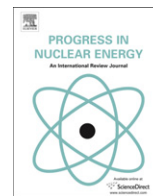




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## SARNET: Severe accident research network of excellence

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## A B S T R A C T

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Fifty-one organisations network in SARNET (Severe Accident Research NETWORK of Excellence) their research capacities in order to resolve the most important pending issues for enhancing, with regard to Severe Accidents (SA), the safety of existing and future Nuclear Power Plants (NPPs). This project, co-funded by the European Commission (EC) under the 6th Framework Programme, has been defined in order to optimise the use of the available means and to constitute sustainable research groups in the European Union. SARNET tackles the fragmentation that may exist between the different national R&D programmes, in defining common research programmes and developing common computer tools and methodologies for safety assessment. SARNET comprises most of the organisations involved in SA research in Europe, plus Canada.

To reach these objectives, all the organisations networked in SARNET contributed to a Joint Programme of Activities, which consisted of:

- Implementation of an advanced communication tool for accessing all project information, fostering exchange of information, and managing documents;
- Harmonization and re-orientation of the research programmes, and definition of new ones;
- Analysis of the experimental results provided by research programmes in order to elaborate a common understanding of relevant phenomena;
- Development of the ASTEC code (integral computer code used to predict the NPP behaviour during a postulated SA), which capitalizes in terms of physical models the knowledge produced within SARNET;
- Development of Scientific Databases in which all the results of research programmes are stored in a common format (DATANET);
- Development of a common methodology for Probabilistic Safety Assessment of NPPs;
- Development of short courses and writing a textbook on Severe Accidents for students and researchers;
- Promotion of personnel mobility amongst various European organisations.

This paper presents the major achievements after four and a half years of operation of the network, in terms of knowledge gained, of improvement of the ASTEC reference code, of dissemination of results and of integration of the research programmes conducted by the various partners.

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After this first period (2004–2008), co-funded by the EC, a further contract SARNET2 with the EC for the next four years started in April 2009 as part of the 7th Framework Programme. During this period, the networking activities will focus mainly on the remaining pending issues as determined during the first period, experimental activities will be directly included in the common work and the network will evolve toward complete self-sustainability. The bases for such an evolution are presented in the last part of the paper.

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## 1. Background and objectives of SARNET

The Nuclear Power Plants (NPPs) existing in Europe are designed with the principles of defence in depth. In particular, they incorporate a strong containment and engineering systems to protect the public against radioactivity release for a series of postulated accidents. Nevertheless, in some very low probability circumstances, severe accident (SA) sequences may result in core melting and plant damage leading to dispersal of radioactive material into the environment and thus constituting a health hazard to the public.

In 2004, many achievements had been already obtained in the field of research on Water Reactor SA, thanks in particular to the numerous European actions undertaken within the 4th and 5th Framework Programmes (FP) of the European Commission (EC). In spite of the progress made, research activities were still needed on several issues in order to reduce further uncertainties considered of importance and to consolidate severe accident management plans (Magallon et al., 2005).

Research programmes on SA were – and still are – decided at national levels. Cooperation agreements are often concluded around these national programmes, but on a case-by-case basis. Facing the inevitable reduction of the national budgets in this field, it was necessary to coordinate better the national efforts to optimise the use of the available expertise and experimental facilities in order to resolve the remaining issues for enhancing the safety of existing and future NPPs.

Therefore, since April 2004, fifty-one organisations involved in R&D in SA, including safety authorities and/or their technical support organisations (TSOs), industries, utilities and universities, decided to seize the opportunity offered by the EC in the FP6 framework to network in SARNET (**S**evere **A**ccident **R**esearch **N**ETwork of Excellence) their research capacities in the severe accident area in a durable way. These organisations came from 18 Member States of the European Union (Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, the Netherlands, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom), Switzerland, Canada and the Joint Research Centres of the EC (Fig. 1). The network benefited from and strengthened the existing complementarities amongst the different partners (corium/fission product chemistry experts, small-scale/large-scale testing, simulants/real materials, experimentalists/model developers/code developers) (Micaelli et al., 2005).

The general objectives of SARNET consisted of:

- Tackling the fragmentation that exists between the different R&D organisations, notably in defining common research programmes and developing/validating computer tools;
- Harmonizing the methodologies applied for assessing risk and improve Level 2 Probabilistic Safety Assessment (PSA) tools;
- Disseminating the knowledge to newcomers to the European Union more efficiently and associating them with the definition and conduct of research programmes more closely;
- Bringing together top scientists in SA research to constitute a world leadership in advanced computer tools for SA risk assessment.

This paper presents the major achievements after four and a half years of operation of the network, in terms of knowledge gained, of improvement of the ASTEC reference code for SA, of dissemination of results and of integration of the research programmes conducted by the various partners.

After this first period (2004–2008), co-funded by the EC, a further contract SARNET2 with the EC as part of FP7 started for the next four years. During this period, the networking activities will focus mainly on the remaining pending issues as determined during the first period, experimental activities will be directly included in the common work and the network will evolve toward complete self-sustainability. The bases for such an evolution are presented in the last part of the paper.

## 2. The Joint Programme of Activities

To achieve the objectives of SARNET a Joint Programme of Activities (JPA) was defined and updated every year. All the organisations in SARNET contributed to the JPA that was broken down into twenty work-packages (Fig. 2) which fall into three categories:

- Integrating activities to strengthen links amongst organisations;
- Joint research activities to resolve remaining outstanding issues;
- Spreading of excellence activities to diffuse the knowledge.

## 3. Main achievements

The main achievements, after four and a half years of operation of the network, are described below.

### 3.1. Integrating activities

The integrating elements of the programme are considered of highest importance and constitute key elements of the JPA.

#### 3.1.1. Advanced communication tool

This ACT tool has been implemented for enabling communication between project partners and for management of the documents. ACT being a key concept to achieve SARNET goals, today's portal technology allows an efficient collaboration within the network, in particular:

- Access, search, publication of documents and codes (concept of knowledge storage);
- Contact and communication with partners (interactive and collaborative services);
- Joint coordination of actions/programmes (cooperative management of the network);
- Links to satellite community projects (R&D projects, related web sites).

The ACT platform has been developed on the basis of the Microsoft Sharepoint Portal Server. Access is given by Web

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