Euratom Research Activities on Severe Accident Management

Michel Hugon
Fission Energy
Directorate Energy
DG Research & Innovation
European Commission
E-mail: michel.hugon@ec.europa.eu

IEM on SAM after Fukushima accidents – 17-21 March 2014 – IAEA – Wien (AT)

Content

- Severe Accident Management Research
- NUGENIA
- Horizon 2020
- Conclusion

Severe Accident Research in DG RTD

European Commission

- From 1988 to 2010, EC involved in management and scientific cooperation in PHEBUS FP programme (largest severe accident research programme carried out in the world) with a **total EC financial contribution of € 40.5 million**
- Since 1992, about 80 shared-cost research projects on severe accidents partly funded by DG RTD with a **total EC contribution around € 66 million**
- Research → better understanding of the phenomenology of severe accidents and help in decreasing the uncertainties of importance for nuclear reactor safety
- In 2004, during FP6 (2002-2006), launching of SARNET Network of Excellence to further integrate research programmes and knowledge on severe accidents in the European Member States

SARNET2: Severe Accident Research NETwork of Excellence

Key objectives:

- Improve knowledge on severe accidents to reduce uncertainties on pending issues, thereby enhance plant safety through experimental and modelling work
- Coordinate research resources and expertise available in Europe
- Preserve research data and disseminate knowledge

April 2009 to March 2013 in FP7
Total cost: 38 937 670 €
Total EC contribution: 5 750 000 €
Coordinated by IRSN (FR)
Work ≈ 40 equivalent full-time persons/year

22 countries

- European Union, Switzerland, Canada, USA, Rep. Korea, India

43 organisations

- 21 research organizations
- 7 universities
- 7 industry/utilities
- 8 safety authorities or Technical Safety Organisations

≈ 230 researchers (+ 25 PhD)

SARNET2 should create a self-sustaining organisation (legal entity, sources of funding) in the field of SA research before its completion

ISTC/STCU CEG – SAM (1)

European Commission

ISTC/STCU Contact Expert Group on Severe Accident Management

- Interaction between SARNET and CEG-SAM (ISTC/STCU) well established according to document entitled "Interaction between EC-SARNET and CEG-SAM activities", which was endorsed by both groups in 2005 and 2010
- **Quite successful since its launching in April 2002**
- **Areas addressed:**
  - Experimental and computer modelling of fuel quenching
  - Modelling of corium-vessel interaction
  - Designing and testing of high-resistant materials for barriers
  - Analysis and description of the condition of Chernobyl NPP materials from 1986 onwards (data-base)

Research & Innovation

ISTC/STCU CEG – SAM (2)

- ***About 5.5 M€ funding from EC for 14 ISTC projects from 2002 to 2011***
- ***1 STCU project funded by Canada (300 k$)***
- *Bottomley D. et al, 2012. Severe accident research in the core degradation area: An example of effective cooperation between the EU and the CIS by the ISTC. Nuc. Eng. Des. 252, 226-241.*
- ***ISTC and STCU funding from EC***
  - **It has decreased from ~ 25 M€ in 2007 to ~ 7.4 M€ in 2009 and in 2010**
  - **No more projects on SAM funded since 2009**
- ***ISTC will be closed on 31/12/2014 and secretariat transferred to Almaty (KA)***
- ***Collaboration with Russia continues through the Euratom-ROSATOM Working Group on nuclear fission*** *(Under the cooperation agreement on nuclear safety between Euratom and Russia in 2002)*
  - **Meeting on 13 October 2011 in Moscow**
  - **Meeting on 15 October 2012 in Brussels**
  - **Next meeting in 2014 in Moscow ?**
- ***Website: https://www.iam.kit.edu/wpt/english/cegsam/index.php*** *(password protected)*

Severe Accident Management Research

Project acronym and title	Key areas of R&D	Coordinator Nb. of partners from nb. of European states	Start date Duration	Total budget / EU contribution Instrument
LACOMECO – Large Scale Experiments on Core Degradation, Melt Retention and Containment Behaviour http://nuklear-server.ka.fzk.de/lacomeco	Reactor Safety – Severe Accident Management QUENCH, LIVE, DISCO-H, HYKA	**KIT (DE)** **1 partner (from 1)**	01/02/10 36 months	**€0.78M / €0.5M** CSA-SA
ERCOSAM - Containment thermal-hydraulics of current and future LWRs for severe accident management	During a SA in a LWR, can a hydrogen stratification be established during part of the transient starting from a LOCA blowdown until the end of bulk hydrogen release from the reactor vessel into the containment?	**PSI (CH)** **8 from 6 inc. Canada, USA** **Coup. to SAMARA with 3 Russian partners**	01/07/10 48 months	**€2.6M / €1.0M** CP-FP

Severe Accident Management Research (following the Fukushima accident)

European Commission

Project acronym and title	Key areas of R&D	Coordinator Nb. of partners from nb. of European states	Start date Duration	Total budget / EU contribution Instrument
PASSAM – Passive and Active Systems on Severe Accident source term Mitigation	To produce simple models and/or correlations to enhance code for current and future NPPs	**IRSN (FR)** **8 from 7**	01/01/13 48 months	**€5.1M / €3.6M** CP
CESAM – Code for European Severe Accident Management - Fukushima accidents, ASTEC, decision-making tool, spent fuel pond, numerical simulation	Improvement of the European reference code ASTEC towards a usage in severe accident management analysis and to improve the understanding of the Fukushima accidents	**GRS (DE)** **18 from 14 + India**	01/04/13 48 months	**€6.3M / €3.6M** CP
SAFEST – Severe Accident Facilities for European Safety Targets	Integration of European severe accident research facilities into a pan-European laboratory for severe accidents and corium studies	**KIT (DE)** **8 partners (6 EU countries + JRC/ITU)** **+ Russia, Japan ?**	Under Negotiation 48 months	**€4.5M / €3.2M** CP-CSA

Research & Innovation

Probability Safety Assessment

European Commission

Project acronym and title	Key areas of R&D	Coordinator Nb. of partners from nb. of European states	Start date Duration	Total budget / EU contribution Instrument
ASAMPSA2 - Advanced Safety Assessment Methodologies: level 2 PSA (European Best Practices L2 PSA guidelines)	Developing best practice guidelines for severe accident probabilistic safety assessment (PSA)	**IRSN (FR)** **21 from 12**	01/01/08 48 months	**€2.1M / €1.5M** CSA-CA
ASAMPSA_E - Advanced Safety Assessment : Extended PSA	To develop good practices in identification of extreme external events using PSA level 1-2 for decision making in the European context	**IRSN (FR)** **27 from 20 incl. CH, UA**	01/07/13 36 months	**€4.0M / €3.0M** CSA-CA

Research & Innovation

First pillar of SNETP: NUGENIA

NUclear GEN II-III International Association

Official creation at Brussels on Nov.14, 2011

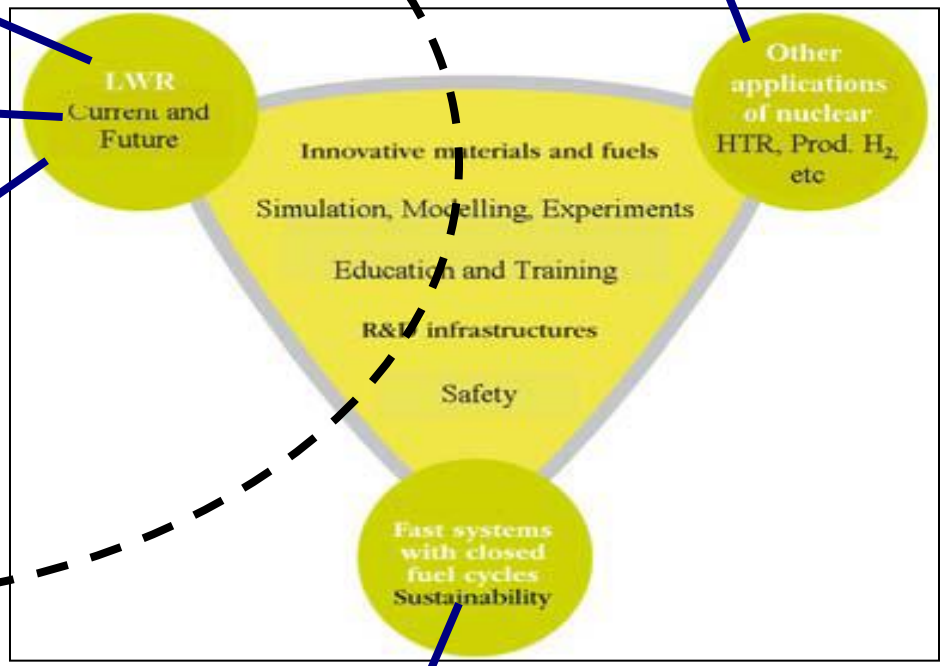
European Commission

"TWG GenII&III" to implement SRA on current and future LWRs

NULIFE NoE to implement SRA on LTO/PLIM

SARNET NoE to implement SRA on Severe Accident

Nuclear Cogeneration Industrial Initiative (NC2I)



European Sustainable Nuclear Industrial Initiative (ESNII)

Research & Innovation

8 main Technical Areas in NUGENIA

European Commission

1 Plant safety and risk assessment

2 Severe accidents

3 Core and Reactor operation

4 Integrity assessment of systems, structures and components

5 Fuel, waste management (all but geological disposal) and dismantling

6 Innovative Gen III design

7 Harmonisation

8 Inspection

Research & Innovation

Euratom R&T Programme 2014-2018

European Commission

Integral part of Horizon 2020 package:

http://ec.europa.eu/programmes/horizon2020/en/

General objective:

- **Improve nuclear safety, security & radiation protection**
- **Contribute to the long-term decarbonisation of the energy system, in a safe, efficient and secure way**

Specific objectives for indirect actions (fission):

- **support safe operation of nuclear systems;**
- **contribute to development of solutions for the management of ultimate waste;**
- **support development and sustainability of nuclear competences;**
- **foster radiation protection;**
- **promote innovation and industrial competitiveness**
- **ensure availability and use of research infrastructures**

Budget under negotiation: *Total € 1 603 million, including Fission € 315.5 million; Fusion € 728 million (without ITER); JRC € 559.5 million*

Euratom Fission WP 2014-2015

- **One** Euratom Work Programme
- **One** Euratom fission call
- **Budget range** per topic and per project
- Overall indicative budget for Euratom 2014 – 2015 Fission Work Programme – **103.17 M€**
- **Single stage** evaluation procedure
- Publication date: 11/12/2013
- Deadline: 17/09/2014

Conclusion

- Since 1988, EC has supported research on severe accident management
- Research on safety of present LWRs will be continued in the framework of the NUGENIA association:
  - Technical Area 2 of NUGENIA addresses severe accidents
- One of the specific objectives of Euratom Programme 2014-2018 in Horizon 2020 is to support safe operation of nuclear systems
- The R&D work on severe accident management
  - is the basis for SAMG development
  - contributes to a better assessment of the source term to be used for emergency response

Information on Horizon 2020 and access to programmes and calls:

http://ec.europa.eu/research/participants/portal/desktop/en/home.html

Research & Innovation