

**WORK PLAN FOR THE PROJECT EXTENSION PERIOD  
5 months, from 01.01.2006 till 31.05.2006 (Q13 and 14)**

**1. Project title: "Investigation of Corium Melt Interaction With NPP Reactor Vessel Steel (METCOR)".**

**2. Project Manager:** Khabensky Vladimir Bentsianovich

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**3. Expected results:**

- 3.1. Quantitative characteristics of vessel steel ablation at its interaction with molten corium depending on:
  - Oxygen potential of the melt, which depends on corium composition (also in case of metallic Zr presence in the melt) and above-melt atmosphere.
  - Molten corium superheating.
  - Presence of molten steel in the suboxidized oxidic melt.
  - Temperature of the vessel steel surface on the interaction interface.
- 3.2. Microstructure, elemental and phase composition of corium ingot, corium-specimen contact zone, steel specimen near the interaction zone.
- 3.3. Developed mechanisms and models of the corium-steel interaction process.
- 3.4. Influence of physicochemical phenomena, which take place at corium-vessel steel interaction, on the efficiency of in-vessel melt retention during the free-convection cooling of reactor vessel with boiling water.

**4. Scope of work**

The project objective is to study physicochemical phenomena taking place at the interaction of molten pool with reactor vessel. The project has two phases of implementation.

The interaction of oxidic corium ( $\text{UO}_2/\text{ZrO}_2/\text{FeO}(\text{Fe}_3\text{O}_4)$ ) with reactor vessel steel in air and neutral (nitrogen) atmosphere above the melt has been experimentally studied during the 1<sup>st</sup> Phase of ISTC # 833 Project (METCOR1).

The interaction of suboxidized oxidic and metal-oxidic melt (different compositions) and vessel steel at different temperatures on the interaction interface in neutral above-melt atmosphere has been experimentally studied during the 2<sup>nd</sup> year of the 2<sup>nd</sup> Phase of the Project.

The interaction of molten corium having the composition of  $\text{UO}_2/\text{ZrO}_2$  and  $\text{UO}_2/\text{ZrO}_2/\text{FeO}(\text{Fe}_3\text{O}_4)$  with vessel steel at the steam atmosphere above the melt will be studied experimentally during the 3<sup>rd</sup> year of the 3<sup>rd</sup> Phase of the Project. Two papers on the results of completed stages have been prepared jointly with collaborators for the publication in NEO; one presentation at the ICAAP-04 conference has been published.

The additional 5-month period of Project extension will be used for the following:

- 4.1. Test MC11 posttest analyses will be completed.
- 4.2. The integrated analysis of all experimental studies of the 1<sup>st</sup> and 2<sup>nd</sup> phases of the Project will be made.

- 4.3. Molten corium – vessel steel interaction mechanisms will be determined and appropriate numeric models developed.
- 4.4. The influence of physicochemical phenomena taking place at the corium-steel interaction on the in-vessel melt retention will be estimated.
- 4.5. Two publications will be prepared jointly with collaborators.

Additional activities will be carried out in the framework of Task 4 and Task 5 implementation.

Task 4. Experimental studies of the interaction between molten corium  $UO_{2+x}/ZrO_2/FeO_y$  and vessel steel in the steam above-melt atmosphere. This work requires additional time for a wider range of physicochemical posttest analyses of the samples of corium, interaction zone and steel specimen.

Task 5. The integrated analysis of experiments completed in the 1<sup>st</sup> and 2<sup>nd</sup> phases of the Project. Additional work within this stage will include in the analysis of corium-steel interaction mechanism and development of numeric model showing the influence of main interaction parameters, as well as the assessment of in-vessel retention sensitivity to the main physicochemical phenomena taking place at the interaction.

<b>Task 4</b>	
<b>Description and main stages</b>	<b>Participating institutions</b>
<b>Study of the interaction between coria having compositions <math>UO_{2+x}/ZrO_2/FeO_y</math> with vessel steel in steam above the melt.</b> Stages during the additional time. 4.1. Physicochemical posttest analysis of MC11 samples and specimens	NITI
<b>Deliverables</b>	
Intermediate report with experimental data and first results of posttest analyses	

<b>Task 5</b>	
<b>Description and main stages</b>	<b>Participating institutions</b>
<p><b>Integrated analysis of completed experiments including: pre- and posttest calculations of power distribution in the components of test facility, melt and experimental section; numeric determination of steel specimen temperature conditions, pre- and posttest electromagnetic calculations, physicochemical analysis of samples and specimens.</b></p> <p>Stages during the additional time.</p> <p>5.1. Task 4, including the analysis of interaction mechanism and development of numeric model.</p> <p>5.2. Integrated analysis of the complete experimental data of the 1<sup>st</sup> and 2<sup>nd</sup> Phases of the Project, including the analysis of interaction mechanism and numeric models.</p> <p>5.3. Evaluation of impact from the interaction phenomena on the in-vessel melt retention efficiency.</p>	NITI
<b>Deliverables</b>	
<p>1. Report on Task 4, Annual report of the 3<sup>rd</sup> year, Final Report</p> <p>2. Joint publications with collaborators</p>	

## 5. Reportable results

Technical and financial quarterly reports will be submitted to ISTC in the end of 10, 11, 12, 13 and 14<sup>th</sup> quarters. Annual Report on the 3<sup>rd</sup> year will be delivered in the 13<sup>th</sup> quarter. In the end of the Project extension period final reports will be produced.

Two publications (papers or conference presentations) will be prepared jointly with collaborators.

## 6. Technical schedule

	<b>Quarters 13 и 14</b>	<b>Man-days</b>
<b>Task 4</b>	Report	
<b>Man-days</b>	<b>550</b>	<b>550</b>
<b>Task 5</b>	Report, publications	
<b>Man-days</b>	<b>706</b>	<b>706</b>
<b>TOTAL</b>	<b>1256</b>	<b>1256</b>

Project manager:

V.B. Khabensky

Date: 01.06.2005