**Final results and conclusions of the ISTC project # K-1265**

**“Study of the processes of corium-melt retention in the reactor pressure vessel” (INVECOR)**

The main objective of the project was the experimental study of nonstationary processes in the confinement of corium in the reactor vessel simulating residual heat.

When the primary task (№ 3) in the integral large-scale experiments up to 60 core melt C-30 was discharged from EMF from the height of the 1,7 m in the model of the reactor vessel with a device placed in it to simulate the residual heat release. Duration of experiments on the confinement of corium in the vessel ranged from 1 to 2 hours. Specific power of energy release in the corium was from 4 to 8 W/cm3. Maximum temperature of the vessel model wall was 1300°C, which was achieved through thermal insulation of the vessel model external surface and regulation of cooling water flow. The addition of steel in the corium was carried out by simulating the vessel inner surface plating by stainless steel (in the experiment INVECOR-2) and dumping of steel sheet on the surface of the corium pool (in the experiment INVECOR-3). In two experiments (INVECOR-1/3 and INVECOR-2) up to 10 kg of oxide corium C-90 was previously put into the vessel model. In the fourth experiment (INVECOR-1/4) efficiency of thermal insulation on the external surface of the vessel model was increased and an optional heat shield on the corium was installed.

Under Task 4 post-test analysis of samples of corium and vessel steel, including cutting the corium ingot and vessel model, sampling, X-ray phase analysis (XRD); optical metallography, elemental analysis, compilation of experimental results was performed.

During the post-test studies it was found that solidified corium was in the form of a continuous ingot, and in the form of small fragments, located on the top of the ingot. A slight erosion of the inner surface of the steel wall of the vessel model was detected.

Study of phase composition of hardened corium showed that the composition of the lower crust of the corium adjacent to the wall of the model of the hull and the composition of the upper layer of the fragments is almost identical and consistent with the rapid cooling of the core melt (quench-effect). This suggests that part of the fragmented corium formed as a result of the primary contact with the melt jet on the cold steel surface.

Weight fragmented corium may depend on the mass ratio of corium / steel. It should be borne in mind that in the experiment INVECOR-1.4 received the highest weight of the fragments compared with previous experiments. Studies have shown that the particles of the lower layer will look like fragments of the upper crust on the corium ingot. Consequently, it could be formed as a result of cracking of the upper crust of the corium with increasing pressure in the closed pores in the ingot, as well as a result of crushing the top of the ingot during thermal expansion.

The hypothesis of formation of a layer of fragments as a result of primary contact of a stream of the melt with case model can be checked up in the course of further experiments INVECOR where the thickness of a wall of model of the body will be reduced that will allow to lower essentially a mass thermal capacity model of the body and, accordingly, to lead to its faster warming up at the expense of heat exchange with corium.

Reduction of a thickness of a wall of model of the body in offered experiments will allow lowering also leakage heat along a case wall to the top flange that will provide higher thermal streams through a model of the wall in a radial direction.

Besides, it is offered to execute experiment without a thermal protection on an external surface of model of the case that will provide heat removal from corium mainly in a radial direction in cooling water.

The third experiment can be executed with preliminary addition hardened of melt of the corium in model of body (earlier executed experiments have shown, that in such configuration the lump fragment of corium is much less since the quench-effect is decreases).