy is therefore the assessment of ASTEC input decks for the nuclear power plant and the analysis of best-estimate severe accident scenarios. The lecture is mainly focused on this activity. The analysis of the ASTEC predictions of the source term for selected severe accident sequences in a generic German KONVOI-1300 plan will be shown, the latest version of the ASTEC code (v2.2.0.1, 2021) being employed.

In particular, a Medium Break Loss-Of-Coolant Accident (MBLOCA, 12” break on the cold leg) and a Small Break LOCA (SBLOCA, 2” break on the cold leg) accident scenario also in conjunction with the occurrence of a Station Black Out (SBO) are considered. Furthermore, the results of the uncertainty quantification of the ASTEC source term evaluations for a selected scenario in the generic KONVOI-1300 plant will be shown. Finally, examples the application of JRODOS to the ASTEC results will be discussed.

gez. R. Stieglitz

Hinweis: Alle auswärtigen Besucher des Seminars werden gebeten, ihren gültigen Personalausweis oder Reisepass mitzubringen.