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Severe accident research in the core degradation area: An example of effective international cooperation between the European Union (EU) and the Commonwealth of Independent States (CIS) by the International Science and Technology Center

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HIGHLIGHTS

- ISTC supported successful nuclear safety projects between EU & Russian institutes.
- Two-tier project monitoring has proved to be very successful and flexible.
- Examples are reactor degradation, corium steel corrosion, and corium thermodynamics.

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ABSTRACT

The International Science and Technology Center (ISTC) was set up in Moscow to support non-proliferation of sensitive knowledge and technologies in biological, chemical and nuclear domains by engaging scientists in peaceful research programmes with a broad international cooperation.

The paper has two following objectives:

- to describe the organization of complex, international, experimental and analytical research of material processes under extreme conditions similar to those of severe accidents in nuclear reactors and,
- to inform briefly about some results of these studies.

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The main forms of ISTC activity are Research Projects and Supporting Programs. In the Research Projects informal contact expert groups (CEGs) were set up by ISTC to improve coordination between adjacent projects and to encourage international collaboration. The European Commission was the first to use this. The CEG members – experts from the national institutes and industry – evaluated and managed the projects' scientific results from initial stage of proposal formulation until the final reporting. They were often involved directly in the project's details by joining the Steering Committees of the project. The Contact Expert Group for Severe Accidents and Management (CEG-SAM) is one of these groups, five project groups from this area from the total of 30 funded projects during 10 years of activity are detailed to demonstrate this: (1) QUENCH-VVER from RIAR, Dimitrovgrad and IBRAE, Moscow, and PARAMETER projects (SF1–SF4) from LUCH, Podolsk and IBRAE, Moscow; these concerned a detailed study of bundle quenching from high temperature; (2) Reactor Core Degradation; a modelling project simulating the fuel rod degradation and loss of geometry from IBRAE, Moscow; (3) METCOR projects from NITI, St. Petersburg on the interaction of core melt with reactor vessel steel; (4) INVECOR project, NNE Kurchatov City, Kazakhstan; this is a large-scale facility to examine the vessel steel retention of 60 kg corium during the decay heat; and finally, (5) CORPHAD and PRECOS projects, NITI, St. Petersburg undertook a systematic examination of refractory ceramics relevant to in-vessel and ex-vessel coria, particularly examining poorly characterised, limited data or experimentally difficult systems.

1. Introduction

The International Science and Technology Center (ISTC) is an international organization that was created in Moscow in November 1992 by Russia, USA, EU, Norway and Japan and began operations in 1994. Later Korea and Canada, and several CIS countries acceded to ISTC. The ISTC's objective is to support non-proliferation of sensitive knowledge and technologies in biological, chemical and nuclear domains by engaging scientists in peaceful research programmes with a broad international cooperation. The main forms of ISTC activity are Research Projects and Supporting Programs (ISTC, 2010).

The paper has two following objectives:

- to describe the organization of complex, international, experimental and analytical research programmes and,
- to inform briefly about some of the results of this programme in the area of materials under extreme conditions such as severe accidents in nuclear reactors.

In the Research Projects, informal contact expert groups (CEGs) were set up by the ISTC to improve interaction between adjacent projects and to stimulate international collaboration; the first was set up by the European Commission. The CEG members – experts from the national institutes and industry – jointly evaluated and managed the projects' scientific results. This was followed from the initial proposal formulation until the final reporting. Members were often involved directly by joining the Steering Committees of the individual projects.

This paper looks at the CEG for Severe Accident and Management (CEG-SAM) that was set up by the European Commission in 2002 and illustrates its success with a few selected projects.

1.1. International Science and Technology Center (ISTC)

Presently, the ISTC has 39 member states (27 from EU), representing the CIS, Europe, Asia, and North America. The Governing Parties of ISTC are Canada, the United States, the European Union, Japan, and Russia. Other Parties are Norway and South Korea. The CIS parties are Armenia, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic and Tajikistan.

The ISTC funding parties are Canada, EU (including Switzerland under a cooperation agreement), USA, Japan and South Korea, while the Recipient Parties have been Russia and the other CIS states listed above. About 500 governmental and private organisations became Funding Partners of the ISTC (providing one third of the budget).

The ISTC has its headquarters in Moscow with branches in each capital of the above CIS states and provides advice to potential institutes and companies wishing to submit proposals. In all, ISTC has funded about 2750 projects worth over $853 million, involving over 58,000 former weapons scientists and their team members in 765 research institutes spread across Russia/CIS and who have collaborated with over 200 foreign companies or research institutes based in the funding countries.

ISTC's Mission, in addition to redirecting weapons scientists to peaceful activities, is that the projects should:

- Contribute to solving national and global technological problems.
- Support basic and applied research.
- Support the transition to market-based economies.
- Encourage their integration into the international scientific community.

In addition to the ISTC management of science R&D projects, the Secretariat also supports the project participants and institutes with travel grants to workshops and towards organising international conferences; it also helps with patenting, commercialization and consultancy.

1.2. Science and Technology Center of Ukraine (STCU)

A similar system was set up in 1993, based in Kiev for the Ukraine and surrounding territories: the Science and Technology Center of Ukraine (STCU) (STCU, 2012). The Governing STCU Parties are: USA, EU, Canada, Sweden and Ukraine. The Funding Parties are USA, EU and Canada, while the Recipient Parties are Ukraine and Azerbaijan, Georgia, Moldavia and Uzbekistan from the CIS. It has funded over 1430 projects worth over $209 million (Tocheny and Gozal, 2009). It has a similar set of objectives to its sister organisation to redirect former weapons scientists towards peaceful uses of their expertise and to encourage their integration into the international scientific community. The administrative system was similar to that of the ISTC as was the project assessment by the EC.

1.3. Contact Expert Group for Severe Accidents and Management

The Contact Expert Group for Corium Management was set up by the Directorate General for Research and Technological Development (DG-RTD) in April 2002. It was later renamed as the Contact Expert Group for Severe Accidents and Management in order to technically assess & manage a broadening range of proposals and funded projects.