Национальный исследовательский центр
КУРЧАТОВСКИЙ ИНСТИТУТ

Proposals of NRC "Kurchatov Institute" on Contributions to Collaborative Framework on ATF Activity

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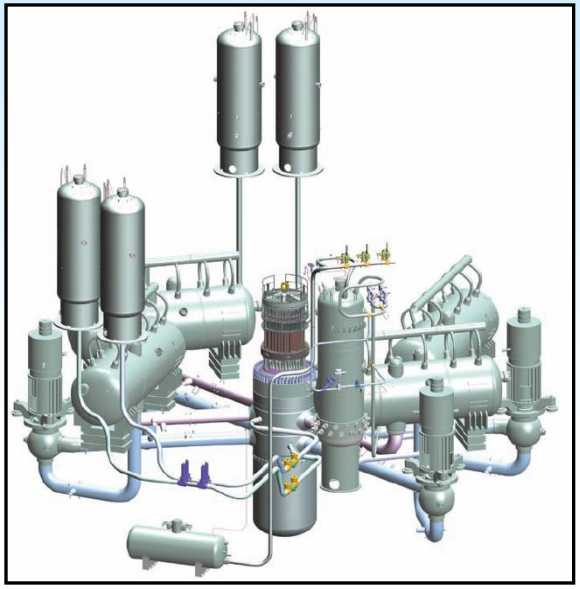
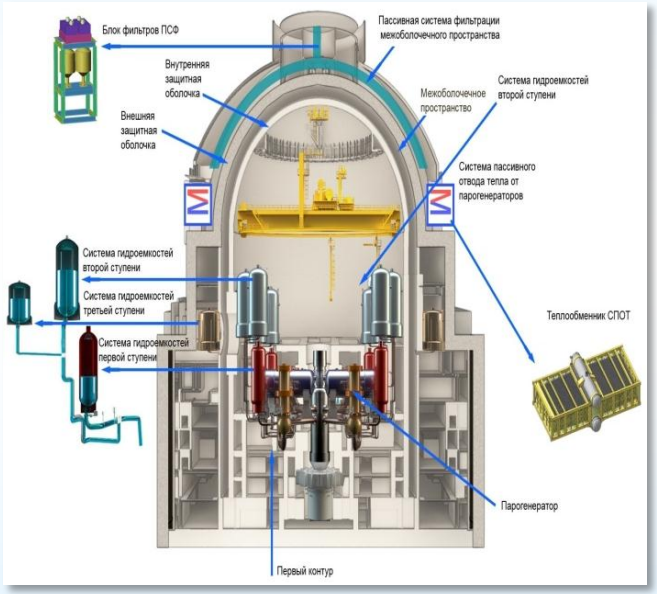
Research of Severe Accidents on NPPs with VVER

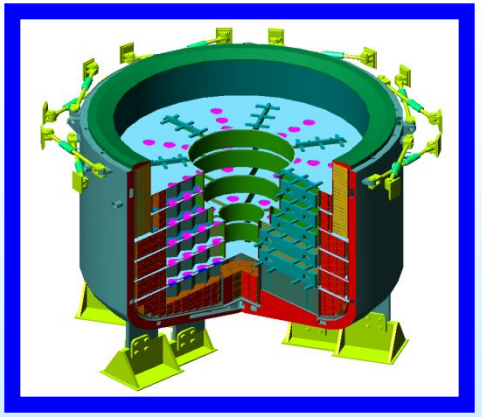
SOCRAT code for **Reactor Facility** modeling⟶





ANGAR code for

⟵**Containment** modeling



GEFEST-ULR code for **Core Catcher** modeling ⟶

SOCRAT Severe Accident Code

SVECHA Module - for core (fuel, claddings and control rods) degradation modeling

Models:

- Zr cladding oxidation,
- Liquefaction of B_4C by solid SS,
- B_4C absorber rod degradation,
- Dissolution of UO_2 by molten Zr,
- ZrO_2 layer loss of integrity,
- Material relocation.

EURATOM 5th Framework Program (1998-2002)
COLOSS project (COre LOSS during a severe accident)

NRC "Kurchatov Institute" (Russia) + IRSN (France) + FZK (Germany)

The joint work on Advanced Treatment of Zircaloy Cladding High-Temperature Oxidation in Severe Accident Calculations.

The results of this work were published in the "Nuclear Engineering and Design":

- **Schanz G., Adroguer B., Volchek A., Zvonarev, Yu., Fichot F., "Advanced Treatment of Zircaloy Cladding High-Temperature Oxidation in Severe Accident Calculations", Part I – Part III. Nucl. Engineering and Design, 232, 2004.**
  - **Part I – Experimental database and basic modeling.**
  - **Part II – Best-fitted parabolic correlations.**
  - **Part III – Verification against representative transient tests.**

In the frame of the bilateral contract between IRSN (France) and NRC "Kurchatov Institute" developed correlations for Zircaloy Cladding High-Temperature Oxidation were implemented in the Western European ASTEC and ICARE/CATHARE codes.

Application of the Modified ASTEC and ICARE/CATHARE Codes for Analysis of SA on NPPs

The modified ICARE/CATHARE code with above mentioned correlations was used for analysis of the incident with cleaning tank on PAKS-2 NPP:

- **Zvonarev Yu., Volchek A., "Results of Fuel Behaviour Calculations of PAKS-2 Cleaning Tank Incident with ICARE/CATHARE Code", Final Meeting of the OECD-IAEA Paks Fuel Project, Budapest, Hungary, April 26–27, 2007.**

The modified ASTEC and ICARE/CATHARE codes actively used for simulation of severe accidents on NPPs with VVER:

- **Zvonarev Yu., Budaev M., Kobzar V., Volchek A., "ICARE/CATHARE and ASTEC Codes Validation and Application to Safety Analysis of NPPs with VVER", Proceedings of ICAPP'05, Seoul, KOREA, May 15-19, 2005.**
- **Zvonarev Yu., Kobzar V., Budaev M., Chatelard P., Van Dorsselaere J.P., "ASTEC and ICARE/CATHARE Application to Simulation of a VVER-1000 Large Break LOCA", J. of Energy and Power Engineering, vol. 4, N°3, 2010.**
- **Zvonarev Yu, Volchek A, Kobzar V., Chatelard P., Van Dorsselaere J.P., "ASTEC and ICARE/CATHARE modeling improvement for VVERs", Nucl. Engineering and Design, 241, 2011.**
- **Zvonarev Yu., Budaev M., Kobzar V., Volchek A.,"ASTEC Application for In-Vessel Retention Modelling in VVER Plants", Nucl. Engineering and Design, 7638, 2014.**

Proposals of NRC "Kurchatov Institute" on Contributions to Collaborative Framework on ATF Activity

- New ATF material (fuel, claddings and control rods) properties assessment in normal operation conditions, and behaviour in accident conditions;
- Overview of the status of the modelling tools applicable for the evaluation of ATF, in relation with the phenomena impacted by the fuel properties focusing on the Russian severe accident SOCRAT code;
- Development new models for modelling of ATF (fuel, claddings and control rods) behaviour in severe accident conditions;
- Implementation of new models for ATF into severe accident SOCRAT code and the modified code validation;
- Application of the modified SOCRAT code to analysis of BDBA scenarios on NPPs with VVER reactors.

Thank you for attention!