SIXTH FRAMEWORK PROGRAMME

NUCTECH 2003-3 4.3.1-2

Other Activities in the field of Nuclear Technologies and Safety
Safety of Existing Nuclear Installations

NETWORK OF EXCELLENCE

Annex I - "Description of Work"

Project acronym:	SARNET
Project full title:	"Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology"
Contract no.:	FI6O-CT-2004-509065
Date of preparation of Annex I:	21st January 2004
Start date of project:	1st April 2004

Table of Contents

1 NETWORK SUMMARY 4

2 OBJECTIVES OF SARNET 5

2.1. NEEDS 5
2.2. OBJECTIVES OF SARNET 6

3 CONTRACTOR LIST 8

4 RELEVANCE TO THE OBJECTIVE OF THE EURATOM PROGRAMME 11

5 POTENTIAL IMPACT 13

6 THE SARNET ACTIVITIES 15

6.1. ASSOCIATED PROGRAMMES 16
6.1.1 ASTEC 16
6.1.2 Research programmes 17
Resolution of Corium issues 17
Resolution of containment issues 19
Resolution of source term issues 20
6.1.3 Level 2 PSA 21
6.2. JOINT PROGRAMME OF ACTIVITIES (JPA) 21
Integrating activities (JPA/IA) 21
Advanced communication Tool 21
Integral Code ASTEC 24
Level 2 PSA 27
Implementation of scientific databases 30
Research priority assessment 31
Integration monitoring 32
6.2.1 Programme for Jointly executed Research Activities (JPA/JRA) 32
Resolution of corium issues 34
Resolution of containment issues 35
Resolution of Source Term issues 35
6.2.2 Activities designed to spread excellence 36
6.2.3 Management activities 38
6.3. PLANS 39
6.3.1 Plan for using and disseminating knowledge 39
6.3.2 Gender Action plan 39
6.3.3 Raising public participation and awareness 40
6.4. MILESTONES 40
6.4.1 Major Milestones over full project duration 40

7 QUALITY OF INTEGRATION AND PERFORMANCE INDICATORS 42

8 PROJECT ORGANISATION, MANAGEMENT AND GOVERNANCE STRUCTURE .. 44

8.1. THE GOVERNING BOARD 44
8.2. THE ADVISORY COMMITTEE 45
8.3. THE AD-HOC SCIENTIFIC REVIEW COMMITTEE 45
8.4. THE MANAGEMENT TEAM 45

9 DETAILED JOINT PROGRAMME OF ACTIVITIES (JPA) – FIRST 18 MONTHS 47

9.1. INTRODUCTION – GENERAL DESCRIPTION, MILESTONES AND MEASURABLE OBJECTIVES 47
9.2. WORK PACKAGE LIST/OVERVIEW 47
9.3. GRAPHICAL PRESENTATION OF WORK PACKAGES 50
9.4. DETAILED DESCRIPTION, PLANNING AND TIME TABLE 51
9.5. DELIVERABLE LIST 83

9 PROJECT RESOURCES AND ESTIMATION OF INCURRED ELIGIBLE COSTS..... 85

10 PROJECT RESOURCES AND ESTIMATION OF INCURRED ELIGIBLE COSTS... 85

10.1 EFFORTS FOR THE FULL DURATION OF THE PROJECT..... 85
10.2 EFFORTS FOR THE FIRST 18 MONTHS..... 89
10.3 EC CONTRIBUTION FOR THE FULL DURATION OF THE PROJECT 98
10.4. PROJECT MANAGEMENT LEVEL DESCRIPTION OF RESOURCES AND GRANT..... 102

Appendix A Consortium description

A.1 : Participants and consortium
A.2 : Sub-contracting
A.3 : Third parties
A.4 : Third country participants

Appendix B Reporting Procedures (Integrated Projects and Networks of Excellence)

1 Network summary

In spite of the accomplishments reached in severe accident research, a limited number of specific items remain where research activities are still necessary to reduce further uncertainties that are considered of importance for nuclear reactor safety and to consolidate severe accident management plans.

Facing and anticipating budget reductions, 49 European R&D organizations, including technical supports of safety authorities, industry, utilities and universities, have decided to join their efforts in SARNET in a durable way to resolve outstanding severe accident safety issues for enhancing the safety of existing and future Nuclear Power Plants (NPPs). SARNET will:

- Tackle the fragmentation existing in defining/carrying out research programmes;
- Harmonize and improve Level 2 Probabilistic Safety Analysis (PSA) methodologies;
- Diffuse the knowledge to Associated Candidate Countries more efficiently;
- Bring together top scientists in severe accident research so as to be a world leader in advanced computer tools for severe accident risk assessment.

The integral severe accident analysis code ASTEC will provide the backbone of the integration. Actions are proposed to integrate in ASTEC the current knowledge and all the future knowledge generated within SARNET. In addition, the code will be adapted so as to be used for any water-cooled reactor applications in Europe. IRSN and GRS will do their best to provide the necessary capacity for maintenance, training and developments.

The Network management will coordinate the knowledge generation through joint projects of research activities, monitor its integration in ASTEC, make sure that access rights are correctly implemented, disseminate appropriate information using electronic communication links, preserve the knowledge in scientific databases, and identify the missing knowledge. These actions will be decided and controlled by a Governing Board assisted by appropriate advisory capacities.

Most organisations involved will contribute to the diffusion of the knowledge by contributing to the education and training programme or by welcoming foreign researchers in their research laboratories.

2 Objectives of SARNET

The current 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. In some low probability circumstances, some severe accident 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 well beyond the borders of the State where the damaged plant is located.

It is therefore crucial that the best state of knowledge on severe accident phenomenology, qualified computer tools and appropriate methodology should be used uniformly throughout Europe, in order to evaluate the corresponding risks and update former evaluations, taking into account notably the inevitable evolutions in reactor operations (e.g. new type of fuel, higher burn-up, extension of plant life). Additional appropriate engineering devices and/or accident management measures may have then to be developed and implemented in order to reduce the risks to an acceptably low level.

Therefore, a number of European R&D organizations, including technical supports of safety authorities, industry, utilities and universities, have decided to seize the opportunity offered by the European Commission in the 6th Framework Programme (FWP) to network in SARNET (Severe Accident Research and management NETwork) their capacities of research in the severe accident area in a durable way (see MOU appended), in order to resolve outstanding severe accident safety issues for enhancing the safety of existing and future NPPs. The general objectives of SARNET are to:

- Tackle the fragmentation that exists between the different R&D organizations, notably in defining research programmes and developing/qualifying computer tools;
- Harmonize the methodologies applied for assessing risk and improve Level 2 PSA tools;
- Diffuse the knowledge to Associated Candidate Countries more efficiently and associate them to the definition and the conduct of our research programmes more closely;
- Bring together top scientists in severe accident to be a world leader in advanced computer tools for severe accident risk assessment.

2.1. Needs

Remarkable achievements have been obtained in the field of Water Reactor Severe accident research, thanks in particular to the numerous European actions undertaken within the 4th and 5th Framework Programmes. In spite of the accomplishments reached, a limited number of specific issues remain where research activities are still necessary in order to reduce further uncertainties that are considered of importance and to consolidate severe accident management plans: core quenching, iodine chemistry, ex-vessel melt coolability, timing of base-mat failure are examples of remaining issues underlined by the Phenomena Identification and Ranking Table (PIRT) action conducted within the EURSAFE thematic network of the 5th Framework Programme (contract FIKS CT 2001-20147).

Up to now, research programmes in Severe Accident are usually decided first at national levels, though co-operation agreements are then 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 is now 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. This coordination will take benefits of, and strengthen, the existing complementarities between the different laboratories throughout Europe (corium/fission product chemistry experts, small scale/large scale testing, simulants/actual materials, experimenters/model developers/code developers).

Presently, different integral computer tools are used by the industry and the technical support organizations of the regulators. A large effort is spent in benchmarking each of these codes against experimental results and amongst themselves. Furthermore, integrating new knowledge requires multiple development and qualification actions, sometimes depending on non-European teams.

Focusing all our effort towards a single advanced fully integrated numerical tool that can be widely used in Europe for assessing accident sequences in any NPPs, but also for preparing and analysing the experiments designed and performed to improve the level of understanding, would contribute to optimise the resources and provide an efficient platform for preserving and diffusing the accumulated knowledge.

Level 2 PSA is a powerful tool to assess the plant vulnerability and the risk of radioactive material release into the environment resulting from a severe accident. As for integral codes, each organization is developing its own tool and methodology, in most cases on the basis of existing US technologies. There is clearly a need to harmonize the methodology and to develop advanced Level 2 PSA tools, using modern technologies like dynamic event trees, in order to increase the reliability of these studies and assess related uncertainties.

To be sure that the research conducted on severe accident is efficient and well focused, the PIRT exercise will have to be regularly updated, evaluating the most recent experimental results and taking into account the remaining safety issues, as those highlighted by Level 2 PSA studies as being of high priority for reducing uncertainties. These evaluation activities will be conducted in close relation with the work performed in existing international organizations, as the OCDE/CSNI and the IAEA.

In addition, in order to diffuse the knowledge in the severe accident area, in particular to the Associated Candidate Countries, and to preserve the competence for the future, actions have also to be taken to train researchers and develop a new generation of experts in this field.

2.2. Objectives of SARNET

To satisfy these needs, it is proposed to network most of the European organizations around a joint programme of research activities on severe accident phenomena and management. The ultimate objective is to form a virtual laboratory based on national resources, know-how and expertise, and having a strong coordinating structure. This laboratory will have the mission to carry out the commonly agreed research programmes in an optimised way in order to resolve remaining safety issues and produce highly validated and qualified tools for Level 2 PSA studies for any kind of NPP in Europe. It will also receive the mission of contributing to diffuse the knowledge in this field, in particular to the Associated Candidate Countries, and to train new generations of researchers.

SARNET will be constituted by most of the research capacities and expertise in severe accident from 49 organizations, coming from 11 Member States (Austria, Belgium, Finland, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden, United Kingdom), from 6 Associated Candidate Countries (Bulgaria, Czech Republic, Hungary, Romania, Slovakia, Slovenia), from Lithuania and Switzerland, plus the Joint Research Centre of the European Community.

The backbone of the integration will be provided by the integral computer code ASTEC developed jointly by IRSN (France) and GRS (Germany), and proposed to the Network by these organisations in the continuity of the EVITA action of the 5th FWP (FIKS-CT-1999-00010). IRSN and GRS commit, within their capabilities and financial availabilities, to make their best efforts to provide the necessary maintenance and developments for satisfying the Network users. In particular, actions will be taken to integrate in ASTEC the current knowledge and all the future knowledge generated by the research activities performed within SARNET. Most of the ongoing research activities will have the ultimate objective to provide ASTEC with appropriate physical modelling. In addition, the tool will be adapted, through mostly co-operative actions, so as to be used for any reactor applications in Europe.

Furthermore, ASTEC will be a powerful vector to diffuse knowledge, in particular to the Associated Candidate Countries. E-learning and training sessions will be organized to support broad diffusion of the code.

Integration of the experimental research capacities will be necessarily more progressive. The main obstacle to integration is here the need to raise funding at national and extra-national levels in order to support the cost of the experimental programmes, notably in case of large ones. Nevertheless, most of the ongoing national experimental research programmes have been proposed in SARNET in view of providing the critical mass of competence needed to resolve the remaining issues identified so far by the ongoing PIRT activities conducted in the EURSAFE action. A clear policy in terms of access rights to experimental data produced within the network is proposed to preserve the interests of the different organizations. Progress reports on restricted experimental programmes will be widely disseminated in the frame of SARNET in order to promote extension of existing collaborations within other members of the Network.

This will be one the major objectives of the Network to re-orientate progressively the existing national programmes and contribute to launch new ones in a more coordinated way and in accordance with the research priorities identified by the Network, eliminating duplications and developing complementarities.

In parallel, actions will be taken for training students and researchers in experimental techniques, in risk evaluation and in code development, and for facilitating their mobility into the corresponding teams.

Advanced communication links and user-friendly databases will be developed to facilitate the capitalization and the diffusion of knowledge, and the joint execution of the programme of research activities together with reducing rapidly the number of meetings and amount of travel: e-learning, on-line assistance to code users, access to experimental databases and thermodynamic databases, work flow between co-developers, co-development and management of technical documentation, multi-site videoconference, etc… Actions will be taken to normalize and secure the scientific and technical information produced by the Network.

3 Contractor list

List of Participants

Particip. Role*	Particip. Number	Participant name	Participant short name	Country	Date enter project**	Date exit project**
CO	1	Institut de Radioprotection et de Sûreté Nucléaire	IRSN	France	Month 1	Month 48
CR	2	AEA Technology	AEAT	United Kingdom	Month 1	Month 48
CR	3	KFKI Atomic Energy Research Institute	AEKI	Hungary	Month 1	Month 48
CR	4	ARC Seibersdorf research GmbH	ARCS	Austria	Month 1	Month 48
CR	5	Association Vincotte Nucleaire	AVN	Belgium	Month 1	Month 48
CR	6	Budapest University of Technology and Economics Institute of Nuclear Techniques	BUTE	Hungary	Month 1	Month 48
CR	7	Commissariat à l'Energie Atomique	CEA	France	Month 1	Month 48
CR	8	Centro Elettrotecnico Sperimentale Italanio Giacinto Motta SpA	CESI	Italy	Month 1	Month 48
CR	9	Chalmers tekniska högskola	CHALMERS	Sweden	Month 1	Month 48
CR	10	Centro de Investigaciones Energeticas Medio Ambientales y Tecnologicas	CIEMAT	Spain	Month 1	Month 48
CR	11	The Consejo de Seguridad Nuclear	CSN	Spain	Month 1	Month 48
CR	12	National Centre for Scientific Research "DEMOKRITOS"	DEMOKRITOS	Greece	Month 1	Month 48
CR	13	Universita' di Pisa	UPI	Italy	Month 1	Month 48
CR	14	Empresarios Agrupados International, S.A.	EA	Spain	Month 1	Month 48
CR	15	Electricité de France	EDF	France	Month 1	Month 48
CR	16	Ente per le Nuove Tecnologie, l'Energia e l'Ambiente	ENEA	Italy	Month 1	Month 48
CR	17	Fortum Nuclear Services Ltd.	FORTUM	Finland	Month 1	Month 48

Particip. Role	Particip. Number	Participant name	Participant short name	Country	Date enter project**	Date exit project**
CR	18	Framatome ANP SAS	FRA ANP SAS	France	Month 1	Month 48
CR	19	Framatome ANP-Gmbh	FRA ANP-Gmbh	Germany	Month 1	Month 48
CR	20	Forschungszentrum Juelich GmbH	FZJ	Germany	Month 1	Month 48
CR	21	Forschungszentrum Karlsruhe GmbH	FZK	Germany	Month 1	Month 48
CR	22	Forschungszentrum Rossendorf e.V.	FZR	Germany	Month 1	Month 48
CR	23	Gesellschaft für Anlagen- und Reaktorsicherheit mbH	GRS	Germany	Month 1	Month 48
CR	24	University of Stuttgart	IUSTT-IKE	Germany	Month 1	Month 48
CR	25	National Autonomous Company for Nuclear Activities Nuclear Research Subsidiary Pitesti	INR	Romania	Month 1	Month 48
CR	26	Institute for Nuclear Research and Nuclear Energy	INRNE	Bulgaria	Month 1	Month 48
CR	27	Inzinierska Vypoctova Spolocnost Trnava Ltd	IVS	Slovakia	Month 1	Month 48
CR	28	EURATOM Joint Research Center of ISPRA	JRC ISPRA	EEC	Month 1	Month 48
CR	29	EURATOM Joint Research Center Trans Uranian Institute	JRC ITU	EEC	Month 1	Month 48
CR	30	EURATOM Joint Research Center of Petten	JRC PETTEN	EEC	Month 1	Month 48
CR	31	Josef Stephan Institute	JSI	Slovenia	Month 1	Month 48
CR	32	Kungl Tekniska Högskolan	KTH	Sweden	Month 1	Month 48
CR	33	Lithuanian Energy Institute	LEI	Lithuania	Month 1	Month 48
CR	34	National Nuclear Corporation Ltd	NNC	United Kingdom	Month 1	Month 48
CR	35	Nuclear Research & Consultancy Group v.o.f.	NRG	The Netherlands	Month 1	Month 48
CR	36	Paul Scherrer Institut	PSI	Switzerland	Month 1	Month 48
CR	37	Ruhr-Universität Bochum	RUB	Germany	Month 1	Month 48
	38					
CR	39	Swedpower AB	SWP	Sweden	Month 1	Month 48

Particip. Role	Particip. Number	Participant name	Participant short name	Country	Date enter project**	Date exit project**
CR	40	Technicatome	TA	France	Month 1	Month 48
CR	41	Thermodata	THERMODATA	France	Month 1	Month 48
CR	42	Suez-Tractebel SA	TE	Belgium	Month 1	Month 48
CR	43	Technical University of Sofia	TUS	Bulgaria	Month 1	Month 48
CR	44	Université Libre de Bruxelles	ULB	Belgium	Month 1	Month 48
CR	45	Université Catholique de Louvain	UCL	Belgium	Month 1	Month 48
CR	46	Urad Jadroveho Dozoru SR	UJD	Slovakia	Month 1	Month 48
CR	47	Ustav Jaderneho Vyzkumu Rez a.s.	UJV	Czech Republic	Month 1	Month 48
CR	48	Universidad Politecnica de Madrid	UPM	Spain	Month 1	Month 48
CR	49	VEIKI Institute for Electric Power Research Co.	VEIKI	Hungary	Month 1	Month 48
CR	50	VTT Technical Research Centre of Finland	VTT	Finland	Month 1	Month 48
CR	51	VUJE Trnava, a.s. – Inzinierska, Projektova a Vyskumna Organizacia	VUJE	Slovakia	Month 1	Month 48
CR	52	Becker Technologies GmbH	BTech	Germany	Month 1	Month 48

*CO = Coordinator
CR = Contractor

** Normally insert “month 1 (start of project)” and “month n (end of project)”
These columns are needed for possible later contract revisions caused by joining/leaving participants

WARNING:

- ***Participants 28, 29 and 30 are a unique contractor legal entity: EEC-JRC***
- ***There is no contractor N°38.***

4 Relevance to the objective of the Euratom Programme

By networking most of the European research organisations around a joint programme of research activities, SARNET will provide an appropriate frame for achieving within a couple of years a sustainable integration of the European research capacities on severe accident. Nuclei of co-operations already exist around some national research programmes. It is one of the missions of SARNET to promote and extend progressively the co-operations to other members of SARNET, by disseminating useful information on these programmes to potentially future partners, because they may be mutual interest for the Network and these partners.

Most of the research activities of the Network will be focused on developing and validating the existing French-German code ASTEC, so as to make it the European reference for any safety studies. This integral computer code is already able to calculate most of the full sequences of a LWR severe accident, taking into account engineered safety systems, such as spray and passive autocatalytic hydrogen recombiners, and accident management measures. ASTEC will be adapted, so as it can be used for any kind of water-cooled NPP existing in Europe (PWRs, BWRs, VVERs, CANDU and RBMK). It is already used extensively in France to perform Level 2 PSAs on PWRs.

Another integration activity of SARNET will consist in harmonizing Level 2 PSA methodology, in identifying the most important sources of uncertainty and developing advanced numerical tools to combine deterministic approach (ASTEC calculations) and probabilistic approach (Dynamic Event Tree). Such advanced techniques are already considered in other sectors of industry, as the aerospace industry. This activity will provide a forum for exchanging information between experts on the different approaches used in Europe to assess plant vulnerability, and to identify the most important remaining sources of uncertainty. The ultimate goal will be to provide a reference methodology for Level 2 PSAs in Europe.

On the basis of the comparisons between the results of the Level 2 PSAs performed in the different member organisations and also of the outcomes of the ongoing research activities, the EURSAFE action will be continued through the SARNET structures. Research priorities will be set-up, which will indicate the strategic orientations of the research to be performed.

The SARNET research activities will be targeted in order to resolve the most important remaining uncertainties and safety issues. The programmes will be defined bearing in mind the necessity to optimise the resources and the use of the available means and to constitute sustainable research groups. The programmes proposed by the different organisations, in response to the needs identified first by EURSAFE and then by the Network, will be defined in concert with the experts in the field. They will then be assessed by high-level scientific experts and proposed to the SARNET Governing Board (see § 6) for approval. The experimental results of these programmes will be analysed with the systematic objective of developing physical models to be integrated in ASTEC (with the only exception of the steam explosion domain) and providing an extended database for validating the computer codes.

As the main obstacle to integration of most of the experimental programmes is the need to raise funding at national and extra-national levels, a clear policy in terms of knowledge management, notably regarding access rights to experimental data produced within the network, is proposed to preserve the interests of the different organizations. For instance, data reports on “protected” experimental programmes will only be distributed to members whose are already partners as co-founders, or to members who, through the activity they offer valorise significantly the data (production of analyses, model development and assessment). In addition, it is planned to issue progress reports on these “protected” programmes, so as to provide any member with the opportunity to negotiate with the owners of these programmes the access to the data and then to participate to the research activities around them. In any case, the outcome of these programmes will be models to be implemented in ASTEC or in qualified databases thereby contributing to diffuse the knowledge to the members.

Knowledge management will be a key activity of the Management Team (see §8). It will have the mission to:

- Coordinate the knowledge generation through the Joint Programme of Activities (see § 6),
- Monitor the knowledge integration in ASTEC,
- Make sure that the access rights and use rights as stipulated in the Consortium agreement are correctly implemented,
- Disseminate appropriate information on the knowledge by using electronic communication links and by organizing conferences/workshops,
- Preserve the knowledge in scientific databases with long-term maintenance capacities,
- Identify the missing knowledge (continuation of EURSAFE action).

Furthermore, at the strategic level, generated knowledge and proposed actions to acquire missing knowledge will be assessed by high level scientific experts, whereas the Governing Board will decide with the advice of end-user representatives upon the orientations to be taken regarding missing knowledge.

All the actors in the nuclear community are participating actively to SARNET. As the end-products developed by the Network (ASTEC, Level 2 PSA guides and advanced tool, scientific databases) may be used not only for R&D activities but also for industrial purposes, under conditions that will be defined in the Consortium agreement, most of the European Industry (EDF, TRACTEBEL, FRAMATOME ANP, SWEDPOWER, EA, FORTUM, TECHNICATOME) is contributing to SARNET. In return, the end-products of the Network that will capitalize the large amount of knowledge acquired in this area, will contribute to the improvement of safety of existing and future NPPs. In addition, most if not all Technical Support Organisations to the Regulatory Authorities are also actively participating in SARNET. An Advisory Committee, comprising managers of end-user organisations, including Vendors, Utilities and Regulatory Bodies from Western and Central Europe, will provide the Governing Board with advices on strategic orientations of the research activities of SARNET, with the ultimate goal of a better prevention and mitigation of severe accidents in European NPPs.

Most the organisations involved will contribute to diffuse the excellence by contributing to the education and training programme on severe accident or by welcoming foreign researchers in their research laboratories. The training programme devoted to ASTEC will be reinforced, providing notably capacities to train by using Web technology. Conferences will be regularly organized (every 18 months for instance), for presenting the progress in knowledge made by SARNET and the future plans.

Advanced communication tools will be developed and implemented to make easier any collaborative work within a large number of laboratories and save travel costs. The system will be used to make easier the access to scientific databases and foster information dissemination.

5 Potential Impact

A very large amount of knowledge has already been obtained in the field of Water Reactor Severe accident research, in particular within the 4th and 5th Framework Programmes (corium behaviour, melt coolability, hydrogen risks, source term). However, if no action is taken, this knowledge may be used only partly and furthermore only by a few teams. It may very well disappear if not preserved appropriately for the next generation. The proposed long term SARNET activity of permanently capitalizing knowledge in the integral computer tool ASTEC as well as in scientific databases, will provide the necessary conditions for preserving this knowledge and diffusing it to a large number of current and future end-users throughout Europe. To achieve successfully this objective, it is necessary to gather in a federative structure and in a durable way, the available technical and scientific excellence in severe accident phenomena and management in Europe and have them sharing and working on the same computer tool.

In addition, so far, European end-users are mostly using integral computer codes developed in the United States. This results in a strong dependence on the US in code maintenance and development. Furthermore, Level 2 PSAs are based on US technology, which has been adapted differently from an organization to the other. SARNET, by fostering collaborative work in these two areas of excellence within a large number of European organizations, will create the necessary conditions for harmonizing the approaches and for Europe to become a world leader in severe accident computer code and risk assessment methodology.

A limited number of specific issues remain where research activities are still necessary in order to reduce further uncertainties that are considered of importance and to consolidate severe accident management plans: core quenching, iodine chemistry, ex-vessel melt coolability, timing of base-mat failure are examples of remaining issues underlined by EURSAFE. Whereas up to now, research programmes in Severe Accident were usually decided at national levels, it is now necessary to better coordinate the national efforts to optimise the use of the available expertise and experimental facilities in view of the reductions in the national budgets in this field.

By providing an appropriate forum of exchange of technical and scientific information between experts in various fields and by its strong coordination structure involving high management level representatives, SARNET will contribute to prioritise the research needed, to favour co-programming amongst organizations, optimise the use of the available research capacities and promote the co-operation between the different members. This will be done by taking benefits of and strengthening the existing complementarities between the different laboratories: experimental activities using simulant materials vs. actual materials; experts in corium behaviour vs. containment behaviour and fission product chemistry; physical model developers vs. code developers.

Thus, it can be expected that SARNET will modify the landscape of research on severe accident in Europe in a durable way, even after the end of the Contract with the Commission, as agreed upon by the organisation representatives (see Memorandum Of Understanding which has been appended to the proposal sent in April 2003). Indeed, SARNET will become a reference in terms of research priorities in the field of severe accident having impact on national programmes and fund allocations. Progressively all the research activities in this field will become strongly coordinated by the Network and ASTEC will progressively become a federative tool thereby contributing to integrate, preserve and diffuse knowledge.

In addition to ASTEC, the SARNET research activities will contribute efficiently to keeping competence and expertise in the area of severe accident management for current European water reactors, including those of Russian design, and also for future nuclear reactor designs. To reach this objective SARNET will develop partnerships with ISTC programmes, VVER research programmes and advanced reactor research programmes related to severe accidents.

An education and training programme is set up to diffuse the excellence and knowledge in the severe accident area. It is intended to be an in-depth treatment so that the researchers will be able to a) understand (b) develop the methodology in the topics further and (c) use analysis tools (e.g. ASTEC) more effectively. A mobility programme under which students and researchers will be able to go into different laboratories of SARNET for training will complete this. In addition, a large conference will be organised every 18 months on the progress made in SARNET. The audience should be international and of the same level as the large conferences organised by the USNRC in this domain (CSARP, MCAP). A Web site will advertise the work performed in SARNET and the knowledge acquired, giving access to information open to the public. This communication plan will have to be approved by the Governing Board.

SARNET may also develop partnerships with other Networks of Excellence, as NEPTUNO (Integral Project on Education and Training in Nuclear Science). In the case of NEPTUNO, SARNET will contribute to some of its activities by providing lectures and support material, and provide some internships for students.

6 The SARNET activities

The SARNET activities will consist of:
- the R&D activities carried out by SARNET members in the frame of national or international programmes, contributing to the resolution of remaining issues identified in the EURSAFE project (or in its updates);
- and of a complementary programme jointly carried out, called Joint Programme of Activities (JPA) and aiming at:
    - progressively integrating the above national/international research programmes,
    - initiating and launching new programmes jointly carried out by sustainable research groups,
    - capitalizing the acquired knowledge in the integral code ASTEC and in data bases,
    - diffusing knowledge.

The JPA will constitute the kernel of SARNET. Such activities will give the orientations to be followed, in terms of research and work distribution between SARNET members. They will build the necessary links between national programmes, facilitate the necessary transfers of information (inside and outside the network), and organize the work partition in order to make the most of available competences and means.

The JPA can be broken down in 4 main activities (see table NoE list of Activities, §9.2):
- Integrating Activities (IA) to strengthen links between organisations;
- Joint Research Activities (JRA) to pilot the research activities addressing remaining outstanding issues, to elaborate synthesis, and programme proposals;
- Spreading Excellence Activities (SEA);
- Management Activities (MA).

The ASTEC code will be the main integrating component and will be one of the gathering places of the knowledge. It will contribute to the diffusion of this knowledge efficiently. Activities linked to ASTEC will thus appear as "*Integrating Activities*", whereas some of them contribute also to the range of "*Spreading Excellence Activities*". Concerning *"Joint Research Activities"*, most of them will have links with ASTEC, as it is one of their ultimate goals to provide physical models to be integrated in ASTEC. Furthermore, the exchange of information on the detailed models developed by the various experts through interpretation of experiments will lead at medium and long term to generic common models used in the different detailed codes (example of ICARE/CATHARE and ATHLET-CD). Besides, adequate models will be derived from these detailed models and will be included in the common reference ASTEC code.

The R&D needs will be periodically updated and the objectives of future experiments will be defined taking into account the outcome of the collaborative work on risk studies. A consensus could be reached on closure of some issues and would allow redistributing competence and manpower on open ones in concert with other international projects (e.g. ISTCs, OECD projects…).

Most of the JPA elements are interlinked: for instance, experimental database activity and ASTEC physical assessment; or model recommendation formulated in the JRA and model implementation in ASTEC. This will contribute to tighten the links between the different participants to these activities (horizontal integration).

The R&D activities surrounding the JPA and connected to it are mainly:
- the GRS-IRSN programme aiming at developing the integral code ASTEC and making it open and available for all SARNET partners,
- the diverse national research activities (experimental programmes, related interpretation and modelling activities) that aim at resolving open issues identified as important and of common interest in EURSAFE conclusions (and their updating),

- the development of Level 2 PSA methodologies, the results of which will provide inputs for the definition of research priorities elaborated by SARNET partners.

These key programmes will be called associated programmes in the rest of the document.

The JPA will clearly constitute the active link connecting all these associated programmes and making, in a sustainable way, the whole system more and more efficient.

Beyond programmes carried out by SARNET contractors, some external programmes will be taken into account:

- ISTC,
- OECD projects,
- and more generally, programmes of interest carried out by non-SARNET members or non-European organizations (i.e. specific VVER joint research programmes, …).

It will be a priority task of the Consortium to define the way to associate or integrate these programmes and the involved teams, when there are in a position to complement in a sustainable way the competence and expertise of SARNET in domains of importance.

6.1. Associated programmes

As said previously, the main elements of these associated programmes are:

- ASTEC development by GRS and IRSN,
- Research programmes carried out in organizations which are members of the network, (experimentation, interpretation and modelling),
- Current Level 2 PSA methodology developments.

They are described below in order to give the boundary conditions of the JPA, main component of the present contract.

6.1.1 ASTEC

This code, which is jointly developed by IRSN and GRS, describes the complete behaviour of a NPP under severe accident conditions. It is extensively used by IRSN for Level 2 PSA regarding 900 MWe Pressurized Reactors. It will behave as the main integrator of knowledge in SARNET and contribute to diffuse it to all members.

For the first 18 first months of SARNET (April 2004 to September 2005), two ASTEC V1 releases are foreseen:

- **2004: Release of ASTEC V1.1** to SARNET partners, this version will be characterized by:
  - a new MCCI module called MEDICIS,
  - several improvements in fission product modules (release, transport, containment).

  One year of preliminary assessment and testing is foreseen to consolidate this version and lead to the version V1.2.
- **2005: Release of ASTEC V1.2**, consolidated version, for which a large and detailed campaign of assessment is to be organized.

Then, the future version V2 will be developed, taking into account inputs provided by different tasks and Work-Packages of the JPA. The other main characteristics of the V2 version will be:

- The merging of ASTEC with ICARE (IRSN) for core degradation and with other specialized codes. This merging should allow to make more efficient and less time-consuming the development and the maintenance of the different computer tools;
- The capability to adequately treat other reactors than PWR (VVER in a first priority).

6.1.2 Research programmes

Such activities concern experimental programmes, interpretation work and/or modelling activities. EURSAFE highlighted some remaining important safety issues, which can be broken down into:

- corium issues
- containment issues
- source term issues.

Current and future activities to be carried out by partners with the objective to solve the above-mentioned issues have been selected for SARNET. More precisely, they consist of:

- performing new experimental work (separate-effect or integral tests) and preparing/interpreting it with models or codes;
- interpreting already performed experiments with models or codes;
- performing scenario sensitivity studies in reactor conditions with models or codes in order to target actual conditions in the experiments or to investigate the influence of various models or model options;
- modelling activities.

Resolution of Corium issues

In vessel phenomena

The issues identified in 5th FWP EURSAFE project concerning in-vessel phenomena are:

- Water injection (hydrogen generation, core coolability, ex-vessel corium coolability);
- Late-phase in-vessel degradation and loss of Reactor Pressure Vessel (RPV) integrity (molten pool/debris behaviour in the lower plenum);
- Lower head failure and corium release to cavity;
- Specific remaining issues on early-phase degradation (including B_4C effects from control rods),
- Reactor Cooling System (RCS) integrity including risk of induced breaks in steam generators.

For each one, experimental and interpretation activities have been initiated in the frame of national programmes. These programmes may be classified into five topics:

- T1: Hydrogen generation during core reflooding;
- T2: Core and debris coolability during reflooding, including ex-vessel debris bed coolability;
- T3: Late phase core degradation and corium behaviour in lower head, including in-vessel melt retention strategies;
- T4: Vessel failure and release into cavity;
- T5: Early phase degradation and boron carbide effects.

The concerned experimental programmes underway (or planned) by the SARNET organisations and to be considered as associated to the network are given in the table below:

NAME	Topic	Leading organisation
COLIMA	T3	CEA
DEBRIS	T2	IUSTT-IKE
FOREVER	T4	KTH
LIVE	T3	FZK
MADRAGUE	T1, T5	IRSN
PHEBUS FP	T3, T5	IRSN
QUENCH	T1, T5	FZK
STYX	T2	VTT

The interpretation of experiments is carried out with different models or codes (ICARE/CATHARE, SCDAP/RELAP5, SCDAPSIM, ATHLET-CD, KESS, MELCOR, ASTEC).

Among all needs of R&D identified in EURSAFE, only two in-vessel phenomena are not currently covered by experimental proposals: "Effect of Lower-head penetrations in case of external cooling" (very dependent on NPP design) and "Steam generator plenum and tube failure". They refer to thermal hydraulics studies and will be examined later on. A proposal to tackle these problems shall be elaborated in the frame of the JPA.

Ex-vessel phenomena

Likewise, the issues identified in the 5th FWP EURSAFE and EUROCORE projects concerning ex-vessel phenomena are:

- T6: MCCI: molten pool configuration and concrete ablation;
- T7: Ex-vessel corium coolability, top flooding;
- T8: Ex-vessel corium catcher: corium ceramics interaction and properties;
- T9: Ex-vessel corium catcher: coolability and water bottom injection.

These items have been selected with the following rationales:

- Improve predictability of axial versus radial ablation up to late phase MCCI to determine basemat failure time and loss of containment integrity;
- Increase the knowledge of cooling mechanisms by top flooding the corium pool to demonstrate termination of accident progression and keeping containment integrity;
- Demonstrate the efficiency of specific corium catcher designs by improving the predictability of the corium interaction with corium catcher materials;
- Demonstrate the efficiency of water bottom injection to cool corium pool and its impact on containment pressurisation.

They are addressed in the following experimental programmes to be considered as associated to the network:

NAME	Topic	Leading organisation
ARTEMIS	T6-T8	CEA
COLIMA	T6-T8	CEA
COMECO, POMECO	T7-T9	KTH
COMET	T9	FZK
DECOBI	T9	KTH
VULCANO	T6-T8	CEA

The interpretation of experiments is carried out with different models or codes (WEX, WECHSL, MEDICIS, TOLBIAC, TOLBIAC-ICB, MC3D, CROCO-2D, MELCOR, KESS, MEWA).

Thermodynamic and material property research

The objective is to develop reference thermodynamic and thermo-physical property databases for a consistent analysis of severe accidents.

In the case of thermodynamic properties, a database exists (NUCLEA), which is already used in computer codes and for severe accident analysis in general. The work in SARNET will mainly be a continuation of the effort of the ENTHALPY project (5th FWP) to complement and improve this database.

In the case of thermo-physical properties, no such a database exists at European level for severe accident analysis. Existing databases cover essentially properties under normal conditions. Works have been already identified with the scope of filling this gap.

The work consists in analytical and experimental activities as follows:

- Thermodynamic properties database NUCLEA (continuation and extension of work performed in ENTHALPY)
  - Assessment, validation, merging, editing and maintenance
  - Develop approaches for coupling the data base with SA codes (ASTEC)
  - Identify the experimental needs for completing the data base
  - Select the most appropriate capability(ies) of the Network to provide the missing data.
- Thermo-physical properties database preparatory work
  - Collect information on systems used by partners in order to find the best solution to normalise corium thermo-physical properties used for severe accident analysis (continuation and extension of work performed in 5TH FWP ECOSTAR project)
  - Make syntheses from existing experimental data
  - Select the most appropriate capability(ies) of the Network to measure properties of first importance still lacking data
  - Develop a reference database.
- Experimental work
  - Measurement of density of liquid Zr, Fe, U
  - Phase diagram of U-O-Zr-Fe systems.

Resolution of containment issues

The issues identified in 5th FWP EURSAFE project concerning containment phenomena are:

- Hydrogen combustion/detonation and containment atmosphere mixing;
- Fuel-coolant interaction;
- Direct containment heating.

The knowledge about the formation of combustible gas mixtures in containments, local gas composition and potential combustion modes is the basis for hydrogen risk assessment and the development of mitigation strategies for real plants. The experimental and theoretical ongoing research concentrates on the reduction of still existing uncertainties, especially concerning:

- Local multidimensional effects of combustion;
- Reaction kinetics inside catalytic recombiners (PAR);
- Hydrogen distribution in the different parts of the containment with the risk of high local concentrations, taking account of containment geometry (multi-compartment), mass and energy exchanges coming from phenomena as wall condensation, spray and sump evaporation.

During the first 18th months of SARNET, a significant increase of knowledge in the last domain will be obtained, taking account of results of the associated experimental programmes TOSQAN (IRSN), MISTRA (CEA) and ThAI (BTech) experiments. The interpretation of experiments will mainly be carried out with ASTEC and COCOSYS codes and with CFD codes (TONUS…).

For the estimation of potential consequences in real plants due to fuel-coolant interactions, a deep understanding and an increased knowledge is required about specific processes like premixing, melt fragmentation, particle heat transfer mode for code modelling and code validation. The underway main experimental programmes are: TREPAM (CEA), MICRONIS (CEA), ECO (FZK), DROPS (FZK), MISTEE (FZK) and KROTOS (CEA). The interpretation of experimental programmes will be carried out with the codes MC3D, MATTINA, IKEJET/IKEMIX, IDEMO-2D and FRADEMO.

Regarding direct containment heating, experiments performed with different materials (metal and oxide mixtures) are of importance for real plant applications. The dispersion of melt in the cavity, the reactor compartments and the containment in a scaled geometry of German and French reactors will

be undertaken to determine the pressure increase by Direct Containment Heating. The underway main associated experimental programme is DISCO (FZK). The interpretation of this experimental programme will be carried out with the codes AFDM, MC3D and ASTEC.

Resolution of source term issues

The issues identified in 5th FWP EURSAFE project concerning source term are:

- Effect of air ingress;
- Iodine volatility in the Primary Circuit;
- Containment by-pass in case of Steam Generator Tube rupture;
- Iodine behaviour in containment.

In addition, the evolution of current NPP operations, as the evolution of fuel management towards higher burn-up and the use of MOX fuel, make necessary to assess the possible consequences on severe accidents. Source term is also an important issue for future NPPs, as most European Safety authorities require that severe accidents be considered in the design of future power plants.

In the SARNET frame, the following research activities associated with these issues will be carried out.

Several effects of air ingress will be addressed. The impact of oxidising environment on the fuel and on fission products release will be studied through different experimental works, consisting in separate-effect experiments to examine the behaviour of fuel rods and especially the release of Ruthenium (Ru) species under various oxidizing atmospheres (MADRAGUE, VERCORS, RUSET, VERDON). On the theoretical side, reactor scenario studies are planned for the definition of test conditions, separate-effect experiments; interpretation of experimental programmes will be also conducted. The main objective of this research work is a better evaluation of the consequences on air ingress on the reactor source term, in particular source term associated with Ru under oxidising conditions and for various kinds of fuel.

The impact of high temperature behaviour of fission products, especially the iodine one, in the Reactor Coolant System, will be also investigated in the network. The objective of the work is to improve the predictability of iodine species exiting the RCS to provide the best estimate of the source into the containment. It is well known that such behaviour is difficult to predict due to the importance of non-equilibrium chemistry. Associated Programmes Activities include experimental and theoretical works: separate-effect experiments to examine the species formed in the gas phase above the core in the RCS (VERCORS, CHIP), analysis of fission products and aerosols transport and speciation in the integral test Phébus FPT2, analysis of control rod material release and modelling proposals for ASTEC code.

Aerosol behaviour in the reactor has been also identified as an important unsolved issue. The main objective, as recommended by the EURSAFE experts, is to quantify the source term and especially in the case of steam generator tube ruptures which leads to a reactor containment building by-pass. As for other issues, activities will consist of experimental (ARTIST, PSAEro, HORIZON, RADSOL…) and theoretical work. Experimental work will consist in separate-effect tests on aerosol trapping on the steam generator secondary side and in tests on fission product reaction with the substrate and revaporization with simulants and/or samples from integral experiments. Corresponding interpretation work, as well as modelling proposals for ASTEC code, will be performed.

Containment chemistry impact on the source term is still an unclosed issue. The main objective of associated activities carried out in SARNET frame is to improve the predictability of the various chemical and physical processes which control the iodine behaviour both in the gas phase and water phase inside the containment. Various phenomena affecting the iodine chemistry in these phases (adsorption/RI formation/radiolytic destruction/ effect of steam condensation/effects of paints) will be experimentally investigated in separate-effect tests (EPICUR, SISYPHE…). Related interpretation will be carried out, as well as interpretation of the Iodine behaviour in the containment of Phébus FPT2. An Iodine Data Manual that will provide recommendations for experiments and for iodine codes in the context of their use for reactor safety estimates will be prepared. All this work will lead to modelling proposals for ASTEC code.

6.1.3 Level 2 PSA

Several methodologies are under parallel development in organisations needing such a tool for safety analyse. It will be one of the objectives of the JPA to provide a comparison of these different approaches.

6.2. Joint Programme of Activities (JPA)

Joint Programme Activities can be broken down in 4 series:

- Integrating Activities consisting in:
  - the development of "physical" links between contractors in order to make easier and more fluid the exchange of information,
  - the development of common tools or methodology to enhance the capacity of contractors to enhance their capability to harmonize their research activities (ASTEC, Level 2 PSA);
  - the monitoring of end-users need and the joint elaboration of research priorities;
  - the monitoring of the integration and the elaboration of proposal to integrate further the activities carried out in the frame of SARNET.
- Joint Research Activities consisting in:
  - the elaboration of synthesis, based on the results of the different associated programmes; these synthesis shall lead to scientific consensus on proposal of models to be implemented in ASTEC;
  - the coordination of R&D tasks carried out in the frame of SARNET, with the objective to make the best of available competences and means;
  - the proposal of revision or initiation of programme with the objective to tackle the important pending issues.
- Spreading Excellence Activities mainly consisting of education and training, and mobility.
- Management Activities mainly consisting of the administrative tasks.

Integrating activities (JPA/IA)

The Integrating Activities comprise:

- Implementation of an Advanced Communication Tool for fostering exchange of information;
- Delivery of ASTEC code and support to code users, adaptation of ASTEC to users needs and qualification;
- Harmonization of Level 2 PSA methodology and development of advanced tools;
- Implementation of scientific databases;
- Research priority assessment;
- Monitoring of integration criteria.

Advanced communication Tool

Description

Advanced Communication Tool (ACT) is a key concept to achieve SARNET goals. Indeed, ACT is the unified support for efficient communication between SARNET partners (at least 28 of them, those who are involved in ASTEC and other collaborative work; more later on) to achieve the following needs:

- Access, search, publish documents and access codes (concept of knowledge repository),
- Contact and communicate with partners (interactive and collaborative services),

- Joint co-ordination of actions and programmes (co-operative management of the network),
- List links to satellites community projects (R&D projects, related sites).

Re-use or integration of existing similar experiences within community partners should be studied to design the target tool. Of interest will be available team and project collaboration systems, some of which have been deployed in the 4th and 5th FWP projects (SINTER, MICANET, HTR-TN, JSRI).

Since members are working in a heterogeneous environment, the easiest way to provide a rational, up-to-date and simple means of communication is a web-centred solution.

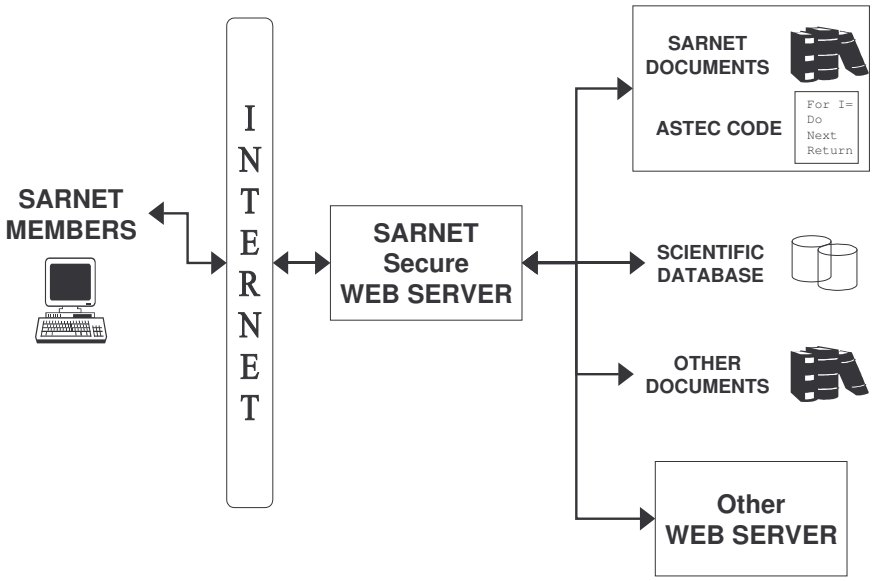
Web portals are designed to provide a central access point to all relevant information of a particular domain and collaboration platform, including:

- A framework for documents (all common document types),
- Cooperative solutions (forums, subscriptions, …),
- Links to community sites (organisation, projects, …).

The web portal should also provide access to existing documentation and code that members are willing to share. This implies that the structure should provide the means to describe data (notion of metadata) in order to ensure the long-term archiving and the homogeneity of the documents served on the portal.

A potential solution for the ACT consists of the following modules fulfilling requirements (non exhaustive nor compulsory list):

- Web portal framework,
- Product Data Management solution to provide knowledge repository for documents produced in SARNET context,
- Easy access to scientific,
- Links to community's tools (portals and databases).



The Web portal framework is the backbone of the community; it provides an integration framework for services, document repository and SARNET codes (mainly ASTEC). This model is in charge of authentication and first discrimination for user access.

The Product Lifecycle Management (PLM) solution consists in a strategic business approach that applies a consistent set of business solutions in support to the collaborative creation, management,

dissemination, and use of product definition information across the extended organisation from concept to end of life, integrating people, processes, and information.

It provides the following functionalities:

- Document management;
- Support tools for collaboration;
- Support for system administration;
- Code management and versioning support.

The scientific code integration module consists in providing for SARNET partners a simple and easy access to ASTEC code. It first implies for code users access to the reference versions (and tools for delivery and installation), as well as communication between users and the maintenance team (user requests, maintenance answers…). Training support (user's guide, samples…) will be also available to ASTEC code neophytes. For partners involved in code development, it will give access to the software management tool.

SARNET Advanced Communication Tool is providing a welcoming access point linked to the existing and future partners portals as well as technical databases. Each partner could ask for integration of links pointing to its own systems and information services whether he considers that it is useful to the community.

Only a small number of partners will be involved in the development/maintenance of this tool; nevertheless most of the SARNET partners will be involved in providing feedback and suggestions for improvement.

Appropriation of the Advanced Communication Tool by the users is a must. Even if tools were well designed and powerful, needless to say that they would fail in their mission if they do not fit to user's habits. This implies the implication of the partners since the very beginning of the project.

The methodology will follow the principle of first establishing the fundamental functionality enabling partners to quickly deploy the web portal, and to continue development of desirable features, depending on the priority given by the partners. The methodology process features:

- Functional and GUI prototype to support user requirements collection,
- User help,
- News to partners all along the project advancement (website and news-letter),
- Satisfaction enquiry at the end of the project.

Powerfulness but also easy use and economy will be the key objectives of this project. Existing technologies will be considered and analysed with respect to these objectives.

The development strategy will be based on 3 phases (see below). Nevertheless, the functional needs will be progressively addressed. The urgent ones (to be developed within the first months of SARNET) will be the development of a WEB portal giving access to:

- general information on SARNET;
- a data-base for SARNET documents (with access rights control);
- the SARNET experimental data base;
- the ASTEC code repository.

General principle of the ACT development:

Phase 1 : Analysis

Functional Analysis

- Analyse the system requirement

- Define the functional needs

Technical Analysis

- Check for possible environment constraints

Analysis of existing tools

- Analyse the existing solutions

Definition of the solution

- Define how the existing tools meet user requirements and can be integrated in the solution
- Presentation of the recommended solution to the SARNET community (key concepts, architecture, features) for decision.

Phase 2 : Development

Prototype development

- Prototype presentations to collect feedback
- Ergonomics
- Lessons learned

Portal module development

- Development of the web portal
- Unit tests

PLM module development

- Development of the document-oriented part of the system
- Unit tests

Integration of links

- Links lists

Phase 3 : Deployment

Deployment on a validation platform

- Installation
- Feedback of partners and technical managers platform

Deployment

- Installation of the ACT on the operational platform
- Satisfaction enquiry enable members to give feedback on ACT

Integral Code ASTEC

28 organizations have expressed their willingness to collaborate on the adaptation and qualification of the Integral Code ASTEC. This code, which is developed by IRSN and GRS, describes the behaviour of a whole NPP under severe accident conditions. It is extensively used by IRSN for Level 2 PSAs regarding 900 MWe Pressurized Reactors. It will serve as the main integrator of knowledge in SARNET and contribute to diffuse it to all members. It is important to note that it will be used in 6 Associated Candidate Countries. The ASTEC project is divided into 3 sub-projects, namely:

- Users support/training, model integration and code adaptation,
- Physical model assessment,
- Reactor application and benchmarking.

IRSN and GRS will endeavour, in the limit of their financial capabilities, to offer the support to the users that such a large diffusion will imply.

Sub-project 1: Users Support and Training, Integration and Adaptation (USTIA)

The objective of these activities is:

- To distribute the code versions, their updates and their documentation to code users, provide a support and training for code users and organize information exchange between code developers and users (Users club).

- To integrate knowledge issued from SARNET into the code, adapt ASTEC to all types of water-cooled NPPs operated in Europe.

An IRSN-GRS team will:

- Analyse the requests of ASTEC users and will propose solutions: code adaptation or users recommendations,
- Make the code updates available for SARNET partners,
- Deliver code versions and documentation.

An ASTEC Web site will be developed and maintained to make easier the exchange of information and documents between the maintenance team and the SARNET users. It will make use of the ACT described previously.

All the organizations participating to the ASTEC JPA will participate to the ASTEC users clubs. Users club meetings will be organized periodically (at least once a year) in order to:

- Exchange information on the code use,
- Examine the code status regarding its development and assessment,
- Examine users requests and discuss their priority,
- Prepare recommendations to be addressed to the Governing Board.

Training sessions will be periodically organized, and an e-learning site (part of ASTEC Web site) will be opened and maintained. All the organizations involved in the ASTEC JPA may participate to this activity (host, teach or learn). For the first training session, IRSN and GRS will provide the teachers. For the next sessions, skilled ASTEC users from other organizations will be encouraged to participate to the teaching activity.

In parallel, specifications of developments requested by ASTEC users on one hand to model the different systems for SAM and on the other hand to model other NPP types than PWRs will be prepared. For the latter, the involved partners (outside of IRSN and GRS) will be:

- For BWR: KTH,
- For VVER: INRNE, TUS, UJV, UJD, ARCS,
- For CANDU INR and for RBMK LEI (in these cases, the specifications of ASTEC extension will only be initiated, their finalization is foreseen in 2006).

The corresponding developments will be carried out, combined with the integration of model proposals elaborated in the frame of Joint Research Activities.

Sub-project 2: ASTEC physical model assessment (PHYMA)

This activity will consist of comparisons between ASTEC and experimental data. In a very few cases, experimental data can be replaced by results provided by detailed reference codes, whose models are largely more detailed and assessed than the ASTEC ones (example: CFD codes compared to CPA /multi-compartment containment part of ASTEC/).

This activity will provide inputs for sub-project 1 above, and for the definition of research priorities in the severe accident domain.

On the medium and long term this activity will use as input the new experimental data produced in the frame of SARNET.

For the short and medium term, the work will be organized as follows:

- 1st year with two tasks in parallel:
    - Participants carry assessment works for ASTEC V1.1. This will update and complete the information derived from assessment works performed earlier by GRS and IRSN and in the EVITA frame (5th FWP). It will provide useful information for further updating of ASTEC V1.

  - Elaboration of a large assessment matrix to be used for the campaign of assessment of the ASTEC V1.2 consolidated version to be released in 2005.

- Next period (2005-06): Assessment work for the version V1.2 following the here above defined assessment matrix. This phase will last 2 years and lead to a complete and detailed assessment of ASTEC V1.2.

For the longer term, the assessment activity will continue following the same scheme:

- Updates and complements taking into account code evolution and new experimental results generated in the frame of SARNET.
- Full revision of the assessment for major code versions (as for V1.2).

This activity will be shared between the different organizations, according to their competences and complementarities (18 organizations will participate to the short-medium term activity).

Five domains will be covered:

- In-vessel phenomena (thermal hydraulic and degradation phenomena): BUTE, CEA, UPI, ENEA, FZK, GRS, IUSTT-IKE, IRSN, IVS, JRC Petten, KTH, LEI, VEIKI
- Ex-vessel corium (MCCI, corium cooling): ARCS, GRS, IRSN, KTH
- Containment behaviour: CIEMAT, UPI, ENEA, GRS, IRSN, JRC Petten, JSI, LEI, VEIKI
- Source term: CEA, CIEMAT, UPI, ENEA, GRS, IRSN, JRC Petten, JSI, TUS, UJV, VEIKI
- Integral tests (Phébus): GRS, INR, IRSN, JRC Petten, JSI, TUS, UJV

Sub-project 3: ASTEC reactor application and benchmarking (RAB)

The objective of this sub-project is to evaluate and improve the capability of ASTEC to simulate reactor transients, including safety systems and main Severe Accident Management (SAM) procedures.

This activity will consist of ASTEC reactor applications and benchmarking with other codes. It will provide inputs for the sub-project 1 above, and for the definition of research priority in the severe accident area.

The reactor transients will concern 5 types of reactors: PWR, BWR, VVER, CANDU and RBMK.

ASTEC will mainly be compared to the integral codes MELCOR and MAAP, but also to some specialized codes such as ICARE/CATHARE, ATHLET-CD, SCDAP/RELAP5, COCOSYS, TONUS…

For the short-medium term, the work will be organized as follows:

- 1st year with three tasks in parallel:
  - Participants carry out assessment works to update and complete for ASTEC V1.1 the benchmarking activity performed in the frame of EVITA and COLOSS projects (5th FWP).
  - Elaboration of a large reactor sequence matrix to be used for the benchmarking activity of the version V1.2, in close connection with the following task.
  - Elaboration of a first set of ASTEC reference input decks for reactor applications (PWR, BWR, VVER, RBMK…). Beyond this task, the set will be periodically updated.
- Next period (2005-06) with reactor calculation and benchmarking activity with the version V1.2. This phase will last 2 years and should lead to an ASTEC evaluation report beginning of 2007.

For the longer term, this activity will continue taking into account code evolution and new reactor concepts or SAM procedures.

This activity will be shared between the different organizations according to their competence (21 organizations will participate to the short-medium term programme).

Most of them will contribute to the evaluation of ASTEC applicability for PWR. The extension of ASTEC applicability for other concepts will be analysed as follows:

- BWR: GRS, IUSTT-IKE, KTH
- VVER 440: INRNE, IVS, UJD, VUJE
- VVER 1000: UPI, INRNE, KTH, TUS, UJV, VEIKI
- CANDU: INR
- RBMK: LEI

Level 2 PSA

Level 2 PSA is a powerful tool to assess plant specific vulnerability regarding NPP severe accidents. It aims at evaluating possible severe accident scenarios in terms of frequency, loss of containment integrity and radioactive release into the environment. It integrates the results of R&D programmes on physical phenomena involved in severe accidents (experimental programmes and development of computer codes), in a risk assessment perspective. In particular, it makes it possible to quantify the contribution of prevention and mitigation measures in terms of risk reduction.

Different approaches are used in Europe, derived from what has been implemented in the US. The objective of this activity is to compare, to improve and to harmonize the methodologies used for developing Level 2 PSA within European countries and to share effort to develop advanced tools, as far as they are required.

On the other hand, the identification of the most critical difficulties encountered in Level 2 PSA in terms of level of knowledge can contribute to a better prioritisation of R&D activities within the SARNET, in continuation with EURSAFE.

Another aspect is the adaptation of methodologies for their application to the reactor types used in the Associated Candidate countries.

Activities could be set up into three sub-projects performed in parallel, each of them involving some active partners and being coordinated by a project leader. Overall, 189 participants, 6 being from Associated Candidate Countries and Lithuania are involved in this activity. The programme proposed for the first 18 months period is mainly dedicated to the exchange of information and the identification of technical points, where complementary work of common interest could be performed in a second stage.

Sub-project 1: Comparison of Level 2 PSA approaches and identification of improvement needs

Objective:

The objective is to compare the approaches encountered by the partners in elaborating, quantifying and reviewing existing or ongoing Level 2 PSAs, in order to identify the points related to methods or knowledge which appear to be the most critical and for which improvements are needed.

Programme:

The different elements of existing Level 2 PSAs amongst partners will be reviewed and compared:

- Level 1 / Level 2 interface,
- Accident progression event tree (structure, events considered),
- Release categories (grouping method),
- Assessment of physical events (general method, quantification of each phenomenon),
- Assessment of systems and human actions,
- Assessment of radiological releases,
- General method for evaluating uncertainties (to be considered in more details in sub-project 2).

These different topics will be discussed, on the basis of papers prepared by the partners, in about 4 meetings. The main purpose is to identify technical subjects, related to methods or knowledge, where some improvements are considered as necessary, in a risk assessment perspective.

The identification of methodological subjects could be used to define new projects within the "Level 2 PSA methodology and advanced tools" domain, in a second stage of the SARNET. In the first stage, two topics have been already identified and are treated by sub-project 2 (assessment of uncertainties) and sub-project 3 (dynamic reliability).

The identification of subjects where knowledge is judged not sufficient to elaborate and quantify Level 2 PSA will be used to better orientate the experimental and theoretical projects performed within the other domains of the SARNET and improve the integral ASTEC code, in a risk assessment perspective. In some way, this will be the living continuation in the framework of the SARNET of the "risk oriented groups" of the previous 5th FWP EURSAFE project.

Sub-project 2: Comparison and improvement of methodologies for assessment of uncertainties

Objective:

The objective of this project is to identify which types of uncertainties have been considered in existing Level 2 PSA amongst the partners, to compare the methods used to assess them and, in a second stage, to improve them and to achieve a certain level of harmonization amongst the partners.

Programme:

The development of Level 2 PSA involves different sources of uncertainties:

- Uncertainties propagated from the Level 1 PSA, related to the frequencies of Level 1 sequences;
- Uncertainties (approximation) due to the binning of Level 1 sequences in Plant Damage States (variables not considered in the interface, values of continuous interface variables);
- Uncertainties (lack of completeness) related to the structure of the Accident Progression Event Tree (events not considered, order and chronology of events);
- Uncertainties (lack of knowledge) related to the probabilities of stochastic events (system failure or recovery, human actions, some physical phenomena such as ignition of hydrogen combustion or triggering of steam explosion);
- Uncertainties (lack of completeness) related to the modelling of physical phenomena;
- Uncertainties (lack of knowledge) related to the values of the parameters of the physical models;
- Uncertainties (approximation) related to the cut-off frequency used in the probabilistic quantification of the Accident Progression Event Tree;
- Uncertainties (approximation) related to the binning of Level 2 sequences in Release Categories (variables non considered, values of continuous variables).

The first step will be to identify which types of uncertainties have been considered in the Level 2 PSA performed so far by the partners and the methods used to assess them.

The second step will be to review in more detail the assessment of uncertainties related to the different physical phenomena involved in severe accidents. According to the level of knowledge and to the level of modelling, different approaches are considered, based on sets of calculations or on expert judgements, and often on a combination of them. When considering physical phenomena where a good level of modelling has been achieved, one can assess the uncertainties related to the model parameters (often by expert judgment) and propagate them by using Monte-Carlo techniques. When the level of modelling is worse or when considering uncertainties related to model uncertainties, one can use directly expert judgment, based on experimental results or a limited number of reactor calculations.

The third step will be to produce some recommendations on the approaches to be followed for the different physical phenomena and to propose some ways of improvement for the methods used for uncertainty assessment in Level 2 PSA.

The different physical phenomena involved in severe accidents and the methods used for assessing corresponding uncertainties will be reviewed, on the basis of papers prepared by the partners, in about 3 meetings. Another meeting will be devoted to the identification of ways of improvement for the methods.

Sub-project 3: Improvement of event tree methodology using dynamic reliability techniques

Objective:
The event tree technique has been developed mainly to represent different scenarios of accidents, influenced by functional events. It has been used first in Level 1 PSA and extended to Level 2 PSA. A specific feature of Level 2 PSA event trees is that physical variables have to be assessed along each branch of the event tree, in order to identify the mode of loss of integrity of the containment and the radioactive release into the environment. Therefore a strong coupling exists between stochastic functional aspects and deterministic (but uncertain) physical aspects of the accidents, which are difficult to take into account within the classical event tree methodology.

The general objective of this sub-project is to study how the techniques of dynamic reliability could be used in order to improve the event tree approach in Level 2 PSA.

Programme:
Dynamic reliability techniques have been developed in order to study the reliability or the availability of continuous processes evolving with time in interaction with functional processes. Examples of such techniques are Petri nets, Discrete Dynamic Event Tree (DDET), Monte-Carlo techniques or combinations of the previous ones.

Some works on (Level 1 or Level 2) PSA have been already performed, in particular by GRS (Germany) and CSN (Spain) in collaboration with the University of Brussels. They are based on DDET and Monte-Carlo techniques.

The work to be performed by the partners within the SARNET, during the first 18 months, will be to identify the current limitations of the classical event tree approach, as they have been encountered in the development of existing or ongoing Level 2 PSA, and to specify a methodology based on dynamic reliability techniques, which could overcome these limitations. The DDET approach, combined with Monte-Carlo one, seems a good candidate as it keeps the notion of scenarios, familiar in all PSA.

When specifying a possible approach, one should consider the assessment of uncertainties in particular those related to physical phenomena. Moreover, the complementary techniques making it possible to reduce the number of calculations, as importance sampling in Monte-Carlo approach, should be considered.

The next stage of the project (beyond the 18 months period) could be to develop a prototype implementing this approach and to apply it on a large-scale example related to Level 2 PSA. The severe accident code to be used in this stage will be ASTEC in order to ensure the consistency with the other domains of SARNET.

The last step could be to develop a computer code to be used by the SARNET partners.

Implementation of scientific databases

The objective is to develop and maintain an instrument that insures preservation, easy access for codes, exchange and processing of severe accident experimental data, including all related documentation.

The data of concern are:

- Existing experimental data that SARNET partners are willing to share with the other partners in the network;
- All new data produced within SARNET.

No European database exists to host severe accident data in a unified platform for long term storage, sharing and use. A first step towards the development of such a platform was undertaken in WP5 of the EURSAFE project (5^{th} FWP).

A plat-form mock-up has been developed in EURSAFE starting from the STRESA structure. Basically, a web connection to a portal hosted by one of the partners (database net administrator) gives access to local servers (nodes) hosted by the other partners. In general, each local server contains the data of the partner who hosts it, but a more centralised storage can be envisaged whenever necessary. A STRESA software is installed on each local server, which is managed by the partner himself who decides and controls access to his data through different authorisation levels as a function of the property rights.

This system is a good candidate to become the SARNET experimental database. The action will be carried out in 3 phases:

Phase 1: Evaluation and decision

Partners already trained to the use of STRESA will assess the plate-form. Recommendation to select or not STRESA will be prepared. In case where the recommendation is positive, specification for complementary development (if necessary) will be prepared. In case where the recommendation is negative an alternative shall be proposed. The governing board will take the decision formally at the latest one-year after the beginning of SARNET. Care will be taken to the protection of data and of the durability of the chosen solution. In particular, the owner of the software has to commit to transfer the know-how to another participant to SARNET, in case he could not continue his activity. This transfer would be negotiated in good faith in a technology transfer and license agreement between the owner and the recipient party.

Phase 2: Deployment

The software will be distributed and implanted on sites of new users. Training sessions will be organised.

Phase 3: Data storing and plat-form maintenance

In the continuation of EURSAFE experimental database work package, some data storage is already foreseen by some partners:

- Data from PLINIUS platform: VULCANO, COLIMA;
- Data from Phébus FP and VERCORS;
- Data from KJET, PREMIX, ECO, QUEOS, DISCO;
- Data from FOREVER, KMFCI, POMECO;
- Data from CODEX-VVER: core degradation bundle tests;
- Data from VICTORIA and HORIZON.

Beyond this, data produced in SARNET will be integrated to the platform as they become available.

In parallel the developer of the plat-form will support the users and up-date the software in the frame of so-called maintenance activity.

This platform will be integrated in a more general SARNET communication tool

To start with, 7 organisations will actively contribute to this activity, including one from Associated Candidate Countries. This number will increase later on as new data will be integrated in the scientific databases.

Research priority assessment

The objective of this action is to provide the Governing Board of SARNET with guidelines for defining the orientations to give to the JPA in terms of joint research activities of common interest and high priority. This action will make use notably of:

- The outcome of the EURSAFE action (results of PIRT on severe accidents);
- The results of the qualification/benchmarking activities on ASTEC;
- The results of reactor calculations carried out in the other activities;
- The outcome of the research performed in the three thematic sub domains of SARNET (corium, containment, source term);

It will make use also of results obtained in the frame of other international projects (ISTC, OECD…), and will be based in particular on the outcome of Level 2 PSA activities carried out in the frame of national programmes (risk-oriented research). It will take into account the potential capabilities of SARNET and identify the potential experimental or theoretical programmes to undertake for resolving the identified important pending issues.

This action will be performed in close collaboration within 12 participants (those mainly involved in EURSAFE), representing TSO, industry and utilities, including organisations of Associated Candidate Countries. This collaboration between those who perform research and those who use its results is essential to correctly address the problem.

The action will result in a ranking and will allow in fact determining which programme should be initiated or pursued and which should be closed or not started. Following proposals made in the frame of OECD-CSNI working groups, the criteria for ranking will reflect considerations such as:

- the priority of the safety research issue it entails,
- the capacity to address a safety issue in a comprehensive manner,
- the potential for substantial improvements in accident mitigation and management procedures,
- the level of risk involved (when risk assessment is feasible and/or appropriate),
- the extend to which it affect plant operation, if it is an operating plant issue,

- the number of plants affected,
- the programme cost duration,
- the likelihood it will bring conclusive results,
- the relevance it has for maintaining strategic competence and infrastructure.

There are conditions under which closing an issue becomes a necessity; nevertheless, defining generic closure criteria is very difficult. The following principle might be used, and a research issue could be proposed for closure:

- when there is convincing information available that the issue addressed does not constitute a challenge to safety plant,
- or when there is a general understanding that knowledge is adequate and further research is not needed;
- or when it is unlikely that further research will provide end users with results that will augment significantly the knowledge that is already available (for instance because the return of knowledge from a programme has substantially diminished with the time);
- or when there have been important changes in situation (e.g. in industry plans or in regulator priorities), which reduce affect overall priorities.

Since closing an issue and the related programmes may lead to teams of experts to be disbanded or facilities closing, it will be important to weight carefully the consequences, and examine which re-orientation might be propose in order to avoid irreversible loss of strategic competence and infrastructures.

This action will lead every two years to a revision of priorities. The results of this action will be distributed to all participants for comment before their release. They will be transmitted to the scientific coordinators coordinating corium, containment and source term activities, for taking into account in the elaboration of their work proposals.

Integration monitoring

This action consists in the evaluation of progress made by the consortium towards its objectives, and in the definition of corrective actions where necessary.
The members of the management team will carry out the action. It will consist in:

- collect of information necessary to measure the evolution of progress indicators as defined in the chapter 7 (quality of integration, indicators)
- analysis of results (explanation of indicator evolution, definition of the progress margins)
- proposal of actions (revision of the JPA, proposal of contractor actions beyond the JPA, …).

6.2.1 Programme for Jointly executed Research Activities (JPA/JRA)

The EURSAFE project highlighted a number of remaining important safety issues, which need to be investigated experimentally. The critical mass of competence (experimental facilities, experts) necessary to address these issues was identified. This competence has been assembled in the SARNET network with part of their current activities, as far as these activities have a link with the issues to be investigated. This assembly constitutes a promising matter of tight cooperation between participants of SARNET.

The Joint Research Activities programme, which will be presented hereafter, is an added element aiming at promoting in sustainable way collaboration within the above assembly, between the main European actors in nuclear safety. The basic elements for such a promotion are:

- reaching a common understanding of issues and phenomena, of their importance in terms of safety and knowledge,
- determining a consensual approach to resolve the remaining uncertainties.

Thus, the JRAs consist of:

- The joint elaboration of syntheses on the interpretation of experimental results and joint elaboration of recommendations for model implementation in ASTEC;
- The joint elaboration of programme proposals; these proposals will address underway programmes (recommendations, re-orientation, …) but also new ones; these proposals will take into account as an input conclusions released by the so-called "research priority assessment" (see §6.2.1.5);
- The joint elaboration of work plans aiming at making the best of available competences and means, and their monitoring.

The JRA is clearly linked to the associated activities described in §6.1.2. Indeed, their results, aiming at solving Corium, Containment and Source Term issues, are the basic inputs of the JPA.

The experts of the network will have to jointly analyse and discuss on experimental programmes performed within national programmes activities. They will have to jointly formulate recommendations on test matrix, on test procedures or on instrumentation (practically partners involved in these experimental programmes will provide these experts with information on facility description, facility capabilities and limitations…). After a first period of work and according to the remaining issues, if new data are required, the experts will have to formulate recommendations on test definition.

Experts will also have joint interpretation activities, which consist of analysing the different interpretation works performed within the associated programmes. From the discussions and analysis and comparison work, only possible in such a network frame, a better understanding of physical phenomena is expected. This activity constitutes a feedback for the orientations of the experimental programmes, and is a really integrating activity for sharing in the European Community the knowledge obtained through interpretation of experimental results.

A similar activity will be undertaken for joint modelling, that is to say that experts in the frame of JPAs will have to analyse, discuss and compare their approach. Such activity has the objective to converge on recommendation on the development of a model. The final outcome is to make recommendation for models implementation in ASTEC.

All the associated experimental programmes will be part of the so-called Pre-Existing Know-How (PEKH). The corresponding access rights will be granted following principles defined in the Consortium Agreement:

- the access rights to pre-existing know-how (when not declared as non available) will be granted on a royalty-free basis for carrying work under the JPA;
- the access rights to "protected" data will have to be negotiated.

Thus, when elaborating the JPA, the access rights limitations have to be identified as soon as possible in order to make possible in a deadline consistent with the timetable the completion of the negotiation.

The results of interpretation of non-European experimental programmes, performed in the frame of for instance OECD or ISTC projects, will be used as inputs of the JRA.

In the particular case of ISTCs (those lying in the domain of interest of SARNET), specific actions will be defined and carried out inside the JPA, and aiming at:

- orientate the corresponding research programmes,
- monitor the progress,
- and carry on the interpretation of experimental results.

These actions will lead to, at least from a technical point of view, to a partial integration of ISTCs in SARNET.

On practical way, the experimental results used in the frame of the project shall be collected and documented in the SARNET experimental database to be shared easily (with all the guarantee concerning the access rights). Thus, as far as possible the data implementation in the experimental data based shall be planned consistently with needs of the JRA.

Expert meetings will be organised twice a year to present synthesis of the work performed and to discuss the orientations of the next 6 months period. Exchanges with other projects and feed-back on project orientations will be possible through the participation of other coordinators to these expert meetings or at least through mutual information on progress reports.

Resolution of corium issues

Eighteen organizations will deal with this domain; three work packages have been defined:

- WP9 Early phase core degradation (EARLY)
- WP10 Late-phase Core Degradation and Vessel behaviour (LATVES)
- WP11 Ex-vessel Core Recovery (EXCORE) dealing with MCCI and Debris Coolability.

WP9 will address the risk of early containment failure, due to rapid generation of hydrogen, which may not be accommodated by re-combiners. It will deal with hydrogen generation during core reflooding conditions (esp. oxidation of metal-rich mixtures), B_4C and fuel burn-up impact on core degradation, and more generally the remaining questions in the core degradation early-phase (in particular, oxidation of clad with advanced alloys and hydrogen generation during melt relocation into water present in the vessel lower plenum). Experts will review experiments such as QUENCH, CORA, MADRAGUE, and will jointly propose recommendations on tests. Interpretations based on main codes calculations (ICARE/CATHARE, ATHLET-CD....), performed by SARNET partners, will be analysed and compared, with the objective to produce a synthesis on joint interpretation of experiments. Proposals of models from partners will also be studied and debated, leading to a synthesis on modelling.

WP10 will be devoted to late-phase degradation and corium behaviour in lower head, with the objective to improve predictability of the thermal loadings on RPV lower head. A review of main experiments (SIMECO, COLIMA....) will be performed, and joint recommendations on these experiments (test specifications,..) will be drawn. As for WP9, experts will also have to study the different interpretations produced by partners on these experimental results, and associated modelling proposals. Syntheses are planned to be issued.

Activities of WP11 should improve the predictability of axial versus radial ablation up to late phase MCCI, in order to determine basemat failure time and loss of containment integrity. Ex-vessel case with water injection will be also part of the activities of this WP: an increase knowledge of cooling mechanisms is expected, in view of being able to demonstrate termination of accident progression. In particular, ex-vessel particulate debris coolability will be investigated. Main experiments on debris coolability (DEBRIS, SILFIDE.…) and on MCCI (MACE, VULCANO...) will be reviewed and recommendations will be expressed. Experts will analyse the interpretation works, and jointly produce

a synthesis. A common proposal of models of corium concrete or ceramic interaction and corium debris or melt coolability will be formulated for implementation into ASTEC.

In order to keep a consistent approach in the modelling of corium behaviour for all the different phases of severe accident scenario, the feed back from scenario sensitivity studies in reactor conditions will define the priority and level of details required to developed new models for remaining issues.

Among the different contributions, the experts on thermodynamic or thermo-physical properties are not merged into a specific work-package. They have to play a role in every WP and in every task. Through their participation in these joint activities, they will access to a large experimental database and contribute actively to definition, interpretation or modelling tasks. A part of WP outcomes will contribute to the assessment and development of data bases (NUCLEA[1] for Thermodynamic properties and CORPRO for Thermo-physic properties), which contribute to the development of the Material Data Bank of the ASTEC code. Moreover, if some data significant for a given phenomenon are missing specific orientation of existing experimental programs or specific programs may be defined in the frame of the related WP.

In the frame of this project, two trans-national access platforms may be included: the PLINIUS and LACOMERA platforms. Today they are outside SARNET network. In the future we can imagine a joint steering of experiments performed on such a platform taking into account also the needs expressed for SARNET training activities. This will need to define in the frame of the elaboration of a "post contract Consortium Agreement" the mechanisms, which could make possible a common funding.

Some non-European R&D programmes, performed in the frame of OECD and ISTC projects, will provide inputs for the SARNET work on corium issues: MASCA (corium molten pool behaviour), ISTC-1648 (core quenching), ISTC-METCOR and ISTC-CORPHAD on corium interactions and properties, and OECD-MCCI on molten corium-concrete interactions.

Resolution of containment issues

The research efforts will concentrate on 2 WPs, involving in overall 19 organizations:

- WP12: Investigation of Hydrogen Behaviour in Containment (HBC),
- WP13: Investigation of Fast Interactions in Containment (FIC).

Within WP12, partners will study the containment atmosphere mixing phenomenon, and hydrogen combustion and associated risk mitigation. Experimental activities carried out in national programmes will be discussed by experts, and recommendations for the tests specifications of TOSQAN, MISTRA or ThAI will be formulated. Interpretations based on TONUS, COCOSYS or ASTEC and other codes, performed by partners, will be checked and compared. Associated modelling proposals as well. From this work, experts will produce syntheses, showing the progress on common understanding of these issues.

WP13 is dedicated to activities concerning the fuel coolant interactions and Direct Containment Heating phenomena. Numerous experiments such as TREPAM, MICRONIS for FCI issue, and DISCO for instance for DCH, will be reviewed by experts with the objective to make common proposals to better address these issues. Interpretation of these experiments, with existing models and codes such MC3D or MATTINA, and performed by partners, will be analysed by experts with the objective to reach a consensus on these interpretations. Experts will give a joint synthesis outlining this consensus. A same process concerning modelling activities will be applied, leading to a joint synthesis as well. A close link with OECD-SERENA programme will be established.

Resolution of Source Term issues

Twenty-one organisations will cooperate in performing research in the Source Term domain. Research activities in this area are organized in 3 WPs:

[1]NUCLEA thermodynamic properties data base is a commercial pre existing know how excluded from SARNET project. It is necessary to buy the data base to use it.

- WP14: Investigation of FP Release and Transport phenomena (FPRT);
- WP15: Aerosol Behaviour impact on Source Term (AEROB);
- WP16: Containment Chemistry Impact on Source Term (CONTCHEM).

WP14 activities will improve the knowledge related to FP release and transport. Within the first years, activities will both address the impact of air ingress in a reactor core on source term and the iodine speciation along its transport in the primary circuit. Experiments such as MADRAGUE, RUSET for air ingress effects, and CHIP for iodine speciation will be reviewed by experts and common proposals and comments will be addressed to either re-orient some tests or propose new ones. Interpretation work carried out by partners on these experimental materials will be analysed, with the objective to deliver a joint synthesis. Experts will apply a same approach for the modelling proposals. Concerning the air ingress issue, reactor applications simulated by partners with different integral codes such ASTEC or MAAP will be also compared and analysed to determine the impact of remaining uncertainties.

WP15 should reduce uncertainties on quantification of source term for aerosols retention in secondary side of Steam Generator and leakages through cracks in containment walls. ARTIST, PSAero, RADSOL experiments will be analysed by experts, as well as related interpretation work and modelling proposals. Joint synthesis on interpretation and modelling should be issued from the experts' work.

Iodine source term is the main issue considered in WP16. Specific experiments such as EPICUR or CAIMAN will be studied; and common recommendations on test specifications or programmes re-orientation will be given by experts. Experts will also concentrate on analysis of the set of interpretation works and associated modelling proposals on iodine behaviour under severe accident conditions in the reactor containment. Synthesis will be produced relatively to experimental results interpretations and adequate modelling, representative of a common understanding of the phenomena.

6.2.2 Activities designed to spread excellence

Education and Training are undeniable vectors to spread Excellence. A dedicated WP (ET) has been created in the SARNET NoE, whose objectives are to:

- Enhance and maintain competence in Severe Accident Research (SAR), contributing to Severe Accident Management (SAM) through education and training of students and young researchers in Europe;
- Impart additional skills to the researchers and analysts in the severe accident risk assessment;
- Foster integration of national programmes through sharing of researchers and work programmes.

The approach followed to achieve the above objectives during a relatively early part of the SARNET NoE will be to:

- Develop educational forums e.g. yearly courses, text (source) books, etc.;
- Develop training forums e.g. laboratory and reactor plant facilities, plant analyser, etc.;
- Promote personnel mobility between the various European institutions;
- Develop user groups for important computer codes e.g. ASTEC;
- Integrate with other education and training work programmes in other networks;
- Develop links with the NEPTUNO Integral Project in 6th FWP.

The three elements of the Education and Training JPA are:

- Education;
- Training;

- Mobility.

The education element involves Ph. D. students and researchers.

The various activities in the education element will be to:

- Provide a comprehensive course on Severe Accident Phenomenology;
- Develop a text book or source book on Severe Accident Phenomenology;
- Develop and provide a course on Level – 2 PSA, with description of codes (mainly ASTEC), for consequence analysis;
- Encourage the NEPTUNO Integral Project to set up a course on Nuclear Power Safety, including an introduction to the Severe Accidents and to Level – 2 PSA.

The training element involves both students and researchers but primarily the latter. The main activities will be to provide training in:

- Experimental methods and techniques e.g. on the PLINIUS and LACOMERA platforms;
- The operation, checking and debugging of computer codes;
- The workings of a plant analyser having severe accident algorithms.

The mobility element involves both Ph.D. students and researchers. This element is of great importance towards the integration of the European National Programmes in Severe Accidents and in the Probabilistic Safety (Risk) Analysis. In this context, coordination of the mobility programme of SARNET with that developed in the NEPTUNO Integral Project would be very desirable. Clearly, the mobility programme of SARNET will require adequate funding for exploiting the long-term integration possibilities offered by the personnel mobility. The joint activities pursued in this programme element will be to:

- Provide summer internships for students;
- Develop a programme of deputing researchers at the facilities of different partners for periods up to one year;
- Develop teams of researchers drawn from different partner countries that have special talents for different generic research activities followed in the SARNET JPA. Thus, one team of researchers may work on small or medium scale simulant material experiments; another on large-scale simulant experiments; another on prototypic material experiments and another on code development. The teams are formed by assignments of national researchers to the teams, which may last 2 – 3 years, in order to achieve some significant results. In this approach some national laboratories or institutes may specialize in different research areas, depending upon the facilities or the infrastructure that they may have developed over the years. We believe that with this approach the integration of the European National Programmes will be achieved very readily and effectively;
- Develop a training programme for plant operators and interested researchers in the severe accident management procedures. The main idea here is to identify the underlying basis for these procedures for the plant operators so that greater understanding is gained.

The partners who have agreed to work together in making a success of the integration process that will be brought about in the Education and Training sub domain of the SARNET JPA are universities, technical service organizations (TSOs) national laboratories and industrial organizations. They bring enormous talent and experience to the joint programme. They also have the young as well as the more experienced personnel to make education and training a jointly beneficial activity. There are professors from universities who are internationally recognized and who love to teach and there are researchers from national laboratories whose research achievements are well documented. There are participants from the Associated Candidate Countries who will not only bring the knowledge base needed to deal with the Soviet-designed reactors, but also bring the rigor of education that is practiced in Eastern Europe. The Associated Candidate Countries also have relatively larger number of young persons enrolled in nuclear engineering profession as students and researchers. They would increase

the pool of the future competent persons needed for the welfare of the nuclear industry in Greater Europe, which is due to be born in 2004. We believe that we have assembled a great team of participants for the Education and Training JPA.

6.2.3 Management activities

These activities will mainly consist in:

- General coordination of the JPA;
- Financial coordination;
- Reporting;
- Diffusing information.

The technical coordination (knowledge generation, knowledge preservation and identification of needs in knowledge) will more precisely consist in:

- Monitoring progresses;
- Checking release of deliverables in due time;
- Surveying milestones;
- Organizing technical reviews when necessary;
- Anticipating difficulties in carrying out the JPA and taking appropriate actions to overcome them;
- Making a synthesis of all recommendations coming from current projects for updating yearly the JPA;
- Managing the information system and making sure that access rights are fully respected;
- Implementing the decisions of the Governing Board.

The financial coordination will consist in:

- Elaborating estimated budget for coming year;
- Monitoring expenses, in particular those partly or totally covered by the Community funds;
- Allocating Community funds in accordance with the Contract conditions, the Consortium agreement provisions and the decisions of the Governing Board;
- Establishing yearly cost statements for all the expenses of the JPA and funds allocated.

The Management Team will regularly report to the Commission and the Governing Board on the technical progress made in the JPA and on the financial status. It will organize the meetings (preparation, minutes) of the Governing Board, of the Advisory Committee and of the Ad-hoc Scientific Review Committee.
A large part of the management activities will also be devoted to the dissemination of information and Knowledge inside and outside of the Network:

- Information on the progress made in the JPA;
- Information on main outcomes of the JPA;
- Information exchange between participants on their activities and specificities;
- Promotion of joint publications in open literature;
- Organization of annual conferences and topical seminars.

Beyond these tasks a large effort will be initiated two years after the beginning of SARNET to revise the Consortium Agreement in order to define the conditions, which will make possible the prolongation of the network after completion of the contract with the Commission.

6.3. Plans

6.3.1 Plan for using and disseminating knowledge

As the main obstacle to integration of most of the experimental programmes is the need to raise funding at national and extra-national levels, a clear policy in terms of knowledge management, notably regarding access rights to experimental data produced within the network, is proposed to preserve the interests of the different organizations. For instance, data reports on "protected" experimental programmes will only be distributed to those members who need them to perform their part of the Joint Programme of Activities. Generally speaking, these members are already partners as co-funders in these programmes. In addition, it is planned to issue progress reports on these "protected" programmes, so as to provide any member with the opportunity to negotiate with the owners of these programmes the access to the data to participate to the joint research activities around them, or to use the knowledge in application out of SARNET; more, the Consortium members committed to grant the access rights for use outside of SARNET on fair and non-discriminatory conditions. In any case, the outcome of these programmes will be models to be implemented in ASTEC or in qualified databases thereby contributing to diffuse the knowledge to the members.

The dissemination will result from the activities of excellence spreading and efforts made by the organization producing basic knowledge to open data to other organisation especially organisation coming from NAS.

The dissemination of knowledge will result also from 2 other activities:

- the distribution of ASTEC by GRS and IRSN to end users under conditions defined in a specific software agreement;
- the publications and participations to conference.

Knowledge management will be a key activity of the Management Team. It will have the mission to:

- Coordinate the knowledge generation through joint projects of research activities,
- Monitor the knowledge integration in ASTEC,
- Make sure that the access rights and use rights as stipulated in the Consortium agreement are correctly implemented,
- Disseminate appropriate information on the knowledge by using electronic communication links and by organizing conferences/workshops,
- Preserve the knowledge in scientific databases with long-term maintenance capacities,
- Identify the missing knowledge (continuation of EURSAFE action).

Furthermore, at the strategic level, generated knowledge and proposed actions to acquire missing knowledge will be assessed by the Ad-hoc Scientific Review Committee, whereas the Governing Board will decide with the advice of end-user representatives upon the orientations to be taken regarding missing knowledge.

6.3.2 Gender Action plan

There are fewer women scientists than men in SARNET (~15%). Participation of women could be encouraged, in particular by promoting the selection of female scientists as topical coordinators.

In addition, we will encourage the presentation of the work performed by scientist women in the SARNET conferences.

In both cases, the Consortium could accept to reimburse possible expenses for babysitting linked to the participation of a woman who should attend SARNET coordination meetings or SARNET conferences.

6.3.3 Raising public participation and awareness

Actors outside the research community will be contacted with the aim of organizing dissemination to more-general, non-specialist audiences of information on the nature of SARNET activities and their benefits to society and the general public. It is expected that synergies with educational institutions will be especially effective in this respect. It is noted, in particular, that:

- each partner organization is already individually committed to the objective of communicating information, as far as reasonably possible, to a wide public;
- the SARNET network will not only encourage such dissemination efforts but intends, when judged constructive to do so, to coordinate them;
- the SARNET network will also engage in raising the general perception of its results by participating in events open to the public (e.g. the "Journées de la Science" in France) and exploring means of communication through popular-science reviews (magazines, radio programmes, etc.).

6.4. Milestones

6.4.1 Major Milestones over full project duration

The Major Milestones of the project concern:

- the deployment of linking elements such as ASTEC and the ACT;
- the elaboration of a common research programme addressing important (for nuclear safety) pending issues commonly identified and validated by end users;
- the elaboration of a complete documentation for teaching and training in the domain of sever accidents;
- the revision of the Consortium Agreement in order to make possible the continuation of SARNET after the end of the contract with the Commission.

T_0 + 1 year

MM1: Full deployment of ASTEC. The code has been successfully implemented in all the organizations needing the code to carry on their tasks. Users have been trained (at least one trained user per organization). The corresponding efforts will be provided by the so-called integrating activities (WP2).

MM2: The platform to be used to store experimental data has been defined. The data base feeding has been initiated. The corresponding efforts will be provided by the so-called integrating activities (WP6).

T_0 + 2 years

MM3: Full deployment of an ACT. The ACT is working and may be used by the contractors to access to SARNET documentation. The so-called Integrating Activities (WP1) will provide the corresponding efforts.

MM4: Revision 1 of EURSAFE. The research priorities of SARNET have been revised; the associated document describes the topics for which research and development are still required. The so-called Integrating Activities (WP7) will provide the corresponding efforts.

MM5: First edition of an integrated R&D SA programme. This document describes the strategy proposed by SARNET to tackle the pending issues important for reactor safety. A programme is proposed describing the research elements, but also the work distribution making the best of available competence and means. The definition of this common programme will constitute an important step toward the integration of the different national R&D strategies in the domain of severe accidents. The so-called Joint Research Activities (WP9-15) will provide the corresponding efforts.

T_0 + 3 years

MM6: Delivery of a fully assessed version of ASTEC, including developments requested by SARNET users for VVER type reactors. The so-called Integrating Activities (WP2-4) will provide the corresponding efforts.

MM7: Release of a SA book. The so-called Spreading of Excellence (WP18) will provide the corresponding efforts.

MM8: Completion of SA course. The so-called Spreading of Excellence (WP17) will provide the corresponding efforts.

MM9: First draft of the "post contract Consortium Agreement". This point is particularly important since the so-called "post contract Consortium Agreement" will define the conditions in terms of organization and of funding making possible the continuation of SARNET beyond the Commission contract. An ad-hoc working group steered by the Governing Board will carry out this activity.

T_0 + 4 years

MM10: Revision 2 of EURSAFE conclusions

MM11: Update of the integrated R&D SA programme

MM12: Signature of the new CA

7 Quality of integration and performance indicators

By its multidisciplinary structure, SARNET JPA is providing a frame for developing growing associations of complementary expertise towards covering adequately the whole range of the Physics involved in the severe accident area. Thus it is expected that, rather than trying to cover the whole range of phenomena, most organisations will progressively rely on the most competent ones for developing tools or performing tests. Thus, SARNET should lead at mid-term to a global saving at the European level in this area of research.

It is believed that ASTEC, with the strong support of the IRSN-GRS developer team, has all the qualities required to become one of the best codes in the world in reactor severe accident analysis. This is an excellent vector for integrating the research efforts of all participants, diffusing the accumulated knowledge and sharing the experience of each user.

The participants have signed a Memorandum of Understanding, making a commitment towards a deep and durable integration, beyond the period of the Community Contract. This Memorandum of Understanding is appended to this proposal.

To assess the success of the integration, it is proposed to measure the evolution of several indicators.

For monitoring the success of the electronic communication system:

- The number of SARNET member accesses to the SARNET Web site per month (I1);
- The number of collaborative documents elaborated and/or stored using ACT per year (I2);

For monitoring the success in using ASTEC and PSA methodology:

- The number of ASTEC users in SARNET (I3);
- The number of organisations using ASTEC for its own applications (reactor studies or test analyses) (I4);
- The number of industrial applications per year using ASTEC (I5);
- The number of Level 2 PSAs using methodology/recommendations developed by SARNET (I6).

For monitoring the success of developing collaboration in research activities:

- The number of access rights granted by contractors for applications in the frame of SARNET, or new partnerships with ISTC, VVER research programmes and advanced reactor research programmes related to Severe Accidents (I7);
- The fraction (in part of budgets) of research projects carried out in Europe that have been set-up under the aegis of SARNET per year (I8);
- The maximum number of associated organisations in a joint project (I9);
- The number of issues closed (I10);

For monitoring the scientific quality in collaborative research:

- The number of joint publications per year (I11);

For monitoring the success of the Education and Training activities and of the mobility plan:

- The number of attendees to SARNET courses or training sessions (I12);
- The number of researcher detachments (I13).

For monitoring the success of the dissemination of public knowledge:

- The number of presentation of SARNET activities in conferences (I14);
- The number of hours devoted to updating the SARNET web site for diffusing information outside SARNET (I15);
- The number of accesses to the Website from outside the Network (I16).

8 Project organisation, management and governance structure

The SARNET Network shall be organised on the basis of a two levels structure. On the first level, a Governing Board involving all members will be in charge of strategic decisions and will be advised by an Advisory Committee and an Ad-hoc Scientific Committee. On the second level, a Management Team will be entrusted with the task of the day-to-day management of the Network.

A Coordinator, heading the Management team, will be in charge of the relations with the Commission and the overall coordination of the Network.

The addition of participants during the period of Community funding will have to be accepted by the Governing board.

8.1. The Governing Board

SARNET will be steered by a Governing Board. It will review the progress made by the Network, in particular in terms of progressive integration, and make recommendations on future orientations. The Governing Board is composed of:

- 1 member designated by each Contractor;
- 1 representative of the Commission as observer.

Members shall be of high management level and may commit the resources of their organisation for performing those research activities decided by the Governing Board.

The Chairperson may invite any expert or qualified person to attend meetings of the Governing Board with a role of advisor. The chairperson of the Advisory Committee, the chairperson of the Ad'hoc Scientific Review Committee, the Coordinator and the Scientific Coordinators shall attend the Governing Board meetings in an advisory capacity.

The Governing Board is the Consortium's decision-making and arbitration body and shall notably:

- Define the strategic orientations of SARNET, in particular in promoting jointly executed research activities and programmes for diffusing excellence;
- Set up objectives for knowledge management and organize knowledge assessment
- Approve, each year, the JPA for the coming 18 months proposed by the Coordinator and monitor its implementation;
- Decide on the allocation of the financial contribution of the Commission;
- Be informed by the Contractors or the Management Team of any difficulty that a Contractor may have to face in implementing the JPA and examine the actions to be taken to overcome them;
- Decide on any inclusion, exclusion or withdrawal of Contractors.

A representative of a Contractor will chair the Governing Board. The Governing Board will elect the Chairperson for a term defined in the Consortium Agreement. A Deputy coming from another Contractor located in a different State will assist the Chairperson. The Governing Board will also elect the Deputy for the same term.

As far as possible, the Chairperson and the Coordinator should be from entities of different nature (Industry, Utilities, Regulatory authorities, Research organisations).

The Governing Board will endeavour to reach its decisions on a consensual basis. However, in case a consensus could not be reached, the decisions will be taken by vote. Details concerning the voting rights and the voting process are defined in the Consortium Agreement. They are defined such that the Contractors from a single State cannot have cumulated voting rights reaching the qualified majority.

Four principles are developed in the Consortium Agreement in order to make the decision-making process efficient, even if the number of contractors is large:

- The day to day decisions are taken by the Coordinator, in the frame of limits defined by the Governing Board;
- The Chairperson of the Governing Board may organize a consultation of the Governing Board as often as necessary, and decides, according to the circumstances, of the procedure: during a meeting, via teleconference, with or without a formal vote, by electronic vote, by expressing a vote in writing.
- More, in case of unexpected event occurring during the execution of a JPA and requiring an urgent decision beyond the mandate of the Coordinator (so-called emergency situations), the consultation and quorum rules are such that the Chairperson can take a decision within 3 weeks.
- Finally, the Consortium Agreement defines in the detail the possibility for a contractor to grant a power of attorney to an other contractor, such a possibility will significantly reduce the number of contractors to be consulted and/or to attempt Governing Board Meetings.

8.2. The Advisory Committee

The role of the Advisory Committee will be to provide the Governing Board with advice on strategic orientations of the research activities of SARNET. It will involve in particular managers of end-user organisations, including Vendors, Utilities and Regulatory Bodies from Europe and Associated Candidate Countries. The Governing Board will appoint the participants.

They will elect a Chairman for a period to be defined in the Consortium Agreement.

8.3. The Ad-hoc Scientific Review Committee

The role of the Ad-hoc Scientific Review Committee will be to review, on behalf of and at the request of the Governing Board the scientific and technical activities performed by SARNET and the knowledge acquired. It will as well review the future orientations proposed for the JPA. Participants will be scientific experts appointed by the Governing Board and the Chairman of the Advisory Committee.

8.4. The Management Team

The Management Team shall be in charge, on behalf of the Governing Board, of the day-to-day management of SARNET. It is composed of the Coordinator heading the team, of 7 Scientific Coordinators who will coordinate, in concert with Coordinator, the scientific activities in 7 sub-domains of the JPA (corium, containment, source term, ASTEC, Level 2 PSA, Research priorities, Education and training), of a Database Manager, and of an Information System Manager. Administrative experts will assist the Coordinator.

The Management Team shall notably:

- Monitor the progress made in the JPA,
- Promote collaborative work,
- Examine any difficulty, which may arise and examine with the corresponding project leaders the possible actions to overcome them,
- Examine the new projects, promote collaborations and make proposals to the Governing Board for updating the JPA,
- Manage the communication system of the Network
- Manage the databases of the Network,
- Manage knowledge and make sure that the access rights stipulated in the Consortium agreement are fully respected,

- Organise the training and education activities,
- Disseminate information inside and outside the network, in particular by organizing conferences and topical seminars, and by setting a Web site.

The Coordinator acts under the control of the Governing Board, and reports to it on his duety, by:

- Providing technical and financial reports to the Governing Board,
- Coordinating the annual JPA updates for approval by the Governing Board,
- Implementing the decisions of the Governing Board, notably the JPA.

The Coordinator shall be responsible for the relations with the Commission. In particular, he will be in charge of:

- Transmission of all information related to SARNET to the Commission,
- Reception of all payments made by the Commission,
- Administration of the Community contribution: allocation of the Community funds between Contractors and activities in accordance with the Contract and decisions taken by the Governing Board. The Coordinator shall ensure that the appropriate payments are made to Contractors without unjustified delays.
- Keeping accounts making it possible to determine at any time what portion of the Community funds has been allocated to each Contractor for the purpose of the Network so as to inform the Commission of the distribution of funds and the date of transfers to the Contractors on an annual basis.

IRSN will act as the SARNET Coordinator for the duration of the Contract with the Commission. Beyond this period, the Coordinator will be designated among the participants by the Governing Board and rotate over a period to be determined in the Consortium Agreement.

In each scientific sub-domain, a Scientific Coordinator will coordinate the work in his sub-domain with the Work Packages Leaders (if any). Scientific Coordinators will be designated among members of SARNET according to provisions to be defined in the Consortium Agreement.

9 Detailed Joint Programme of Activities (JPA) – first 18 months

9.1. Introduction – general description, milestones and measurable objectives

The JPA for the first 18 months is divided in 20 work packages, including 8 on integrating activities, 8 on jointly executed research activities, 3 on spreading excellence and 1 on management.

They nearly all start from the very beginning of the Network and are conducted in parallel. The main measurable objectives of the first JPA have been connected to milestones. They are:

- the deployment of 3 common tools linking the partners:
  - The deployment of ASTEC should be achieved at the latest 6 months after the beginning of SARNET. Beyond the delivery of the code, this deployment comprises the organisation of a training session.
  - The deployment of the ACT, will be realized in two steps, the first one should be achieved 6 months after the beginning of SARNET and provide the basic functionalities described in § 9.2; the second should be achieved 18 months after the beginning of SARNET and provide all the important necessary functionalities.
  - The definition of the plat-form to be used as the support of the SARNET experimental data base should be taken 6 months after the beginning of SARNET, and the deployment initiated afterwards;
- the definition of the JPA N°2 (month 13-month 30), with further efforts towards integration of research programmes, this revision should increase the granting of access rights between SARNET members;
- the revision of research priorities identified in the EURSAFE project, 18 months after the beginning of SARNET; this revision will take into account:
  - the accomplishment reached by researchers;
  - the identification of remaining uncertainties highlighted by calculations performed in the frame of safety studies;

  This revision will propose R&D programme orientation to tackle revised remaining important issues.
- the first plan for mobility 15 months after the beginning of SARNET;
- and the beginning of writing SA courses and book.

9.2. Work package list/overview

WARNING: The lead contractors identified in the following tables may change during the execution of the JPA.

SARNET Work package list (18 months)

Work-package No	Work package title	Lead contractor No	Start month	End month	Deliverable No
	Integrating activities				
WP1	Development of an Advanced Communication Tool (ACT)	23	1	24	1, 3
WP2	ASTEC Users Support and Training, Integration and Adaptation (USTIA)	1	1	>48	6,7, 34, 35
WP3	ASTEC PHYsical Model Assessment (PHYMA)	1	1	>48	6, 8, 30
WP4	ASTEC Reactor Application and Benchmarking (RAB)	1-23	1	>48	6, 9, 31
WP5	Level 2 PSA methodology and advanced tools (PSA2)	1	1	>48	36, 37, 38
WP6	Implementation of Experimental Database (IED)	28	1	>48	2, 39
WP7	Definition of Severe Accident Research Priorities (SARP)	23	6	42	40
WP8	Integration Assessment (IA)	1	9	12	10
	Joint research activities				
WP9	EARLY phase core degradation (EARLY)	21	1	36	11, 12, 13, 14, 15
WP10	Late-phase Core Degradation and Vessel behaviour (LATVES)	7	1	36	11, 12, 13, 14, 15
WP11	EX-Vessel Corium REcovery (EXCORE)	7-24	1	36	11, 12, 13, 14, 15
WP12	Hydrogen Behaviour in Containment (HBC)	21	1	36	16, 17, 18, 19, 20
WP13	Fast Interactions in Containment (FIC)	21	1	36	16, 17, 18, 19, 20
WP14	Fission Product Release and Transport (FPRT)	1	1	36	21, 22, 23, 24, 25
WP15	AEROsol Behaviour impact on source term (AEROB)	1	1	36	21, 22, 23, 24, 25
WP16	CONTainment CHEMistry Impact on source term (CONTCHEM)	1	1	36	21, 22, 23, 24, 25

SARNET Work package list (18 months - continued)

Work-package No	Work package title	Lead contractor No	Start month	End month	Deliverable No
	Spreading of excellence activities				
WP17	Education and Training (ET)	32	1	>48	32, 33, 41
WP18	BOOK on severe accident phenomenology (BOOK)	32	1	>48	42
WP19	MOBility programme (MOB)	32	1	>48	4, 5, 43
	Management activities				
WP20	MANAGement (MANAG)	1	1	>48	26, 27, 28, 29
20	TOTAL				**43**

WP1 is essential for making easier the communication between the Coordinator and all the participants and reducing the number of meetings. But its effect will only come into force within the next JPA.

ASTEC WP2 to WP4 are continuous actions. WP2 is a key one for a strong use of the code and for extending its capacity to most of water-cooled NPPs in Europe. In addition, WP2 is a key node in the integration process of the knowledge generated by the research activities in WP 9 to WP16.

WP3 to WP5 are providing information on which topics the research must focus. WP 7 will use this as an input together with the states of the art and the recommendations issued by research activities, WP9 to WP15, to make appropriate recommendations to the Governing Board on the orientations to be given to the research in SARNET.

WP6 will make easier the access to the data for model qualification (WP3) and also contribute to knowledge preservation and diffusion.

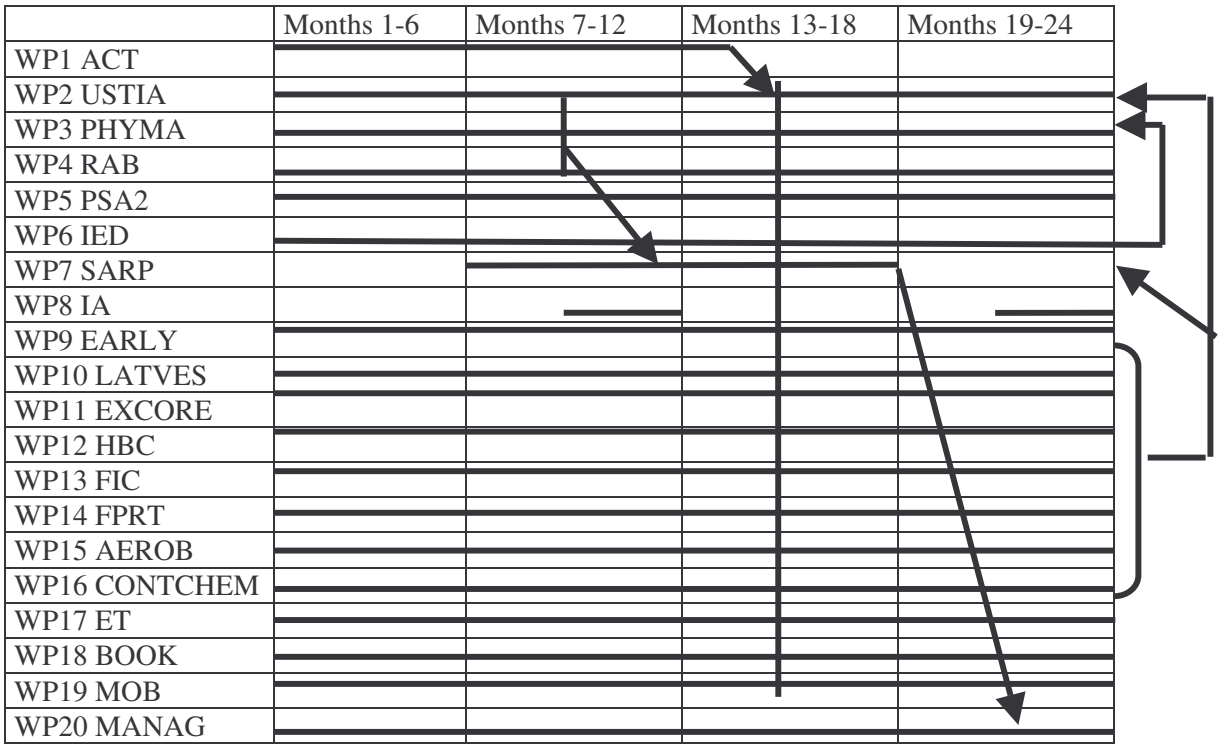
WP9 to WP16 are focused on the issues identified by EURSAFE as being remaining outstanding safety issues. They will contribute to resolve them while promoting the development of collaborations between participants.

WP17 to WP19 have the mission to contribute to the spreading of excellence. They will have links with WP2 on ASTEC, WP5 on PSAs and more generally all research activity WPs.

WP20 will have a strong interface with all the WPs.

9.3. Graphical presentation of work packages

The main links between the WPs are illustrated below:



9.4. Detailed description, planning and time table

The following tables present the different work packages. A summary of the deliverables is given at the end of the section. The person-months per participant are indicated when they correspond to a significant involvement of the contractor (larger than 0.5 m-m).

Development of an Advanced Communication Tool (ACT)

Work package number	1		**Start date or starting event:**										1
Activity Type	Integrating activities												
Participant id	23	1	24	28									
Person-months per participant	*5*												

Objectives

Develop an advanced communication tool to foster collaborative works amongst Network members while decreasing meetings, and to make easier access to large scientific data bases on severe accident research and management.

Description of work

Note that most partners of this sub-project will only be ACT users and will be involved in specifications and or in the assessment of the tool. This participation is not mentioned is the worktable above.

Task 1.1: Urgent developments, analysis of existing tool

- Specifications and development of a WEB site portal with basic functions (general information, links, …).
- Analysis of existing tools to elaborate and manage a documentary database, and for common elaboration of documents (review of partner's existing solution, analysis and re-use study).
- Proposal and implementation of a short-term solution for a document database.

Task 1.2: Specification of the Advanced Communication Tool

- Functional Analysis (interviews of end-users, identification of business processes analysis, documents)
- Technical Analysis (interviews of technical representatives, identification of technical constraints of data systems, analysis, documents).
- Definition of the solution (according to requirements dossiers and analyses).

Task 1.3: Full Implementation of Advanced Communication Tool

- Development of a functional mock-up.
- Development of ACT modules (conception, development, unit tests):
- Development of Web Portal module (authentication, collaborative functions - contact, forum, etc -).
- Development of the PLM module (definition of data formats, implementation of processes, implementation of search engine, implementation of access rights).
- Development of welcoming framework for existing partners portals and for technical databases.
- Development of access structure for ASTEC code and workflow with the maintenance team.
- Writing of technical documents (installation manual, exploitation manual, user's guide).

Task 1.4: Deployment of Advanced Communication Tool

- Deployment on a validation platform (installation of the validation plat-form and acceptance tests, acceptance report).
- Deployment on the operational platform (installation of the operational platform, full integration).
- User training (end-user training campaign, administration training, user support process).

Deliverables

Web site, documentary data base, reference manual: D1 at 6 months
ACT specifications: D3 at 9 months

Milestones and expected result

Full implementation of the ACT at 15 months

Full deployment at 18 months

Project Planning Time Table

WP1 Tasks	ACT	Lead.	Months 1 - 6	Months 7- 12	Months 13 - 18
	MEETINGS		**M**	**M**	
		Part. Id.			
1.1	**Analysis of existing tools**	*1, 23, 24, 28*	--------		
	Urgent developments	*1, 23, 24, 28*	----------D1		
1.2	**Functional and technical analysis**	*1, 23, 24, 28 +Users*	----------		
	Definition of the solution	*1, 23, 24, 28*		----------D3	
1.3	**Development**	*1, 23, 24, 28*		--------	-------
1.4	**Deployment**	*1, 23, 24, 28*			--------M
	User training	*1, 23, 24, 28 +Users*			----------

→ Indicates main dependences between tasks

ASTEC Users Support and Training, Integration and Adaptation (USTIA)

Work package number	2		**Start date or starting event:**										
Activity Type	Integrating activities												
Participant id	1	4	6	7	10	11	13	14	15	16	18	21	23
Person-months per participant	*13.5*	*1*	*3*	*12*	*0.5*	*0.5*	*3*	*1*	*0.5*	*2*	*0.5*	*1*	*11*
Participant id	24	25	26	27	30	31	32	33	35	42	43	46	47
Person-months per participant	*1*	*9*	*9*	*0.5*	*2*	*2*	*2*	*8*	*1*	*1*	*8*	*0.75*	*2*
Participant id	49	51											
Person-months per participant	*0.5*	*2*											

Objectives

Distribute the code versions and their documentation to code users.
Provide a support for code users.
Organize information exchange between ASTEC users.
Capitalize the knowledge by integration of models proposed in the 3 SARNET thematic topics (Corium, containment and source term).
Improve and adapt the code to meet the users requirements, particularly the extension to most types of reactors.

Description of work

Task 2.1: Support to code users. An IRSN-GRS team will:

- analyse the requests of ASTEC users and propose solutions (error corrections, minor development)
- update the code and make these updates available
- deliver code versions and documentation: ASTEC V1.1 release in April 04 to all SARNET partners; ASTEC V1.2 release in 2005 as consolidated version after 1 year of preliminary assessment and testing of V1.1.

The ASTEC Web site will be developed and maintained to make easier exchange of information and documents between maintenance team and users (link with ACT in WP1).

Task 2.2. Users Club
All the organizations participating to the Integral Code JPA will participate to the ASTEC users club.
Periodically users club meetings will be organized in order to: exchange information on the code use; examine the code status regarding its development and assessment; examine users requests and discuss their priority; prepare recommendations to be addressed to the Governing Board. For the first 18 first months of SARNET, 1 user club meeting is planned beginning of 2005.

Task 2.3. Training and learning
All the organisations involved in the Integral Code JPA will participate to this activity (host, teach or learn).
Training sessions will be periodically organized. The e-learning site (on ASTEC Web site) will be open and maintained. During the first 18 months one training session is planned in April-May 2004 (a second one maybe 1 year later). 40 potential trainees have been registered. It will be organized by GRS and IRSN, and hosted by GRS or IRSN.

Task 2.4: Code developments. This activity will cover:

- Specifications of models of the different systems for SAM as requested by ASTEC users,
- Specifications of developments requested by ASTEC users to model BWR and VVER; initiation of specifications for the extension of to CANDU and RBMK.
- Preparation of the detailed specifications of the version V2, using the following inputs provided by different tasks and WP of SARNET: methodology to be used in order to merge ASTEC with ICARE and other specialized codes; above specifications on SAM and NPP; outcomes of the first users' club meeting; the model proposals developed in the frame of all the joint research activities (corium, containment, source term), and finally requirements, if any, of the Level 2 PSA WP.

Deliverables

Yearly general Progress Report on topic ASTEC (D6)

ASTEC Web site (D7) at 6 months

ASTEC V2 development plan (D34) at 18 months

Specifications of ASTEC adaptation to different types of reactor and to new safety systems (D35) at 18 months

Milestones and expected result

Kick off meeting (ASTEC JPA general meeting M)

First Users club meeting in early 2005

First users' training session

Delivery of ASTEC V1.2 in 2005

Project Planning Time Table

WP2 Tasks	USTIA	Lead. 1	Months 1 - 6	Months 7- 12	Months 13 - 18
	MEETINGS		**M**	**M**	
		Part. Id.			
2.1	**V1.1. Release of code and user documentation**	*1, 23*	**--→*WP3*** **→*WP4***	**D6**	
	V1.2. Release of code and user documentation	*1, 23*			**--→*WP3*** **--→*WP4***
2.2	**Users club**	*1, 23 + Users*	**----------**	**----------M-D6**	**----------**
	ASTEC Web site dev.	*1*	**----------D7 →*WP1***	**D6**	
	ASTEC Web site updating	*1*		**----------**	**----------**
2.3	**Training session**	*1, 23*	**--M**		**--M**
	E-learning	*1*		**----------**	**---------- →*WP1***
2.4	**Specifications for adaptation to other reactors and systems**	*CSB, CSV, 25,33*	**----------**	**----------**	**----------D35**
	V2 development plan	*1,23*			**----------D34**

→ Indicates main dependences between tasks

Users = 1, 4, 6, 7, 10, 11, 13, 14, 15, 16, 18, 21, 23, 24, 25, 26, 27, 30, 31, 32, 33, 35, 42, 43, 46, 47, 49, 51

CSB= 1, 23, 24, 32

CSV= 1, 4, 23, 26, 43, 46, 47

ASTEC Physical Model Assessment (PHYMA)

Work package number	3			**Start date or starting event:**					1			
Activity Type	Integrating activities											
Participant id	1	4	6	7	10	13	16	21	23	24	25	27	30
Person-months per participant	*9*	*3.5*	*15*	*6*	*8.5*	*9*	*8*	*8.5*	*8*	*8.5*	*3*	*2*	*16*
Participant id	31	32	33	43	47	49							
Person-months per participant	*7*	*8*	*5*	*5*	*3*	*3.5*							

Objectives

Assess the physical models of the ASTEC code through comparison to experimental results.

Description of work

This activity consists of comparison of ASTEC with experimental data; exceptionally experimental data can be replaced by results provided by detailed reference codes, whose models are mainly more detailed and assessed than the ASTEC ones (example: CFD codes compared to CPA /multi-compartment containment part of ASTEC/).

The work organization during the 18 first months is:

- 1st year period with two tasks in parallel:
  - **Task 3.1**: Participants carry out assessment works for ASTEC V1.1. This will update and complete the information derived from assessment works performed earlier by GRS and IRSN and in the EVITA frame (5th FWP). It will provide useful information for further updating of ASTEC V1.
  - **Task 3.2**: Elaboration of a large assessment matrix to be used for the campaign of assessment of the ASTEC V1.2 consolidated version to be released early 2005.
- Next period with **Task 3.3**: Assessment work for the version V1.2 following the here above defined assessment matrix. This phase will continue beyond the 18 first months (it should last 2 years after the release of ASTEC V1.2).

This activity will be shared between 18 organisations, according to their competence:

- In-vessel phenomena (thermal hydraulic and degradation phenomena): BUTE, CEA, UPI, ENEA, FZK, GRS, IUSTT-IKE, IRSN, IVS, JRC PT, KTH, LEI, VEIKI
- Ex vessel corium (MCCI, corium cooling): ARCS, GRS, IRSN, KTH
- Containment behaviour: CIEMAT, UPI, ENEA, GRS, IRSN, JRC Petten, JSI, LEI, VEIKI
- Source term: CEA, CIEMAT, UPI, ENEA, GRS, IRSN, JRC Petten, JSI, TUS, UJV, VEIKI
- Integral tests (PHEBUS): GRS, INR, IRSN, JRC Petten, JSI, TUS, UJV

Deliverables

Yearly general Progress Report on topic ASTEC (D6)

ASTEC V1 assessment matrix (D8) at 12 months

Conclusion of the ASTEC V1.1 assessment (D30) at 15 months

Milestones and expected result

Kick off meeting (ASTEC JPA general meeting – M)

Finalisation of ASTEC V1.1 assessment at 12 months

Project Planning Time Table

WP3 Tasks	PHYMA	Lead. 1	Months 1 - 6	Months 7- 12	Months 13 - 18
	MEETINGS		M	M	
		Part. Id.			
3.1	In-vessel corium	*CIV*	----------	----------	D30 → *WP2*
	Ex-vessel corium	*CEV*	----------	----------	
	Containment	*CCO*	----------	---------- D6	
	FP	*CFP*	----------	----------	
	Integral tests	*CIT*	----------	----------	
3.2	Assessment matrix	*CAM*	----------	---------- D8	
3.3	In vessel corium	*CIV*			----------
	Ex vessel corium	*CEV*			----------
	Containment	*CCO*			----------
	FP	*CFP*			----------
	Integral tests	*CIT*			----------

→ Indicates dependence between tasks

***CIV*=** 1, 6, 7, 13, 16, 21, 23, 24, 27, 32, 33, 47, 49
***CEV*=** 1, 4, 23, 32
***CCO*=** 1, 10, 13, 16, 23, 30, 43, 49
***CFP*=** 1, 7, 10, 13, 16, 23, 30, 31, 33, 43, 47, 49
***CIT*=** 1, 23, 25, 30, 31, 43

***CAM*=** 1, 16, 21, 23, 24

ASTEC Reactor Application and Benchmarking (RAB)

Work package number	4		**Start date or starting event:**					1				
Activity Type	Integrating activities											
Participant id	23	1	11	13	14	15	16	18	24	25	26	27	32
Person-months per participant	*8*	*9*	*6*	*6*	*6.5*	*4*	*8*	*5.5*	*8.5*	*6*	*9*	*7.5*	*8*
Participant id	33	35	42	43	46	47	49	51					
Person-months per participant	*5*	*4*	*3.5*	*5*	*10*	*4*	*14*	*16*					

Objectives

Evaluate and improve the capability of ASTEC to simulate reactor transients.

Description of work

This activity will provide inputs for the WP2 and WP7. The reactor transients will concern 5 types of reactors: PWR, BWR, VVER, CANDU and RBMK.

ASTEC will be compared on reactor transients with the integral codes MELCOR and MAAP and with some specialized codes such as: ICARE/CATHARE, ATHLET-CD, RELAP-SCDAP, COCOSYS, TONUS …

The work organization during the first 18 months is:

- 1st year period with three tasks in parallel
  - **Task 4.1**: Participants carry out assessment works to update and complete for ASTEC V1.1 the benchmarking activity performed in the EVITA and COLOSS frame (5th FWP).
  - **Task 4.2**: Elaboration of a large reactor sequence matrix to be used for the benchmarking activity of the version V1.2, in close connection with the following task.
  - **Task 4.3:** Elaboration of a first set of ASTEC reference input decks for reactor applications (PWR, BWR, VVER, RBMK…). Beyond this task, the set will be periodically updated.
- Next period: **Task 4.4**. Reactor calculation and benchmarking activity with the version V1.2. This phase will continue beyond the 18 first months (it should last 2 years after ASTEC V1.2 release).

This activity will be shared between 21 organisations. Most of them will contribute to the evaluation of ASTEC applicability for PWR (see project time table).

The extension of ASTEC applicability for other reactor types will be analysed as follows:

- BWR: GRS, IUSTT-IKE, KTH
- VVER 440: INRNE, IVS, UJD, VEIKI, VUJE
- VVER 1000: UPI, INRNE, KTH, TUS, UJV
- CANDU: INR
- RBMK: LEI

Deliverables

Yearly general Progress Report on topic ASTEC (D6)

ASTEC V1 plant application matrix at 12 months (D9)

Conclusion of ASTEC V1.1 evaluation for reactor application (D31) at 15 months

Milestones and expected result

Kick off meeting (ASTEC JPA general meeting)

Finalization of ASTEC V1.1 evaluation at 12 months

Project Planning Time Table

WP4 Tasks	RAB	Lead. 23-1	Months 1 - 6	Months 7- 12	Months 13 - 18
	MEETINGS		M	M	
		Part. Id.			
4.1	PWR, EPR	*CPR*	----------	----------	D31 →*WP2, WP7*
	BWR	*CBR*	----------	----------D6	
	VVER	*CVR*	----------	----------	
4.2	Input deck data base	*CID*	----------	----------	→ *WP2*
4.3	Plant application matrix	*CEM*	----------	----------D9	
4.4	PWR, EPR	*CPR*			----------
	BWR	*CBR*			----------
	VVER	*CVR*			----------
	CANDU, RBMK	*25, 33*			----------

⟶ Indicates dependence between tasks

CPR = 1, 11, 13, 14, 15, 16, 18, 23, 24, 25, 35, 42
CBR = 23, 24, 32
CVR = 13, 26, 27, 31, 32, 43, 46, 47, 49, 51

CID = 1, 11, 14, 23, 25, 26, 27, 33, 51

CEM = 1, 11, 14, 15, 16, 23, 24, 25, 27, 33, 42, 46, 47, 51

Level 2 PSA Methodology and Advanced Tools (PSA2)

Work package number	5		**Start date or starting event:**							1			
Activity Type	Integrating activities												
Participant id	1	5	7	11	15	19	23	25	30	33	34	36	39
Person-months per participant	*4.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
Participant id	43	44	47	49									
Person-months per participant	*2.5*	*2.5*	*1.5*	*2.5*									

Objectives

Compare, improve and harmonize the methodologies used for developing Level 2 PSA within European countries and share effort to develop advanced tools, as far as they are required.
Identify most critical knowledge difficulties in continuation with EURSAFE for R&D prioritisation.
Adapt methodologies for application to the reactor types used in the NAS countries.

Description of work

Task 5.1: Comparison of Level 2 PSA approaches and identification of improvement needs:

- Level 1 / Level 2 interface,
- Accident progression event tree (structure, events considered),
- Release categories (grouping method),
- Assessment of physical events (general method, quantification of each phenomenon),
- Assessment of systems and human actions,
- Assessment of radiological releases,
- General method for evaluating uncertainties (to be considered in more details in foll. task 2).

Task 5.2: Comparison of methodologies for assessment of uncertainties and identification of improvement and harmonization needs:

- Identify which types of uncertainties have been considered in the Level 2 PSA performed so far by the partners and the methods used to assess them.
- Review in more detail assessment of uncertainties related to different physical phenomena involved in severe accidents (sets of calculations, expert judgements, combination of them).
- Recommend approaches and propose ways of improvements

Task 5.3: Improvement of event tree methodology using dynamic reliability techniques:

- Identify current limitations of classical event tree approach,
- Specify methodology based on dynamic reliability techniques to overcome these limitations (DDET approach, combined with the Monte-Carlo one).

Deliverables

Report on Level 2 PSA comparisons and recommended improvements (D 36) at 18 months

Report on uncertainty assessment comparison and recommended improvements (D37) at 18 months

Report on event tree approach limitations and proposed methodological approach (D38) at 18 months

Milestones and expected result

Kick off meeting (M)

Report release 18 months later

Project Planning Time Table

WP5 Tasks	PSA2	Lead. 5	Month 1 - 6	Month 7- 12	Month 13 - 18
MEETINGS (see Tasks)					
		Part. Id.			
5.1	Comparison	*List 5.1*	M----------M----	--------M----------	-------M------D36 →*WP2*
5.2	Uncertainty	*List 5.2*	M----------M----	--------M----------	-------M------D37 →*WP7*
5.3	Dynamic reliability	*List 5.3*	M----------	--------M----------	-------M------D38

List 5.1: 1, 5, 11, 15, 19, 23, 25, 34, 36, 39, 43, 47, 49

List 5.2: 1, 7, 11, 15, 19, 23, 30, 33, 34, 36, 43, 47, 49

List 5.3: 1, 7, 11, 15, 19, 23, 25, 33, 36, 44

Implementation of Experimental Database (IED)

Work package number	6		**Start date or starting event:**					1					
Activity Type	Integrating activities												
Participant id	28	1	3	7	17	21	32						
Person-months per participant	*4.5*	*4.5*	*4.5*	*4.5*	*4.5*	*3.5*	*4.5*						

Objectives

Provide SARNET with, develop and maintain an instrument that ensures preservation, easy access for codes, exchange and processing of Severe Accident experimental data

Description of work

Task 6.1: Finalization of the STRESA plate-form assessment, elaboration of a reference document describing the principle for deployment and use, and addressing data protection and durability of the solution.

Task 6.2: Introducing in the network organisations that were not part of the EURSAFE activity on the data base (AEKI and FORTUM), and support to the others:

- Creation of local STRESA nodes for the newcomers
- Organisation of one-week training for these organisations

Providing support for establishing the links with communication tool developed in WP1.

Task 6.3: Completing the existing EURSAFE database network developed from STRESA structure with the other available severe accident data of the participating organisations.

- Data from PLINIUS platform: VULCANO, COLIMA (CEA)
- Data from KJET, PREMIX, ECO, QUEOS, DISCO (FZK)
- Data from FOREVER, KMFCI, POMECO (KTH)
- Data from Phébus.FP (FPT0, FPT1) and VERCORS (IRSN)
- Data from CODEX: core degradation bundle tests (AEKI)
- Data from VICTORIA and HORIZON: Helium and aerosol experiments (FORTUM)

Deliverables

Description of the proposed SARNET experimental data base system including its integration within the overall SARNET communication tool and its evaluation (D2) at 6 months

Data base catalogue (D39) at 18 months

Milestones and expected result

First Database meeting for launching the activities)

Endorsement of the proposed structure by Governing Board consortium as the SARNET experimental data base system (on the basis of evaluation, durability perspectives), at 6 months

Project Planning Time Table

WP6 Tasks	IED	Lead. 28	Month 1 - 6	Month 7- 12	Month 13 - 18
MEETINGS			M		
		Part. Id.			
6.1	Assessment	*List 6.1*	----------D2		
6.2	Deployment by partners 3 and 17	*List 6.2*	---------	-----	
	Deployment continuation and user support	*28*		----------	----------
6.3	Data Base Completion	*List 6.3*		----------	----------D39

List 6.1: 28, 1, 7, 21, 32

List 6.2: 28, 3, 17

List 6.3: 28, 1, 3, 7, 17, 21, 32

Definition of Severe Accident Research Priorities (SARP)

Work package number	7			**Start date or starting event:**				6				
Activity Type	Integrating activities											
Participant id	23	1	7	15	21	32	43	50				
Person-months per participant	*4.5*	*3*	*3*	*3*	*3*	*3*	*3*	*2*				

Objectives

Prioritise the research to be performed in the field of severe accident phenomena and management, notably using the results of EURSAFE, and ASTEC and Level 2 PSA work packages

Description of work

- Agree on methodology
- Review issues resulting from EURSAFE not appropriately covered by SARNET
- Analyse R&D progresses and results from Level 2 PSA studies
- Review issues ranking
- Review potential experimental and theoretical programmes to address these issues
- Make recommendations for R&D programme revision

Deliverables

Updated version of EURSAFE conclusions and proposals (D40) at 18 months

Milestones and expected result

SARNET Integrated R&D elaborated in the frame of Joint Research Activities WPs at 24 months

Project Planning Time Table

WP7 Tasks	SARP	Lead. 23	Month 1 - 6	Month 7- 12	Month 13 - 18
MEETINGS			**M**		
		Part. Id.			
7.1	**Methodology definition**	***List 7***	**----------**		
7.2	**Revision of EURSAFE conclusions/ proposals**	***List 7***		**----------** ***JRA →***	**----------D40** ***→JRA***

List 7: 23, 1, 7, 15, 21, 32, 43, 50

The JRA (Joint Research Activities) provide inputs during the revision process.

The revision leads to recommendations to be integrated in the update of the JRA.

Integration Assessment (IA)

Work package number	8		**Start date or starting event:**							9			
Activity Type	Integrating activities												
Participant id	1	7	21	23	28	32							
Person-months per participant													

Objectives:

To monitor the progress of the network and propose corrective actions in order to reach the SARNET objectives.

Description of work

Task yearly carried out, 3 months before the release of the annual report.

The Coordinator, concerned Scientific Coordinators and some WP leaders carry out the work.

The work consists in:

- Collect the information necessary to measure the evolution of the 16 indicators defined in chapter 7;
- Analyse the results, and propose if necessary JPA corrective actions;
- Propose the revision of the list in order to make easier the assessment.

For the first year, the evolution of only one part of the indicators will be significant:

- I1: number of member accesses to the Web site
- I3: number of ASTEC users in SARNET
- I7: the number of access rights granted to contractors for application in SARNET
- I11: the number of joint publications/communications
- I12: the number of attendees to SARNET course or topical trainings
- I14: the number of presentations of SARNET

Deliverables

Annual assessment report D10 at 12 months

Milestones and expected result

Continuous improvement of the process leading to fulfil SARNET objectives.

Early-phase core degradation (EARLY)

Work package number	9		**Start date or starting event:**						1			
Activity Type	Other specific activities											
Participant id	21	1	15	16	23	29	36	41	47			
Person-months per participant	*1.5*	*1.5*	*2*	*4.5*	*1.5*	*4.5*	*4.5*	*1.5*	*2*			

Objectives

These issues result from:

- Selection of the research issue N°1.1 in 5th FWP EURSAFE project with following selection rationale: rapid generation of hydrogen which may not be accommodated by re-combiners and risk of early containment failure; improve knowledge about the magnitude of hydrogen generation.
- Conclusions of the COLOSS 5th FWP project and preparation of Phébus FPT3 test which showed needs of improvements of understanding and modelling of B_4C impact on core degradation. Same conclusions for irradiated fuel dissolution.

A more complete understanding is needed on the following physical processes: hydrogen generation during core reflooding conditions (esp. oxidation of metal-rich mixtures), B_4C and fuel burn-up impact on core degradation, and more generally the remaining questions in the core degradation early-phase (in particular, oxidation of clad with advanced alloys and hydrogen generation during melt relocation into water present in the vessel lower plenum).

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 9.1. Review and selection of available experiments/models for interpretation and modelling activities. Joint recommendations on the test specifications (matrix…).

Main experiments (separate-effect tests or integral tests): QUENCH (incl. ISTC-1648 frame), CORA, experiments of dissolution of fuel (UO_2, MOX) by Zry, Phébus FPT2, MADRAGUE.

Task 9.2. Synthesis of analyses and interpretations of selected experiments from above Task, using different models and/or codes (or thermodynamic databases such as NUCLEA).

Main codes: ICARE/CATHARE, SCDAP/RELAP5, SCDAPSIM, ATHLET-CD, MELCOR, ASTEC.

Task 9.3. Model synthesis and proposal of models to be implemented into ASTEC.

Deliverables

Progress report on CORIUM topic (D11) at 12 months

Progress report on review of experiments of the CORIUM topic (D12).

Progress report on synthesis of experimental result interpretation for CORIUM topic (D13).

Synthesis Progress report of the CORIUM topic on proposals of models for ASTEC (D14)

Definition of the joint R&D programme in the next JPA period for the CORIUM topic (D15)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

Project Planning Time Table

(Here example for WP9 but valid for WP 9 to 16)

WP9 Tasks	WP 9	Lead.	Months 1 - 6	Months 7- 12	Months 13 - 18
	MEETINGS		M	M	M
		Part. Id.			
1	Joint review of experiments	*All*	M ----------	----------D12	----------
2	Joint interpretation	*All*	----------	----------D13	-D11, D15- ------ → *WP7*
3	Proposals of models for ASTEC	*All*		----------D14	---------- →*WP2*
4 (Depends on WP)	Synthesis of plant applications	*All*	----------	----------D11	---------- → *WP7*

LATe-phase Core Degradation and VESsel behaviour (LATVES)

Work package number	10			**Start date or starting event:**					1			
Activity Type	Other specific activities											
Participant id	32	1	7	21	22	23	24	37	40	41		
Person-months per participant	*2.5*	*1.5*	*5*	*1.5*	*4.5*	*1.5*	*2*	*2*	*1.5*	*1.5*		

Objectives

The rationales for these issues result from 5th FWP EURSAFE project:

- For late-phase degradation and corium behaviour in lower head, Research issue N°1,3 with following selection rationale: Improve predictability of the thermal loadings on RPV lower head (or corium catcher devices) to maintain their integrity. It is also related to the Research issue N°1.4 "External vessel cooling and RPV integrity" for in-vessel melt retention strategies.
- For vessel integrity and corium release to cavity, Research issue N°1,6 with following selection rationale: Improve predictability of mode and location of RPV failure to characterise the corium release into the containment. This addresses also part of Research issue N°3.1 "Melt relocation into water and particulate formation" through the melt relocation from core region into water filled space.

A more complete understanding is needed on the following physical processes:

- For coolability of a molten corium pool in the lower plenum or in an external core-catcher: in case of dry cavity, initial corium characteristics from the core region when relocating to the lower plenum, and behaviour of molten pool in the lower plenum (segregation/stratification, heat transfers to boundaries…); in case of external vessel cooling, critical heat flux and external cooling conditions in order to evaluate and design AM strategies for in-vessel melt retention.
- For vessel integrity and corium release to cavity: in conditions of dry cavity, vessel mechanical failure (mode, instant, location) due to thermal and mechanical loadings, and breach opening processes and characteristics of corium release to the cavity.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 10.1. Review and selection of available experiments/models for interpretation and modelling activities. Joint recommendations on the test specifications (matrix…).

Main experiments:

- for late-phase degradation: SIMECO, COLIMA, LIVE, Phébus FPT4….
- for vessel integrity: FOREVER, analytical tests on plate fissuring…

Other inputs may come from international projects: MASCA, CORVIS, OLHF, PLINIUS….

Task 10.2. Synthesis of analyses and interpretations of experiments from above Task with existing models or codes (or thermodynamic databases such as NUCLEA).

Main codes: ICARE/CATHARE, ATHLET-CD, CFD codes, ANSYS, ASTEC.

Task 10.3. Synthesis of reactor scenario studies in order to improve the evaluation of initial or limit conditions or to determine the impact of remaining uncertainties on accident evolution, using different codes (ICARE/CATHARE, ATHLET-CD/KESS, ANSYS).

Task 10.4. Model synthesis and common proposal of models on late-phase degradation and vessel integrity to be implemented into ASTEC.

Deliverables

Progress report on CORIUM topic (D11) at 12 months

Progress report on review of experiments of CORIUM topics (D12).

Progress report on synthesis of experimental results interpretation of experiments for CORIUM topic (D13).

Synthesis Progress report of the CORIUM topic on proposals of models for ASTEC (D14)

Definition of the joint R&D programme in the next JPA period for the CORIUM topic (D15)

Milestones and expected result

Kick-off meeting, status of R&D and selection of for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

Ex-vessel Corium Recovery (EXCORE)

Work package number	11		**Start date or starting event:**						1			
Activity Type	Other specific activities											
Participant id	24	1	7	15	19	21	23	32	37	41	47	48	50
Person-months per participant	*2.5*	*1.5*	*4*	*2.5*	*3.6*	*1.5*	*1.5*	*2*	*2.5*	*1.5*	*2.5*	*4.5*	*4.5*

Objectives

The rationales for these issues result from 5th FWP EURSAFE and EUROCORE projects:

- For ex-vessel case w/o water injection (EURSAFE items N°2.1 “MCCI: molten pool configuration and concrete ablation" and N°2.3 “Ex-vessel corium catcher: corium ceramics interaction and properties”: improve predictability of axial versus radial ablation up to late phase MCCI to determine basemat failure time and loss of containment integrity; demonstrate the efficiency of specific corium catcher designs by improving the predictability of the corium interaction with corium catcher materials.
- For ex-vessel case with water injection (EURSAFE items N°2.2 and 2.4): increase knowledge of cooling mechanisms by top flooding the ex-vessel corium pool to demonstrate termination of accident progression and maintenance of containment integrity; demonstrate efficiency of water bottom injection to cool corium pool and its impact on containment pressurization.
- The scope of the work-package is extended also to particulate debris coolability for in-vessel situation (EURSAFE item N°1.2): termination of the accident by re-flooding of the core while maintaining RCS integrity. Increase predictability of core cooling during re-flooding.

A more complete understanding is needed on the following physical processes:

- For corium behaviour during interaction with concrete or ceramic and for ex-vessel pool corium coolability: pool stratification and layers stability under gas sparging; heat transfer mechanism, power distribution and ablation homogeneity; fission product remaining in the pool; ceramic dissolution mechanisms; cooling mechanisms with water on top of the melt (bulk cooling, water ingression or melt ejection); crust anchorage phenomena in reactor pit and consequence for melt ejection mechanism; porosity formation during cooling by bottom injection of water into the melt and consequences for water management and steam production.
- For core coolability: behaviour of ex-vessel particulate debris beds in water present in the cavity. thermal hydraulics of debris beds, without or with water injection, coolability of debris beds (in- and ex-vessel), coolability of the molten pool within the core, fuel rod collapse and molten pool crust failure.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 11.1. Review and selection of available experiments/models for interpretation and modelling activities. Joint recommendations on the test specifications (matrix…).

Main experiments:

- for debris or corium pool coolability: DEBRIS, STYX, SILFIDE, POMECO, POMECO-Grand, PERCOLA, DECOBI, KAPOOL, COMET, VULCANO, COMECO, DECOBI ….
- for MCCI: BALI-Ex-vessel, BALISE, BETA, MACE, ACE, ISABEL, CIRMAT, ARTEMIS, VULCANO, COLIMA, COMETA….

Other inputs may come from international projects: OECD-MCCI, MASCA, RASPLAV 2 and 3….

Task 11.2. Synthesis of analyses and interpretations of experiments from above Task with existing models or codes (or thermodynamic databases such as NUCLEA).

List of codes:

- for debris coolability: ICARE/CATHARE, KESS and ATHLET-CD, WECHSL, ASTEC, TOLBIAC-ICB, THEMA, CROCO 2D, WEX, COCOSYS, MELCOR, MC3D….
- for MCCI: WEX, WECHSL, ASTEC, TOLBIAC, TOLBIAC-ICB, CROCO 2D, MELCOR, MEWA, COSACO…

Task 11.3: Synthesis of plant applications in order to determine the impact of remaining uncertainties on accident management.

Task 11.4. Model synthesis and common proposal of models of corium concrete or ceramic interaction and corium debris or melt coolability to be implemented into ASTEC.

Deliverables

Progress report on CORIUM topic (D11) at 12 months

Progress report on review of experiments of CORIUM topics (D12).

Progress report on synthesis of experimental results interpretation of experiments for CORIUM topic (D13).

Synthesis Progress report of the CORIUM topic on proposals of models for ASTEC (D14)

Definition of the joint R&D programme in the next JPA period for the CORIUM topic (D15)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

Hydrogen Behaviour in Containment (HBC)

Work package number	12		**Start date or starting event:**					1		
Activity Type	Other specific activities									
Participant id	1	7	13	20	21	23	30	31	32	33	35
Person-months per participant:	*2*	*2*	*4.5*	*4.5*	*4.5*	*2.5*	*4.5*	*2*	*2.5*	*4.5*	*2.5*
Participant id	37	43	48	49	52						
Person-months per participant:	*2*	*2*	*4.5*	*4.5*	*4.5*						

Objectives

This WP concerns two main issues:

- Containment atmosphere mixing and hydrogen distribution in the containment, with respect to risk of high concentration,
- Hydrogen combustion and associated risk mitigation.

A more complete understanding is needed on the following physical processes:

- For containment atmosphere mixing, it is essential to determine with good confidence the hydrogen distribution in the different parts of the containment, taking account of containment geometry (multi-compartment), mass and energy exchanges coming from phenomena as wall condensation, spray and sump evaporation. During the first 18th months of SARNET, a significant increase of knowledge in that domain will be obtained, taking account of forecast test results of TOSQAN, MISTRA and ThAI experiments.
- For hydrogen combustion and associated risk mitigation: formation of combustible gas mixtures in containments, its local gas composition and potential combustion modes. The investigations take into account the containment geometry (multi-compartment), mass and energy exchanges (wall condensation, spray and sump evaporation), local multidimensional effects of hydrogen combustion and the reaction kinetics inside catalytic recombiners.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 12.1. Review and selection of available experiments/models for interpretation and modelling activities. Discussion of experimental activities and recommendations for the specification of experiments/programmes: TOSQAN, MISTRA (OECD and national), ThAI (OECD).

Task 12.2. Synthesis of analyses and interpretations of experiments from above Task with existing models or codes (CFD codes, TONUS, COM3D, REACFLOW, ASTEC, COCOSYS….).

Task 12.3. Synthesis of plant applications, particularly CFD code adaptation for VVER-type reactors.

Task 12.4. Model synthesis and common proposal of models to be implemented into ASTEC.

Deliverables

Progress report on CONTAINMENT topic (D16) at 12 months

Progress report on review of experiments of the CONTAINMENT topic (D17).

Progress report on synthesis of experimental results interpretation for the CONTAINMENT topic (D18).

Synthesis Progress report of the CONTAINMENT topic on proposals of models for ASTEC (D19)

Definition of the joint R&D programme in the next JPA period for the CONTAINMENT topic (D20)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities)

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

Fast Interactions with Corium (FIC)

Work package number	13		**Start date or starting event:**					1		
Activity Type	Other specific activities									
Participant id	1	7	15	21	23	24	31	32	37	43
Person-months per participant:	*2.5*	*2.5*	*3*	*4.5*	*2*	*4.5*	*2.5*	*2*	*2.5*	*2.5*

Objectives

The diverse interaction modes of corium, ejected into the reactor cavity after RPV failure, may lead to high temperature and pressure loads on the containment or vital components. Depending on the conditions at failure and on reactor geometry, fuel-coolant-interactions (FCI) or direct containment heating (DCH) can take place.

A more complete understanding is needed on the fluid-dynamic, thermal and chemical processes, for model development and validation, especially for the application to the reactor case that requires a scaling in dimension and from model fluids to corium.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models, for the DCH only, for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 13.1. Review and selection of available experiments/models for interpretation and modelling activities. Define important phenomena for which models have to be improved or developed on the basis of the EURSAFE tables. Discussion of experimental activities and recommendations for the specification of experiments/programmes for the DCH issue (DISCO facilities) and the FCI issue (exp. facilities: TREPAM, MICRONIS, ECO, DROPS, MISTEE and KROTOS). Delineate the necessary data to be measured. As for FCI, a close link with OECD-SERENA programme will be established.

Task 13.2. Synthesis of analyses and interpretations of experiments from above Task with existing models or codes (MC3D, MATTINA, IKEJET/IKEMIX, IDEMO-2D, FRADEMO, COMETA).

Task 13.3. Model synthesis and common proposal of models to be implemented into ASTEC.

Deliverables

Progress report on CONTAINMENT topic (D16) at 12 months

Progress report on review of experiments of the CONTAINMENT topic (D17).

Progress report on synthesis of experimental results interpretation for the CONTAINMENT topic (D18).

Synthesis Progress report of the CONTAINMENT topic on proposals of models for ASTEC (D19)

Definition of the joint R&D programme in the next JPA period for the CONTAINMENT topic (D20)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

Fission Product Release and Transport (FPRT)

Work package number	14	**Start date or starting event:**						1			
Activity Type	Other specific activities										
Participant id	1	3	7	15	16	25	36	50			
Person-months per participant:	*3*	*4.5*	*2.5*	*2*	*4.5*	*4.5*	*2*	*4.5*			

Objectives

The rationales for these issues related to fission product release and transport in the RCS result from 5th FWP EURSAFE project:

- Quantification of the source term, in particular for Ru, under oxidation conditions / air ingress for HBU and MOX fuel.
- Improvement of predictability of iodine species exiting RCS to provide the best estimate of the source into the containment.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 14.1. Review and selection of available experiments/models for interpretation and modelling activities. Discussion of experimental activities and recommendations for the specification of following experiments/programmes: MADRAGUE, VTT Ru speciation tests, VERDON, RUSET, CHIP, VERCORS, Phébus-FP.

Task 14.2. Synthesis of analyses and interpretations of above experiments with existing models or codes.

Task 14.3. Synthesis of plant applications in order to determine the impact of remaining uncertainties.

Task 14.4. Model synthesis and common proposal of models to be implemented into ASTEC.

Deliverables

Progress report on SOURCE TERM topic (D21) at 12 months

Progress report on review of experiments of SOURCE TERM topic (D22).

Progress report on synthesis of experimental results interpretation for SOURCE TERM topic (D23).

Synthesis Progress report of the SOURCE TERM topic on proposals of models for ASTEC (D24)

Definition of the joint R&D programme in the next JPA period for the SOURCE TERM topic (D25)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

AEROsol Behaviour impact on source term (AEROB)

Work package number	15		**Start date or starting event:**		1					
Activity Type	Other specific activities										
Participant id	1	8	10	12	17	23	29	36	45		
Person-months per participant:	*3*	*4.5*	*2*	*0.5*	*1.5*	*2*	*4.5*	*2.5*	*4.5*		

Objectives

The rationale for the issues related to aerosol behaviour result from 5th FWP EURSAFE project:

- Quantification of the source term for aerosol retention in the secondary side of steam generator and leakage through cracks in the containment wall.
- Quantification of the source into the containment due to re-volatilisation in RCS.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 15.1. Review and selection of available experiments/models for interpretation and modelling activities. Discussion of experimental activities and recommendations for the specification of following experiments/programmes: ARTIST, PSAero, Radsol, PECA/SGTR, JRC re-vaporisation tests, Phébus-FP.

Task 15.2. Synthesis of analysis and interpretations of above experiments with existing models or codes.

Task 15.3. Model synthesis and common proposal of models to be implemented into ASTEC.

Deliverables

Progress report on SOURCE TERM topic (D21) at 12 months

Progress report on review of experiments of SOURCE TERM topic (D22).

Progress report on syntheses of experimental results interpretation for SOURCE TERM topic (D23).

Synthesis Progress report of the SOURCE TERM topic on proposals of models for ASTEC (D24)

Definition of the joint R&D programme in the next JPA period for the SOURCE TERM topic (D25)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

CONTainment CHEMistry impact on source term (CONTCHEM)

Work package number	16	**Start date or starting event:**							1		
Activity Type	Other specific activities										
Participant id	1	2	7	9	10	15	19	23	30	43	52
Person-months per participant:	*3*	*4.5*	*2*	*4.5*	*2.5*	*2.5*	*4.5*	*2.5*	*4.5*	*4.5*	*4.5*

Objectives

The rationale for the issues related to iodine chemistry in containment result from 5th FWP EURSAFE project that concluded on needs of improvement of predictability of iodine chemistry in the containment to reduce the uncertainty in iodine source term.

The main WP objective will be the progressive integration of the R&D capacities on these issues, in order to better coordinate the research activities and optimise the available competences and resources. This will be done particularly through:

- Joint investigation of the physical processes in order to reach a common understanding through syntheses on experimental programs and on their interpretation.
- Development of adequate models for the above physical processes to be implemented into ASTEC.

This will lead to the definition and proposal of a joint R&D programme (models, experiments) to solve this issue, either by re-orientation of existing programmes or by launching new ones.

Description of work

Task 15a.1. Review and selection of available experiments/models for interpretation and modelling activities. Discussion of experimental activities and recommendations for the specification of following experiments/programmes: EPICUR, CAIMAN, Chalmers tests, PARIS, Phébus-FP.

Task 15a.2. Synthesis of analyses and interpretations of above experiments with existing models or codes.

Task 15a.3. Model synthesis and common proposal of models to be implemented into ASTEC.

Deliverables

Progress report on SOURCE TERM topic (D21) at 12 months

Progress report on review of experiments of SOURCE TERM topic (D22).

Progress report on synthesis of experimental results interpretation for SOURCE TERM topic (D23).

Synthesis Progress report of the SOURCE TERM topic on proposals of models for ASTEC (D24)

Definition of the joint R&D programme in the next JPA period for the SOURCE TERM topic (D25)

Milestones and expected result

Kick-off meeting, status of R&D and selection of data for interpretation and modelling activities

First period conclusion meeting, assessment of work and definition of future joint R&D at 12 months

Education and Training (ET)

Work package number	17	**Start date or starting event:**							1		
Activity Type	Other specific activities										
Participant id	32	1	7	10	12	22	23	36	37	43	41
Person-months per participant:	*2*	*1*	*1*	*1*	*0.5*	*1*	*1*	*1*	*1*	*1*	*1*

Objectives

Develop Courses on Severe Accident Phenomenology and the PSA, Integrate with the NEPTUNO Integral Project

Description of work

The Education and Training programme in SARNET is focusing on raising the competence level of the students and researchers engaged in severe accident research. Towards this purpose a course will be developed on the phenomenology of the various areas of severe accident phenomenology. This would include topics such as the early and late phase of in-vessel core degradation, fission product release, aerosol transport, vessel failure, DCH, hydrogen combustion and detonation, MCCI, containment loading etc. The teaching will not be a survey but an in-depth treatment so that the students and researchers will be able to (a) understand (b) develop the methodology in the topics further and (c) use analysis tools (e.g. ASTEC) more effectively.

The PSA course will be developed to provide the students and researchers a hands-on experience with the Level 2 PSA of PWR, BWR and VVER plants. The description of the scenarios with event trees and of the failure rates with fault trees will be demonstrated and efforts will be made to determine the probabilities of the various events occurring. The consequences analysis is performed in codes like ASTEC, MELCOR, MAAP and their phenomenology will be explained. In particular, the models in the ASTEC code will be explained. The best estimate analysis will be supplemented with an uncertainty analysis. It will be used to demonstrate the margins that are available in the plant designs and operations.

A course on Reactor Safety in which Introductory Severe Accident phenomenology is taught will be proposed to the NEPTUNO Integral Project for the European Masters in Nuclear Engineering programme.

Deliverables

Course on Severe Accidents (SA) will be available for delivery at 15 months (D32).

Course on PSA will be available for delivery at 18 months (D41).

Course in Reactor Safety with introduction to SA will be proposed to NEPTUNO by June 2005 (D33).

Milestones and expected result

Initiation and kick off meeting for the SA Phenomenology course at 3 months

Initiation and kick off meeting for the PSA course at 6 months

Integration activities with NEPTUNO IP (June 2005)

Completion of the SA Phenomenology Course at 24 months

Completion of the PSA Course at 24 months

BOOK on severe accident phenomenology (BOOK)

Work package number	18		**Start date or starting event:**					3			
Activity Type	Other specific activities										
Participant id	32	1	10	12	23	33	37	43			
Person-months per participant:	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*			

Objectives

To develop a text (source) book on Severe Accident Phenomenology.

Description of work

At present there is no text (source) book on severe accident phenomenology, which can be used by the students and researchers to learn the subject area. A textbook is quite essential in terms of providing knowledge in a concise and focussed manner along with the references, which could be used by a student or a researcher to perform independent and more detailed studies. The textbook should deal with the whole progression of the severe accident including the initial transient leading to a severe accident caused by additional faults. This textbook, probably, would be quite voluminous due to the large body of material and the large number of papers and studies in Severe Accidents. The text should be reviewed by a set of peer reviewer. The intent should be to provide not only the methodology but also an assessment of the research results. The textbook should be addressed to students and researchers beyond the level of Masters in Nuclear Engineering. An abbreviated version may be addressed to the students, who enrol in the European Masters in Nuclear engineering Programme under the NEPTUNO IP.

Deliverables

SA Book skeleton with some chapters ready D 42 at 18 months.

Milestones and expected result

Initial meeting and decisions on the principal and the supporting authors at 3 months

The first draft of the book should be completed in 2006.

MOBility programme (MOB)

Work package number	19		**Start date or starting event:**					1			
Activity Type	Other specific activities										
Participant id	32	1	7	10	12	13	23	24	25	43	
Person-months per participant:	*1.5*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	

Objectives

To develop the Mobility and Training Programme for students and researchers, to form teams of researchers and to develop training for reactor operators in severe accident domain.

Description of work

At present there is no organized programme in Europe under which students and researchers could go to different laboratories for education and training in the severe accident area. One element to develop is the summer internship programme under which a student spends a summer at another University (than his own) to learn about the severe accident work ongoing there.

The second element of this WP would be the development of the deputation programme in which a researcher from one laboratory will spend a year at another European Laboratory where he / she would participate in an area of the severe accident research ongoing there. In this mobility programme, the long term goal is to build teams which would engage together in a certain activity of the NoE e.g. code debugging, code validation, simulant material experiments, real material experiments, etc.

The third element of this WP is to develop a training programme for plant operators and interested researchers in the severe accident management procedures with, or without, a simulator. Here, the emphasis should be in identifying what these procedures are based on and why they are effective.

Deliverables

Completion of a development plan and cost to SARNET for student summer internship at 9 months (D4)

Completion of a development plan for researcher deputation and placing of 2 – 3 researchers for 1 year at 9 months (D5)

Completion of a development plan for operator training in SA management procedures at 24 months (D43)

Milestones and expected result

Initial meeting between partners at 3 months

Placing of 2 – 3 students on summer internships at 12 months

Placing of 2 – 3 researchers for deputation at other laboratories at 12 months

MANAGement (MANAG)

Work package number	20		**Start date or starting event:**						1		
Activity Type	Other specific activities										
Participant id	1	7	21	23	32						
Person-months per participant:	*27*	*4.5*	*4.5*	*1.5*	*3*						

Objectives

Coordinate the JPA technically and financially

This activity involves mainly the Coordinator and the topical coordinators

Description of work

- Monitor progress of JPA
- Check release of deliverables and survey milestones
- Organize technical reviews when necessary
- Anticipating and examining possible difficulties in JPA execution
- Making synthesis for JPA update (12 months after SARNET beginning) for Governing Board approval
- Elaborate budget for the second JPA (month 13 to month 30)
- Distribute community funds as decided in the Consortium agreement;
- Organize meetings of Governing Board, Advisory Committee and Ad-hoc Scientific Review Committee.
- Establish cost statement for the first year
- Organize information diffusion (newsletter, progress reports, …)
- Organize periodically a general conference (to be coupled with ASTEC users club meeting), every 18 months

Deliverables

At 12 months:

Annual progress report (D26)

JPA update proposal (D27)

Budget estimates for 2nd JPA (D28)

Synthesis of 1st year cost statements (D29)

Milestones and expected result

First SARNET conference (2005)

9.5. Deliverable list

The JPA for the first 18 months is divided in 28 work packages, including 8 on integrating activities, 16 on jointly executed research activities, 3 on spreading excellence and 1 on management.

Deliverables list
Joint programme of activities (18 months period, month 01 - 18)

Del. no. [2]	Deliverable name	WP no.	Lead particip-ant	Estimated indicative person months	Nature[3]	Dissemination level[4]	Delivery date[5] (proj. month)
1	SARNET WEB site	1	23	2	O	PU	6
2	Data Base Proposal	6	28	10	R	CO	6
3	ACT specification	1	23	3	R	CO	9
4	Student mobility plan	18	32	1	R	PU	9
5	Researcher mobility plan	18	32	1	R	PU	9
6	Progress report on ASTEC Activities	2-4	1-23	20	R	CO	12
7	ASTEC WEB site	2	1	3	O	RE	12
8	ASTEC Assess. Matrix	3	1	15	R	RE	12
9	ASTEC Bench. matrix	4	1-23	15	R	RE	12
10	Indicator Assessment.	8	1	4	R	CO	12
11	Progress report on CORIUM Activities	9-11	7	3	R	CO	12
12	CORIUM Exp. Recom	9-11	7	10	R	CO	12
13	CORIUM Interp Synth.	9-11	7	28	R	CR	12
14	CORIUM Model Recom	9-11	7	18	R	CR	12
15	CORIUM Prog. Revision	9-11	7	10	R	CO	12
16	Progress report on CONTAIN. Activities	12,13	21	3	R	CO	12
17	CONTAIN. Exp. Recom	12,13	21	10	R	CO	12

[2] Deliverable numbers in order of delivery dates: D1 – Dn

3 Please indicate the nature of the deliverable using one of the following codes:

R = Report
P = Prototype
D = Demonstrator
O = Other

[4] Please indicate the dissemination level using one of the following codes:

PU = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).
CR = Confidential, parts of the reports only for members of working on the same subject (including the Commission Services)

[5] Month in which the deliverables will be available. Month 1 marking the start of the project, and all delivery dates being relative to this start date.

18	CONTAIN. Interp Synth.	12,13	21	28	R	CR	12
19	CONTAIN. Model Recom	12,13	21	18	R	CR	12
20	CONTAIN.Prog. Revision	12,13	21	10	R	CO	12
21	Progress Report on Source Term (ST) activities	14-16	1*	3	R	CO	12
22	ST Exp. Recom	14-16	1*	10	R	CO	12
23	ST Interp Synth.	14-16	1*	28	R	CR	12
24	ST Model Recom	14-16	1*	18	R	CR	12
25	ST Prog. Revision	14-16	1*	10	R	CO	12
26	Annual progress report	20	1	6	R	CO	12
27	JPA update	20	1	4	R	CO	12
28	Budget Revision	20	1	1	R	CO	12
29	Cost statements	20	1	1	R	CO	12
30	ASTEC Assessment Report	3	1	100	R	CR	15
31	ASTEC Evaluation Report	4	1-23	100	R	CR	15
32	SA Course	17	32	12	R	PU	15
33	NEPTUNO Particip.	17	32	2	R	PU	15
34	ASTEC V2 dev. Plan	2	1-23	12	R	RE	18
35	ASTEC adaptation to SARNET users needs, specifications	2	1	30	R	CO	18
36	Status Report on PSA2, methodology	5	1	15	R	RE	18
37	Status Report on PSA2, uncertainty assessment	5	1	15	R	RE	18
38	Status Report on PSA2, event tree	5	1	15	R	RE	18
39	Experimental Data Base Catalogue	6	28	21	R	CO	18
40	Revision of EURSAFE Conclusions	7	23	30	R	PU	18
41	PSA2 Course	17	32	12	R	PU	18
42	Book, skeleton	18	32	12	R	RE	18
			TOTAL	669			

* The lead of ST activities is temporally attributed to the contractor 1, this attribution should be changed before or during execution of the first JPA.

10 Project resources and estimation of incurred eligible costs

10.1 Efforts for the full duration of the project

Network Effort Form 1[6] - Indicative efforts for full duration of project

Project Number (acronym) - 509065 (SARNET)

Figures followed by a * concern the organisations responsible for coordination of Topics in SARNET (during the duration of the project, these responsibilities may change, and this will modify the efforts provided by concerned organisations).

Network Activity Type	**Joint Programme of Activities**[7]			**Management activities**	TOTAL per PARTICIPANT
	Integrating Activities[8]	Jointly executed research activities[3]	Spreading of Excellence activities[3]		
1. IRSN *	158	36	8	72	274
2. AEAT		12			12
3. AEKI	12	12			24
4. ARCS	12				12
5. AVN	8				8
6. BUTE	48				48

[6] Indicate effort in person months
[7] 'other specific activities' according to Article II.25 of Annex II to the contract
[8] except management of the consortium activities

7. CEA *	78	48	8	12	146
8. CESI		12			12
9. Chalmers		12			12
10. CIEMAT	24	12			36
11. CSN	24				24
12. DEMOKRITOS		2	8		10
13. UPI	48	12			60
14. EA	20				20
15. EDF	24	36			60
16. ENEA	48	24			72
17. FORTUM	12	4			16
18. FRA ANP SAS	10				10
19. FRA ANP-Gmbh	8	24			32
20. FZJ		12			12
21. FZK *	72	36	8	12	128
22. FZR		12	4		16
23. GRS *	102	36	8	4	150
24. IUSTT-IKE	52	24	8		84

25. INR	54	12	4		70
26. INRNE	48				48
27. IVS	36				36
28. JRC-ISPRA *	12				12
29. JRC-ITU		24			24
30. JRC-PETTEN	54	24			78
31. JSI	24	12			36
32. KTH *	65	24	12	8	109
33. LEI	54	12	8		74
34. NNC	8				8
35. NRG	12	8			20
36. PSI	6	24	4		34
37. RUB		24	8		32
38.					
39. SWEDPOWER	12				12
40. TA		12			12
41. THERMODATA	3	12			15
42. TE	16				16

43. TUS	54	24	8		86
44. ULB	12				12
45. UCL		12			12
46. UJD	28				28
47. UJV	30	24			54
48. UPM		24			24
49. VEIKI	48	12			60
50. VTT	8	24			32
51. VUJE	50				50
52. BTech		24			24
TOTAL per ACTIVITY Type	1404	692	96	108	
Overall TOTAL efforts					2294

WARNING: This table has been established with the assumption that during the duration of the contract there is no changing in organizations (*) responsible of coordinating domains or managing databases or information systems.

10.2 Efforts for the first 18 months

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 1 IRSN	Participant 2 AEA-T	Participant 3 AEKI	Participant 4 ARCS	Participant 5 AVN	Participant 6 BUTE	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							
USTIA	13.5			1		3	17.5
PHYMA	9			3.5		15	27.5
RAB	9						9
PSA2	4.5				2.5		7
IED	4.5		4.5				9
SARP	3						3
IA *	0						0
Jointly executed research activities							
CORIUM	4.5						4.5
CONTAINMENT	4.5						4.5
SOURCE TERM	9	4.5	4.5				18
Spreading of Excellence activities							
ET	1						1
BOOK	1						1
MOB	1						1
TOTAL JPA	56.5	4.5	9	4.5	2.5	18	103
Management Activities							
MANAG	27 **						27
TOTAL Management	27						27
TOTAL per PARTICIPANT	91.5	4.5	9	4.5	2.5	18	
Overall TOTAL EFFORTS							130

* the corresponding efforts are counted in the coordination tasks of each topic.

** this effort covers the coordination of Source term activities during the first JPA. Another participant could take this effort in charge.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) – 509065 (SARNET)

	Participant 7 CEA	Participant 8 CESI	Participant 9 Chalmers	Participant 10 CIEMAT	Participant 11 CSN	Participant 12 DEMOKRITOS	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							
USTIA	12			0.5	0.5		30.5
PHYMA	6			8.5			42
RAB					6		15
PSA2	2.5				2.5		12
IED	4.5						13.5
SARP	3						6
IA *	0						
Jointly executed research activities							
CORIUM	9						13.5
CONTAINMENT	4.5						9
SOURCE TERM	4.5	4.5	4.5	4.5		0.5	36.5
Spreading of Excellence activities							
ET	1			1		0.5	3.5
BOOK				1		1	3
MOB	1			1		1	4
TOTAL JPA	48	4.5	4.5	16.5	9		188.5
Management Activities							
MANAG	4.5						31.5
TOTAL Management	4.5						31.5
TOTAL per PARTICIPANT	52.5	4.5	4.5	16.5	9	3	
Overall TOTAL EFFORTS							220

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 13 UPI (Pisa Univers.)	Participant 14 EA	Participant 15 EDF	Participant 16 ENEA	Participant 17 FORTUM	Participant 18 FRA ANP SAS	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							
USTIA	3	1	0.5	2		0.6	37.6
PHYMA	9		4	8			63
RAB	6	6.5		8		3	38.5
PSA2			2.5				14.5
IED					4.5		18
SARP			3				9
IA *							
Jointly executed research activities							
CORIUM			4.5	4.5			22.5
CONTAINMENT	4.5		3				16.5
SOURCE TERM			4.5	4.5	1.5		47
Spreading of Excellence activities							
ET							3.5
BOOK							3
MOB	1						5
TOTAL JPA	23.5	7.5	22	27	6	3.6	278.1
Management Activities							
MANAG							31.5
TOTAL Management							31.5
TOTAL per PARTICIPANT	23.5	15	22	27	6	3.6	
Overall TOTAL EFFORTS							309.6

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2- 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 19 FRA ANP-Gmbh	Participant 20 FZJ	Participant 21 FZK	Participant 22 FZR	Participant 23 GRS	Participant 24 IUSTT-IKE	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT					5		5
USTIA			1		11	1	50.6
PHYMA			8.5		8	8.5	88
RAB			8.5		8	8.5	63.5
PSA2	2.5				2.5		19.5
IED			3.5				21.5
SARP			3		4.5		16.5
IA *							
Jointly executed research activities							
CORIUM	3.6		4.5	4.5	4.5	4.5	44.1
CONTAINMENT		4.5	9		4.5	4.5	39
SOURCE TERM	4.5				4.5		56
Spreading of Excellence activities							
ET				1	1		5.5
BOOK					1		4
MOB					1	1	7
TOTAL JPA	10.6	4.5	38	5.5	46.5	28	420.2
Management Activities							
MANAG			4.5		1.5		37.5
TOTAL Management			4.5		1.5		37.5
TOTAL per PARTICIPANT	10.6	4.5	42.5	5.5	56	28	
Overall TOTAL EFFORTS							457.7

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 25 INR	Participant 26 INRNE	Participant 27 IVS	Participant 28 JRC ISPRA	Participant 29 JRC ITU	Participant 30 JRC PETTEN	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							5
USTIA	9	9	0.5			2	71.1
PHYMA	3		2			16	109
RAB	6	9	7.5				86
PSA2	2.5					2.5	24.5
IED				4.5			26
SARP							16.5
IA *							
Jointly executed research activities							
CORIUM					4.5		48.6
CONTAINMENT						4.5	43.5
SOURCE TERM	4.5				4.5	4.5	69.5
Spreading of Excellence activities							
ET							5.5
BOOK							4
MOB	1						8
TOTAL JPA	26	18	10	4.5	9	29.5	517.2
Management Activities							
MANAG							37.5
TOTAL Management							37.5
TOTAL per PARTICIPANT	26	18	10	4.5	9	29.5	
Overall TOTAL EFFORTS							554.7

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 31 JSI	Participant 32 KTH	Participant 33 LEI	Participant 34 NNC	Participant 35 NRG	Participant 36 PSI	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							5
USTIA	2	2	8		1		84.1
PHYMA	7	8	5				129
RAB		8	5		4		103
PSA2			2.5	2.5		2.5	32
IED		4.5					30.5
SARP		3					19.5
IA *							
Jointly executed research activities							
CORIUM		4.5				4.5	57.6
CONTAINMENT	4.5	4.5	4.5		2.5		59.5
SOURCE TERM						4.5	74
Spreading of Excellence activities							
ET		2				1	8.5
BOOK		1	1				6
MOB		1.5					9.5
TOTAL JPA	13.5	39	26	2.5	7.5	12.5	618.2
Management Activities							
MANAG		3					40.5
TOTAL Management		3					40.5
TOTAL per PARTICIPANT	13.5	42	26	2.5	7.5	12.5	
Overall TOTAL EFFORTS							658.7

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 37 RUB	Participant 38	Participant 39 SWEDPOWER	Participant 40 TECHNICATOME	Participant 41 THERMODATA	Participant 42 TRACTEBEL	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							5
USTIA						1	85.1
PHYMA							129
RAB						3.5	106.5
PSA2			2.5				34.5
IED							30.5
SARP							19.5
IA*							
Jointly executed research activities							
CORIUM	4.5			1.5	4.5		68.1
CONTAINMENT	4.5						64
SOURCE TERM							74
Spreading of Excellence activities							
ET	1				1		10.5
BOOK	1						7
MOB							9.5
TOTAL JPA	11		2.5	1.5	5.5	4.5	643.2
Management Activities							
MANAG							40.5
TOTAL Management							40.5
TOTAL per PARTICIPANT	11		2.5	1.5	5.5	4.5	
Overall TOTAL EFFORTS							683.7

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 43 TUS	Participant 44 ULB	Participant 45 UCL	Participant 46 UJD	Participant 47 UJV	Participant 48 UPM	TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							5
USTIA	8			0.75	2		95.85
PHYMA	5				3		137
RAB	5			10	4		125.5
PSA2	2.5	2.5			1.5		41
IED							30.5
SARP	3						22.5
IA *							
Jointly executed research activities							
CORIUM					4.5	4.5	77.1
CONTAINMENT	4.5					4.5	73
SOURCE TERM	4.5		4.5				83
Spreading of Excellence activities							
ET	1						11.5
BOOK	1						8
MOB	1						10.5
TOTAL JPA	35.5	2.5	4.5	10.75	15	9	720.45
Management Activities							
MANAG							40.5
TOTAL Management							40.5
TOTAL per PARTICIPANT	35.5	2.5	4.5	10.75	15	9	
Overall TOTAL EFFORTS							760.95

* the corresponding efforts are counted in the coordination tasks of each topic.

Network Effort Form 2 - 18 months period, month 1 - 18

Project Number (acronym) - 509065 (SARNET)

	Participant 49 VEIKI	Participant 50 VTT	Participant 51 VUJE	Participant 52 BTech			TOTAL ACTIVITIES
Joint Programme of Activities							
Integrating activities							
ACT							5
USTIA	0.5		2				98.35
PHYMA	3.5						140.5
RAB	14		16				155.5
PSA2	2.5						43.5
IED							30.5
SARP		2					24.5
IA *							
Jointly executed research activities							
CORIUM		4.5					81.6
CONTAINMENT	4.5			4.5			82
SOURCE TERM		4.5		4.5			92
Spreading of Excellence activities							
ET							11.5
BOOK							8
MOB							10.5
TOTAL JPA	25	11	18	9			783.45
Management Activities							
MANAG							40.5
TOTAL Management							40.5
TOTAL per PARTICIPANT	25	11	18	9			
Overall TOTAL EFFORTS							823.95

* the corresponding efforts are counted in the coordination tasks of each topic.

10.3 EC contribution for the full duration of the project

Contract Preparation Forms

EUROPEAN COMMISSION

6th Framework Programme for Research, Technological Development and Demonstration

Network of Excellence

A3.1

Proposal Number	509065	Proposal Acronym	SARNET

Estimated breakdown of the requested EC contribution per reporting period			
Reporting Periods	**Month x – Month y**	**Requested Grant for Integration**	
		Total	**In which first six months**
Reporting Period 1	M1 – M12	1 570 000	
Reporting Period 2	M13-M24	1 570 000	785 000
Reporting Period 3	M25-M36	1 570 000	785 000
Reporting Period 4	M37-M48	1 570 000	785 000
Reporting Period 5	M49-M60		
Reporting Period 6	M61-M72		
Reporting Period 7	M73-M84		
Total	Full duration	6 280 000	

Estimated costs of the Joint Programme of Activities	
Estimated costs for the full duration	24 352 520 EURO
Estimated costs for the first 18 months	9 376 353 EURO

Contract Preparation Forms

EUROPEAN COMMISSION

6th Framework Programme on Research, Technological Development and Demonstration

Network of Excellence

A3.2

Proposal Number	509065	Proposal Acronym	SARNET

Number of researchers to be integrated (Network of Excellence)

Participant n°	Participant short name	Number of researchers to be integrated			Number of doctoral students to be integrated in the network			Maximum allowable EC contribution for project duration
		Female	Male	Total	Female	Male	Total	
1	IRSN	3	25	28	1	3	4	
2	AEAT	1	1	2				
3	AEKI		3	3				
4	ARCS		1	1				
5	AVN		2	2				
6	BUTE		1	1		1	1	
7	CEA	4	14	18				
8	CESI		1	1				
9	Chalmers		1	1		1	1	
10	CIEMAT	1	1	2	1		1	
11	CSN		3	3				
12	Demokritos		2	2		1	1	
13	UPI		2	2				
14	EA		1	1				
15	EDF	1	3	4				
16	ENEA	1	4	5				
17	FORTUM	1	1	2				
18	FANP SAS		1	1				
19	FANP Gmbh		3	3				
20	FZJ		1	1		2	2	
21	FZK	2	14	16				
22	FZR		2	2				
23	GRS		9	9				
24	IUSTT-IKE		6	6		2	2	
25	INR	1	5	6				
26	INRNE	3	1	4				
27	IVS		2	2				
30	EC-JRC		7	7				
31	JSI		2	2				
32	KTH	1	8	9		2	2	
33	LEI		5	5		5	5	
34	NNC	1	1	2				
35	NRG		2	2				

Contract Preparation Forms

EUROPEAN COMMISSION

6th Framework Programme on Research, Technological Development and Demonstration

Network of Excellence

A3.2

Proposal Number	509065	Proposal Acronym	SARNET

Number of researchers to be integrated (Network of Excellence)

Participant n°	Participant short name	Number of researchers to be integrated			Number of doctoral students to be integrated in the network			Maximum allowable EC contribution for project duration
		Female	Male	Total	Female	Male	Total	
36	PSI		3	3				
37	RUB		2	2		2	2	
39	SWP		1	1				
40	TA		1	1				
41	Thermodata		2	2				
42	TE	1		1				
43	TUS		6	6	1	1	2	
44	ULB		1	1	1		1	
45	UCL		1	1				
46	UJD	1	1	2				
47	UJV		3	3		1	1	
48	UPM		2	2				
49	VEIKI		3	3				
50	VTT	2	1	3				
51	VUJE		2	2				
52	BTech		2	2				
Total		24	166	190	4	21	25	14 000 000,00

The total number of researchers and doctoral students to be integrated are 190 and 25, respectively (see table A3.2) and, therefore, the maximum allowable EC contribution for the duration of this NoE is 14.000.000 Euro. However, the total EC contribution requested by the consortium for the total activities envisaged in the contract is 6.280.000 Euro. The estimated breakdown for the EC contribution is shown in Table A3.1 (page 99).

10.4. Project management level description of resources and grant

The two following tables describe the resources needed to carry out the Joint Programme of Activities, respectively for the first 18 months period and for the total duration of the contract (48 months).

For the first JPA (18 months)

3 kinds of expenses are considered:

- man power, it has been evaluated starting from the estimation given in § 10.2, with a lump value of the man-year cost (125000 €/year)
- travel for mission, with an average cost of 750€ per mission
- other expenses related to:
    - support of ASTEC users, one part of this activity will required a subcontract of 1m-y/y (125000€)
    - a sub contract for specific development for the ACT (provision of 50000€)
    - the organisation of one SARNET conference (50000€)
    - mobility; it has been evaluated to 20000 €

The total expenses will be around 9 M€.

For the total duration of the contract

We made the following assumptions:

- no significant changes in the investigated domains, and in the number of organisation participating to each one;
- 1 m-y/y for the coordinator;
- 2 m-y/y for support, training of users and model implementation in ASTEC (1 of the 2 m-y is provided via a sub contract);
- 1.5 m-y/y for the coordination of scientific and excellence spreading activities;
- 0.25 m-y/y for the management (and user-training) of the experimental data base;
- 0.25 m-y/y for the management of the information system (ACT);
- 0.66 m-y/y/participant to ASTEC activities;
- 0.25 m-y/y/participant to each one of the following activities: Corium, Containment, Source Term,
- 0.15 m-y/y/participant for Research priorities
- 0.15 m-y/y/participant to level2 PSA activities;
- 0.15 m-y/y/participant to excellence dissemination activities

We kept the same assumption as above for ACT possible sub-contract.
We assumed the holding of 2 SARNET conferences.

The total expenses will be around 24M€.

JPA COST FOR THE FIRST 18 MONTHS PERIOD (JPA1)

Activities	Nb of organisations	Nb of correspondents per organisation	Nb of meetings within the first 18 months	Meeting cost	Nb of men-months	Manpower cost	Other costs	Total	
ACT development				0		0	50000	50000	
Electronic network administration	1	1	2	1500	5	52085		53585	
ASTEC user support	2				18	187506	187506	375012	
ASTEC WPs	28	1	3	63000	376,35	3920437,95		3983437,95	
Level 2 PSA	17	1	3	38250	43,5	453139,5		491389,5	
Exp. Data Base Administration	1	1	1	750	4,5	46876,5		47626,5	
Exp. Data Feeding	5	1		0	26	270842		270842	
Research priorities	8	2	2	24000	24,5	255216,5		279216,5	
Integration Monitoring	7			0	0	0		0	
				0					
Corium WPs	18	2	3	81000	81,6	850027,2		931027,2	
Containment WPs	19	2	3	85500	82	854194		939694	
Source Term WPs	21	2	3	94500	92	958364		1052864	
								0	
Education & training	12	1	2	18000	19,5	203131,5		221131,5	
Mobility programme	10	1	0	0	10,5	109378,5	20000	129378,5	
Management team	7	1	3	15750	40,5	421888,5		437638,5	
Governing board meetings	49	0,66	2	48510				48510	
Advisory committees meetings	10	1	2	15000				15000	
SARNET CONFERENCES (1)							50000	50000	
Total				485760	823,95	8583087,15	257506	9376353,15	

Lump cost of one man-month (€)	10417
Lump cost of one participation /meeting €	750

SARNET JPA COST (€)	9376353,15

JPA FULL COST FOR THE CONTRACT DURATION (4 years)

Activities	Nb of organisations	Nb of correspondents per organisation	Nb of meetings per year	Meeting cost	Nb of men-years/year	Manpower cost	Other costs	Total
ACT development				0		0	50000	50000
Electronic network administration	1	1	1	3000	0,25	125000		128000
ASTEC user support	2				1	500000	500000	1000000
ASTEC WPs	28	1	2	168000	18,98	9490000		9658000
Level 2 PSA	17	1	2	102000	2,55	1275000		1377000
Exp. Data Base Administration	1	1	1	3000	0,25	125000		128000
Exp. Data Feeding	5	1		0	1,25	625000		625000
Research priorities	8	2	1	48000	1,2	600000		648000
Integration Monitoring	7			0	0	0		0
				0				
Corium WPs	18	2	2	216000	4,75	2375000		2591000
Containment WPs	19	2	2	228000	5	2500000		2728000
Source Term WPs	21	2	2	252000	5,5	2750000		3002000
								0
Education & training	12	1	1	36000	1,45	725000		761000
Mobility programme	10	1			0,5	62500	60000	122500
Management team	7	1	2	42000	2,5	1250000		1292000
Governing board meetings	49	0,66	1	97020				97020
Advisory committees meetings	10	1	1,5	45000				45000
SARNET CONFERENCES (2)							100000	100000
Total				1240020	45,18	22402500	610000	24352520

Lump cost of one man-year (€)	125000
Lump cost of one participation /meeting €	750

SARNET JPA COST (€)	24352520

Appendix A- Consortium description

A.1 Participants and consortium

A few organizations are covering a wide range of competence though not complete, whereas others are specialized in very specific areas and thus complementarities are developing. Overall, it is estimated that the critical mass of competence for performing experiments needed in the severe accident domain, analysing them, developing models and integrating them in the ASTEC code are met for most types of NPPs in Europe. Associated Candidate Countries are appropriately associated to most projects. Furthermore, SARNET will network a strong competence in Level 2 PSAs.

Thus SARNET will be the crucible for an horizontal type of integration of a vast range of multidisciplinary activities with two main end-products: the integral code ASTEC and Level 2 PSA guidelines.

The consortium comprises most of the actors involved in severe accident research in Europe:

IRSN:
It groups together more than 1 500 experts and researchers. IRSN carries out research, analysis and work within the fields of nuclear safety, protection against ionising rays, the control and protection of nuclear materials and protection against acts of malevolence. IRSN will play an active role in providing information to the public within its fields of expertise: nuclear and radiological risks.
In the domain of severe accidents IRSN has more than 20 years of experience. It carried several kinds of R&D activities: in-pile testing (PHEBUS), separate-effects testing, interpretation and modelling, code system development (ICARE, ASTEC), and PSA. Its domains of competence involve fission product chemistry, core degradation, corium modelling, and containment modelling, including hydrogen behaviour and containment thermal hydraulics. It has a large experience in managing international collaborations (PHEBUS, CABRI, ICARE, ASTEC) and EU projects (CIT, COLOSS, ENTHALPY, EVITA, EURSAFE, THENPHEBISP).
The key persons involved are:
J.C. Micaelli, B. Clément, J.P. Van Dorsselaere, D. Jacquemain, P. Giordano, B. Adroguer, R. Gonzalez, F.Fichot, G. Repetto, B. Chaumont, C. Caroli.

AEA-T:
AEA-T is a private sector company, formerly part of the United Kingdom Atomic Energy Authority. It offers solutions based on know-how built-up over 40 years of leading edge science and engineering, first in the nuclear industry, but increasingly for a wide range of industry. Experts of AEA-T have a large experience in the domain of fission products (they participated and coordinated a large number of projects of the 4th and 5th FWP devoted to fission products behaviour). Their involvement in SARNET will address fission product chemistry, in particular the iodine aspects.
The key person involved is:
S. Dickinson

AEKI:
The severe accident related activities of the KFKI Atomic Energy Research Institute in Budapest include both experimental and analytical work. The CODEX (Core Degradation Experiment) facility has been applied to the investigation of VVER and PWR fuel bundles under high temperature accidental conditions. With air ingress conditions the only integral tests were performed here. Small-scale tests series have been carried out to study the interactions of different core materials paying special attention to VVER specific materials and designs. Computer codes have been used for the preparation and evaluation of experiments

and for plant application purposes. The institute participated in several EU projects in the field of severe accident: OPSA, COLOSS, ENHALPY, THENPHEBISP.
The key person involved is:
Dr Zoltan Hozer

ARCS:
The "ARC Seibersdorf research GmbH" is one of the so-called "Austrian Research Centers". This consortium of research centres employs more than 700 persons and designs product and process from drafting to development and testing to industrial application. The centre located in Seibersdorf has developed an experience in the nuclear field (SAM, analysis of severe accident scenarios and related source terms), and has a strong experience in code validation and in VVER 1000 applications, which will be its domain of involvement in SARNET.
The key person involved is:
Dr Gert Sdouz

AVN:
AVN is a neutral and independent control organization, recognized by the Federal Agency for Nuclear Control (FANC) within the framework of the protection of the workers, the population and the environment against the dangers of ionising radiation. With the statute of non-profit institution AVN accomplishes its mission with a work force of approx. 50 high-level experts, receiving permanent further training.
AVN boasts more than 30 years of experience within the nuclear safety and radioprotection areas.
In particular, AVN controls the seven Belgian nuclear power plants and furnishes support and expertise to foreign safety authorities. Its experience is increased through frequent international contacts that allow exchange of information on experience feedback and topical issues, such as modifications of the licensee's organization. It has a large experience in SAM analysis, analysis of accident scenarios and Level 2 PSA.
The key persons involved are:
Pieter De Gelder, Dries Gryffroy, Michel Van Haesendonck

BUTE:
The Institute of Nuclear Techniques (INT) of the Budapest University of Technology and Economics (BUTE) is part of the Faculty of Natural Sciences. The Institute is constituted of two units: the Department of Nuclear Techniques organises the educational tasks of the Institute, whereas the Training Reactor Laboratory operates the Nuclear Training Reactor. The Institute of Nuclear Techniques (INT) is declared as an interuniversity educational and training institution, because of the high-value Nuclear Training Reactor. The main task is to educate the undergraduate, graduate and postgraduate students of the Budapest University of Technology and Economics (BUTE) in different fields of nuclear techniques The INT organises the "Nuclear Techniques" specialisation unit within the education of "engineering physicists". The INT has also its own, accredited PhD program within the framework of the "PhD School", which is being organised together with the Institute of Physics. As part of its educational activity, the INT regularly leads students' scientific projects (TDK), diploma works and PhD works. The Budapest University of Technology and Economics will participate to SARNET through its Institute of Nuclear Techniques and apply to severe accidents its expertise in thermal hydraulics and CFD.
The key person involved is:
Dr. Attila Aszódi.

CEA:
CEA/DEN is the Nuclear Energy Directorate of the French Atomic Energy Commission. Within this directorate, about 5000 staff work on R&D for all the aspects of nuclear energy.
For a long time, the CEA teams have worked on severe accidents, firstly for breeder reactors, then for PWRs. From these studies, a broad expertise has been acquired which can be detailed as follows:

- Long-term experience on operating highly qualified research facilities with different technological background amongst them: small-scale/large-scale, basic phenomena, demonstration of overall processes, real / simulant corium materials … At the present time, CEA operates the largest real material facility in Europe, VULCANO in the PLINIUS platform.
- Expertise on measurement technique.
- Expertise on the physico-chemistry and thermal-hydraulics coupled phenomena.
- Know-how on microanalysis and metallographic investigations.
- Expertise in modelling of the investigated phenomena using different approaches and codes.
- Knowledge on the boundary conditions for real reactor application in existing as well as future reactor plants being currently designed.

Besides these competencies in physics, through the participation in several EC projects from more than 10 years and the coordination of some of them (CSC, EUROCORE, CORIUM EUROCOURSE, PLINIUS…), the CEA severe accident team has now a long-term expertise on organizing and leading multi-partner consortiums for international research programmes.
The key persons involved are:
Dr. J.M. Seiler, G. Ducros, C. Journeau

(Dr. J.M. Seiler, CEA Research Director, is more particularly in charge of the analysis of PWR severe accident studies. He chairs the GAREC group in which experts from CEA, EDF and FRAMATOME discuss R&D related to corium recuperation. He is member of OECD/CSNI MASCA Steering Committee and contributed to the review for the US DOE of the AP 600 core retention report. He has a 25-year experience in nuclear safety started with a PhD thesis on sodium boiling and ranging from safety of nuclear material transport to EPR severe accidents. He is one of the promoters of the coupled approach between physico-chemistry and thermal-hydraulics.)

(Dr. G. Ducros, CEA Research Director, is in charge of fission product studies. He conducted the VERCORS programme in Grenoble in close cooperation with the IRSN experts. Within this programme, he studied the release of fission products from degraded fuel in various conditions including some tests with MOX.)

(Mr. C. Journeau has a 15-year experience in instrumentation and in the analysis of complex experiments. His current field of research is the coupling between heat transfer, physicochemistry and fluid dynamics and corium properties. He stayed one year at JRC Ispra to work on the FARO facility, in which 300 kg of prototypic corium could be melted by direct electrical heating. He is currently the PLINIUS platform scientific officer. He authored 44 peer-reviewed publications and communications. Strong experience on experiments (COLIMA, participation to OECD-MASCA) and modelling on prototypic corium molten pool and debris bed behaviour; both experimental and numerical expertise in the field of containment thermal-hydraulics (MISTRA tests, TONUS development) and hydrogen risk. Expertise also in the area of fission product emission and transport experiments (VERCORS). Previously strongly involved in CIT, CSC, ENTHALPY, ECOSTAR, EUROCORE, EURSAFE,..))

CESI:
CESI is a company operating for more than 40 years in the electro-energetic and environmental sectors in more than 35 countries all over the world. It is a joint-stock company owned by Italian utilities and European industries, a market leader in testing and certification of electromechanical equipment, power system studies and consultancy. The know-how of CESI covers all stages of power system life cycle. Feasibility studies, analysis of industrial processes, development of innovative measurement systems and computer models are part of CESI job. CESI is located in Milan area, employs about 1,000 people and operates several experimental and demonstration plants.
In the NoE, CESI is in charge of modelling in the field of aerosol transport.
The key person involved is:
Dr. Flavio Parozzi.
(Flavio Parozzi was born in 1952 and got a university degree in Nuclear Engineering at Politecnico of Milano, Italy, in 1978. He is a senior researcher at CESI. He has been working on nuclear power researches since early Eighties, participating in both experimental activities regarding radioactive waste

treatment and joining international projects for severe accident studies. In particular, his work has been mainly addressed to safety studies for LWR plants, development of advanced models and computer simulation tools for severe accident analysis, and organization of experimental programs on nuclear safety. Also, he coordinated the construction of complex computer codes and developed original software models. He is presently responsible for safety studies for thermal and nuclear plants and for risk scenarios of industrial plants, managing the development of new thermal-hydraulic and physic-chemical simulation methods in cooperation with utilities, research organizations and universities.)

Chalmers tekniska högskola (Chalmers University of Technology):
The Chalmers University of Technology was founded in 1829. Around 13100 people work and study at Chalmers, including more than 10500 undergraduates. The Chalmers research activities range from mathematics and natural science through engineering, industrial sciences and community development. Sixty departments and divisions are in charge of research and education within natural science and all the engineering science disciplines. Within the domain of Nuclear Science and Engineering, the Department of Materials and Surface Chemistry is a specialist of fission product chemistry, especially iodine behaviour.
The key person involved is:
Pr. Lembit Sihver

CIEMAT:
Since mid eighties, CIEMAT has been involved in several domestic and international projects within the field of nuclear safety. Since the very beginning CIEMAT set up an analytical group in charge of accident simulation by means of using computer codes available at the moment (i.e., CONTAIN, IODE, SPARC, etc.). As a part of their activities they participated in programmes such as OECD-LOFT, LACE, ACE, PHEBUS-CSD, PHEBUS-FP, and others. In the earliest 90's CIEMAT enlarged their capabilities to experimental aspects, and built up an experimental rig essentially devoted to aerosol studies (PECA facility). Since then several research programmes have been undertaken, most of them addressing phenomena involved in cleaning up particle-laden gases, and other facilities have been constructed (i.e., RECA for H_2 recombination studies and GIRS for gaseous iodine removal by sprays).
The key person involved is:
Dr Luis E. Herranz

CSN (Consejo de Seguridad Nuclear):
The Spanish Nuclear Safety Council is the Nuclear Regulatory Organization of Spain. It is an organization independent on the executive power and reporting directly to the Parliament of Spain. It is composed of the five members of the Council as such technically supported by a Technical Regulatory Body lead by a General Secretary and two Board Directors respectively responsible of the Nuclear Safety and Radiological Protection Activities. Within the Nuclear Safety Direction, the Subdirección de Tecnología Nuclear (STN) is responsible among others of PSA licensing and PSA methods development. The Modelling and Simulation Area of STN develops and/or coordinates development of analytical methods and Computer Codes to perform independent safety assessments of Spanish Nuclear Power Plants. It has developed modelling and simulation tools for this purpose now for more than 20 years under different prior CSN organization units. CSN has a large experience in code assessment, reactor scenario analysis and regulation. (Strong experience in MELCOR).
The key person involved is:
José M. Izquiero

DEMOKRITOS:
"Demokritos" National Centre for Scientific Research is the largest research organisation in Greece, consisting of 8 Institutes with a total of more than 800 permanent staff, and covering a wide gamut of scientific research from Nuclear Technology to microelectronics and material science. The Institute of

Nuclear Technology and Radiation Protection (INTRP) operates a 5 MW research reactor. In parallel, research is carried out in the areas of environmental radioactivity, system's reliability, environmental research, and energy research. The Aerosol Group of INTRP conducts theoretical and experimental work on aerosol science and technology, and has a well-established position in the European R&D. The activity, besides serving externally funded projects, is carried out in support to the operational needs of the research reactor and in support to the needs of the nation-wide environmental radioactivity control network. The involved department has a strong experience in the field of aerosol technology and thermal hydraulics (CFD) modelling.
The key persons involved are:
C. Housiadas, K. Eleftheriadis

UPI:
The Department of Mechanical, Nuclear and Production Engineering (DIMNP) is a research structure of the University of Pisa (UPI), with more than 50 academic and research staff members. Since its institution, UPI has been characterised by a strong orientation towards collaborations with Italian and European Industries in applicative research projects with wide scientific and technological significance. The main research activities regard safety analysis in nuclear and conventional fields, management of risk and emergency in industrial plants, characterisation and machining of conventional and innovative materials, design of machines and two- and four-wheel vehicles, and related studies on strength, lubrication, robotics and automation in industrial processes, and rapid prototyping technologies.
Professors and researchers belonging to the Nuclear Engineering Area are traditionally involved in research and teaching activities related to peaceful applications of nuclear energy, with main emphasis on plant design and safety, radiation measurements and reactor physics. The Nuclear Engineering group is continuously involved in researches carried out in cooperation with prestigious international organisations, thus preserving and updating its knowledge and capabilities in the nuclear field, even in a period of nuclear moratoria in the Country.
The Severe Accident group of UPI/DIMNP has a long experience in the field of thermal-hydraulic (both primary system and containment analysis) and on severe accidents analysis. This experience has been gained with autonomous activities and with the participation in different OECD International Standard Problems and EU Projects in past years (COBE; DABASCO, OPSA, INCON, SCACEX, PHEBEN e PHEBEN2). In the past, the same research unit cooperated with ENEL (the Italian Electrical Utility), ENEA (Italian Energy Board) and Westinghouse.
The key persons involved are:
Prof. Francesco ORIOLO, Dr. Sandro PACI.

EA (Empresarios Agrupados Internacional, S.A.):
Empresarios Agrupados is a leading engineering organisation, founded in 1971, in Spain, with a significant international experience, providing a complete range of consulting, project management, engineering and design, procurement, construction management, plant testing, safety assessment, quality assurance, as well as plant operation and maintenance support services to the electric utility industry. EA has provided consultancy and engineering services, and completed projects in Spain and some 35 other countries. The company is ranked by Engineering records News-Record (ENR) among the Top 200 International Design Firms.
In the field of nuclear power generation, EA has been the main or sole engineering, design, licensing, procurement and construction management company in six 1000 MWe nuclear units. EA also provides engineering and support services to all nine nuclear units currently in operation in Spain, as well as to other units abroad. EA is also actively involved in the energy and nuclear safety sectors of the EU Tacis and Phare programmes.
EA has a strong experience in code assessment, reactor scenario analysis and Level 2 PSA (experience in MELCOR and ASTEC); EA actively participated to the EVITA project of the 5th framework programme.
The key person involved is:
M. Antoine Rubbers

EDF (Electricité de France) :
Electricité de France (EDF) was set up in 1946 out of the desire to have a national electrical utility that could help rebuild the country after the Second World War. Since its creation, the company has had the responsibility for generating, transmitting and distributing electricity in France.
The aim of the EDF's R&D Division is to keep electricity costs competitive, prepare the generating facilities of the future, enhance the quality of supply while preserving the environment, as well as to develop innovative solutions with the customer in mind. The variety of these objectives has led EDF to set up a strong R&D function, including multidisciplinary knowledge, and with a balance between basic research and industrial applications. Figures for EDF's R&D activities in 2001: 2464 employees, 70% researchers and executives, 32% women (in majority researchers and executives); 96 teaching researchers, 55 PhD candidates; Participating in 85 European projects during FP5 (among which 12 projects coordinated by EDF)
Specific EDF activities in relation to the project: As EDF operates 58 nuclear reactors; a large part of the R&D programs is devoted to nuclear reactors (safety, fuel, fuel cycle, environment, reactors lifetime, …). The R&D division is divided into 15 branches, each being focused on a scientific domain (for example fluid mechanics and heat transfer, materials, neutronics and information science, …). It develops methods and tools for the engineering and operation needs, and has a strong history in modelling and realising computer softwares. It has a strong collaboration with the CEA, and also, in the field of nuclear safety, with IRSN, but also many collaborations with foreign institutes and universities.
In the field of severe accidents, EDF has research programs in collaboration with the CEA and IRSN on several topics: corium behaviour, core degradation, source term assessment, steam explosion, hydrogen risk. EDF also developed a Level-2 PSA. EDF was involved in the 4th and 5th European programs (CIT, COLOSS, ENTHALPY, EVITA…). EDF also has a strong competency in thermal hydraulics and core degradation modelling (CATHARE, MAAP), and finally, a strong experience in plant applications with severe accident integral codes (MAAP4).
The key persons involved are:
S. Marguet, Y. Dutheillet, F. Duplat

ENEA (Ente per le Nuove tecnologie, l'Energia e l'Ambiente) :
ENEA is a public Italian Organisation responsible of supporting government initiatives toward competitivity and sustainable development in the domains of energy, environment and technology innovation.
In the domain of nuclear applications, it has the responsibility of preserving the scientific and technological knowledge, contributing in the development of innovative systems and in the reduction of the risk associated with nuclear wastes. Since 1998, ENEA is involved in a research program to study the physics and to develop the technologies needed to design an Accelerator Driven System for nuclear waste transmutation, carrying out experimental programmes in Pb/Pb-Bi loops addressed to resolve open technological issues of key-components and systems. ENEA maintains a limited but qualified partnership in several International initiatives on nuclear safety, with specific co-operation agreements (e.g. with IRSN in PHEBUS) or participating in programmes promoted by International Organisations (NEA, IAEA, USNRC). Activities are aimed at maintaining the knowledge on the most relevant methods, solutions and themes related to nuclear fission safety and an adequate domestic capability of evaluating nuclear accident sequences and related risks.
The key persons involved are:
Dr. Massimo Pezzilli, Ing. Giacomino Bandini, Ing. Felice De Rosa, Dr. Nora Davidovitch, Ing. Stefano Ederli, Ing. Sandro Tirini.
(Dr. Pezzili, Assistant of the Director of Unità Tecnologie Fisiche Avanzate , where all the ENEA nuclear research activities are presently located, will act as Contact Person in SARNET. Ing. Bandini and Ing. De Rosa has a multi-annual experience in participating in International Organisation activities (NEA-CSNI WGs) and European Projects (4th and 5th FWPs). Dr. Davidovitch, Ing. Ederli and Ing. Tirini have developed specific competences in severe accident phenomenology analysis, through a direct participation, from the beginning, in the PHEBUS FP test preparation and evaluation.)

FORTUM:
Fortum Nuclear Services Ltd. (former Nuclear Power unit of Fortum engineering and IVO Power Engineering Ltd.) is a nuclear power engineering company fully owned by Fortum Power and Heat Oyj. Fortum Nuclear Services has gained a high level of expertise in its field from Fortum Group's own projects and from numerous assignments abroad. Fortum Engineering provides the Loviisa VVER-440 NPP (owned by Fortum Power and Heat Oy) with technical support services, such as safety analyses, backfitting programmes, and fuel and waste management.
Fortum Engineering has carried out an extensive severe accident research programme for the Loviisa plant since the mid 1980's, which has been supported by Fortum's own experimental and analytical research programmes. The severe accident research programmes have been focused e.g. on in-vessel retention of corium, hydrogen management and fission product retention.
The key persons involved are:
Tomi Routamo, Petra Lunström

FRA ANP SAS (France) and FRA ANP GmbH (Germany):
FRA ANP results from the merging in 2001 of Framatome and Siemens nuclear activities. Framatome ANP is the world leader in the design and construction of nuclear power plants and research reactors, engineering, instrumentation & control, modernisation maintenance and repair services, components manufacture and supply of nuclear fuel. Framatome ANP and its subsidiary Framatome ANP GmbH will both participate to SARNET. They have a large expertise in severe accident scenarios and codes for PWR, BWR and EPR; they built up a large experience in SAM and PSAs. User of various SA codes: MAAP4, MELCOR, ICARE/CATHARE, ASTEC,…. FRA ANP has actively contributed to plant applications in the 5th FP COLOSS project.
The key persons involved are:
A. Caillaux for FRA ANP SAS; M. Fisher and F. Funke for FRA ANP GmbH

FZJ (Forschungszentrum Juelich GmbH):
Forschungszentrum Juelich GmbH is one of the 15 Helmholtz Research Centres in Germany (Helmholtz Community of German Research Centers, HGF). Organised in 39 Institutes, 7 Central Departments, 2 Programme Groups and 3 Project Managements a staff of 4200 work on a broad spectrum of research topics. The research and development programme is guided by the research policy goals of the two partners, the Federal Republic of Germany and the state of North Rhine-Westphalia.
In the area of nuclear safety research the research programme of FZJ addresses the safety issues of devices for control of hydrogen in light water reactors focusing on the application of passive autocatalytic recombiners. The scientific programme includes both experimental and theoretical investigations, thus providing a data base for model validation and aiming at optimising safety concepts as well as the development of new safety directed solutions in such fields where no suitable measures exist. The hydrogen laboratory with several small and medium scale facilities provides excellent possibilities for testing and investigating hydrogen mitigation devices.
The key persons involved are:
Dr. Ernst-Arndt Reinecke

FZK:
The Karlsruhe Research Center (formerly Karlsruhe Nuclear Research Center, KfK) is one of the largest non-commercial science and engineering research institutions in Germany. It works on research and development problems of public interest, exclusively for peaceful purposes, in the fields of technology and the environment. Its "Research for Environmentally Sustainable High Technologies" programme is concentrated on four main areas, Environment, Energy, Microsystems engineering and Fundamental research.
The application-oriented activities of the Center comprise all stages of research, from basic findings to pre-product development. In these fields, the Center cooperates closely with hundreds of partners in science, especially universities, and in industry.

The nuclear research activities in the areas “Safety Research for Nuclear Reactors” and “Safety Research for Nuclear Waste Disposal“ are comprised in the Programme Nuclear Safety Research (NUKLEAR). In the area “Safety Research for Nuclear Reactors”, those accident phenomena are investigated which could lead to the loss of integrity of the reactor containment in the case of a severe accident in a Light Water Reactor. These are especially hydrogen generation, distribution and combustion, steam explosion, in- and ex-vessel corium behaviour, and corium interaction with structural materials. The aim is the development of measures, which effectively control the accident progression and limit release of radioactive materials to the environment to negligible levels.
The Programme Nuclear Safety Research is specialised in the operation of large and mostly unique experimental facilities, supported by analytical and modelling activities. It participated successfully with its experienced research teams in numerous projects in the 4th and 5th EC Framework Programmes and contributed in a fundamental manner to the safety design of the European Pressurized Water Reactor (EPR). It further co-operates with many organisations worldwide. It is therefore well positioned to provide significant contributions to the European research activities in the severe accident field in the frame of a Network of Excellence.
The key persons involved are:
Dr. Hans Alsmeyer, Wolfgang Breitung, Martin Steinbrück, Dankward Struwe

(Dr. Hans Alsmeyer scientific career:

University	Technical University of Karlsruhe (TH), Chemical Engineering (Dipl.-Ing.)	1962-1968
PhD	Technical University of Karlsruhe, Fluid Mechanics/Mechanical Engineering 'Measurement of the Structure of Shock Waves in Argon and Nitrogen'	1968-1974
Further Position	Scientist, Forschungszentrum Karlsruhe	since 1975
Current Position	Head of Section 'Core Melt', IKET	since 1984)

(Dr. Wolfgang Breitung scientific career:

University	University of Darmstadt, Bachelor in Mathematics and Physics	1966-1968
	Technical University of Karlsruhe, Master in Physics	1968-1972
PhD	Technical University of Karlsruhe, Nuclear Engineering 'Evaporation kinetics of nuclear oxide fuels and effects on fissile distribution in irradiated fuel pins'	1972-1976
Further Position	Scientist, Forschungszentrum Karlsruhe	since 1977
Current Position	Head of Section 'Flow and Combustion Engineering', IKET	since 2000)

(Dr. Martin Steinbrück scientific career:

University	Friedrich-Schiller-Universität Jena, Chemistry, Dipl.-Chem.	1981-1986
PhD	Friedrich-Schiller-Universität Jena, Solid State Chemistry 'Investigations of electronically conducting oxide systems containing TiIII and TiIV'	1986-1989
Post-Doc	Research centre of Microelectronic Company Erfurt, X-ray diffraction lab	1990
Further Position	Scientist, Forschungszentrum Karlsruhe	1991-1996
Current Position	Head of Group 'High temperature separate-effects tests', IMF I	since 1997)

(Dr. Dankward Struwe scientific career:

University	Technical University of Berlin, Faculty of Mechanical Engineering	1961-1967
PhD	Technical University of Karlsruhe, Faculty of Mechanical Engineering	1977
Further Positions	Chairman of the 'Whole Core Accidents Codes Group', of the 'Fast Reactor Co-ordinating Committee' of the EC	1978–1989
	External Scientific Member of the advisory group	1978–1991

	'Sodium Cooled Reactors' of the 'German Reactor Safety Commission'	
	Member of the 'Safety Advisory Board' for review of the KNK II Operation	1982–1991
	Member of the 'ad hoc advisory board' for the German Ministry of the Interior for safety features of breeder reactors	1983-1985
	Scientific advisor to the TÜV Rheinland	1984–1985
	External scientific member of the advisory group 'Light Water Reactors' of the 'German Reactor Safety Commission	1990–1999
	Member of the French 'Comité d'Expert Phenix'	1990-1998
	Scientist, Forschungszentrum Karlsruhe	since 1967
Current Position	Head of Section 'System Dynamics and Analyses', IRS	since 1972)

FZR:
The Institute of Safety Research is one of the five scientific institutes of Forschungszentrum Rossendorf e.V. (FZR). The work of the institute is directed to the assessment and enhancement of the safety of technical plants and to the increase of the effectiveness and environmental sustainability of those facilities. Subjects of investigations are equally nuclear plants and installations of process industries. FZR has strong experience on modelling of mechanical failure of the reactor vessel and of use of finite element codes. In the frame of the SARNET network FZR will contribute to the Work package 12 (vessel failure and corium release into cavity).
The key person involved is:
Dr. Eberhard Altstadt

GRS (Gesellschaft für Anlagen- und Reaktorsicherheit mbH):
GRS is Germany's central scientific-technical expert organisation for all issues related to nuclear safety and nuclear waste management. Its task is to provide scientific results and methods and develop them further for the purpose of protecting man and environment from technical hazards and risks. The work of GRS is based on the international state of the art.
The technical competence of GRS is founded on the organisation's own research and development activities, technical analyses and the evaluation of operating experience of technical plants and facilities as well as on co-operation with numerous international organisations. Among the staff of GRS there are specialists for all relevant technical fields, enabling the organisation to make comprehensive safety assessments of complex systems.
The work of GRS serves for the benefit of the general public. GRS is therefore recognised as a non-profit organisation. GRS has about 500 staff members, who which about 300 are scientists and engineers.
The expertise of GRS in the field of severe accidents is result of a continuous participation in international organisations, working groups and code benchmarks, the successful development and validation of well-known codes like ATHLET/ATHLET-CD, COCOSYS and ASTEC (together with IRSN), and an active role in related research activities in Germany. GRS has specific experience in thermal hydraulics and core degradation modelling steam explosion, hydrogen risk and Level 2 PSAs for PWRs and BWRs
The key persons involved are:
Dr. Hans-Josef Allelein, Dr. Horst Löffler, Wolfgang Luther, Bernd Schwinges, Dr. Martin Sonnenkalb, Dr. Claus Spengler, Dr. Klaus Trambauer, Dr. David Beraha.

IUSTT-IKE (Institut für Kernenergetik und Energiesysteme, IKE, Stuttgart University):
Founded in 1829, the Stuttgart University is one of Germany's largest institutions for academic education and research. The university is organised in 10 faculties with 140 Institutes and employs about 5000 people. At present, about 18500 students are educated. Research and education in the nuclear energy field mainly is concentrated at the Institute for Nuclear Energy and Energy Systems (IUSTT-IKE). IUSTT-IKE has more than 30 years of expertise and active experience in theoretical and experimental research especially in the fields of reactor physics, heat transfer and nuclear reactor safety. IUSTT-IKE has carried

out numerous research projects sponsored by the industry, the German government and the EU in the field of severe reactor accidents. E.g., IUSTT-IKE has been an important and reliable partner in the ARVI, COLOSS, ECOSTAR, EVITA, EUROCORE and EURSAFE projects of the 5th FP, IUSTT-IKE has a strong experience on thermal hydraulics and core degradation modelling (ATHLET-CD). Special fields of experience and code development in this frame concern melting in complex structures (MESOCO), debris coolability (DEBRIS experiments and WABE code), break-up of melt jets and vapour explosions.
The key persons involved are:
Prof. G. Lohnert, head of IUSTT-IKE, and M. Bürger, head of reactor safety division at IUSTT-IKE.

INR (Institute For Nuclear Research – Pitesti – Romania):
The Institute for Nuclear Research is the main nuclear power R&D organization in Romania with over 30 years of activity in the nuclear energy field, deeply involved in the management and execution of the R&D National Nuclear Power Program.
The main activities cover a large spectrum of nuclear energy: nuclear safety, designing, manufacturing and testing of nuclear fuels, ageing mechanisms of structural materials, irradiation technologies and radioisotopes production in a TRIGA 14MW research reactor, instrumentation and control, environmental protection, radioactive waste and spent fuel management.
Nuclear safety research is one of the most important technical areas covered by the Institute. It includes the development and application of models and computer codes for deterministic accident analysis, probabilistic safety assessment, reactor physics, nuclear fuel and reactor components behaviour in accident conditions, mainly devoted to CANDU PHWR nuclear power plant.
The key persons involved are:
Ilie TURCU and Andrei RIZOIU

INRNE:
The Institute for Nuclear Research and Nuclear Energy (INRNE) of the Bulgarian Academy of Sciences is founded in 1972 carrying the main part of activities of the former Institute of Physics with Atomic Research Centre. INRNE is the leading Bulgarian Institute for fundamental and applied researches in the field of elementary particles and nuclear physics, high energy physics and nuclear energy, radiochemistry, radioactive wastes treatment, monitoring of the environment, nuclear instruments development and so on. The Institute's staff of about 350 (150 of them are scientific researchers) works in more than 30 research groups. Five basic installations are commissioned at the INRNE. Experience in DBA and BDBA safety analysis. Strong experience in the development and assessment of VVER-440 and -1000 databases.
The key person involved is:
Dr. Pavlin Grudev., Head of Nuclear Power Plant Safety Analyses Laboratory

IVS:
Inžinierska výpočtová spoločnosť Trnava, s.r.o. (Company for Engineering Calculations Trnava, Ltd) is company working in the field of computational modelling of DBA and BDBA of VVER reactors. Main computational tools used are RELAP5, MAAP4-VVER and ASTEC V1 codes. Recent activities relevant to SARNET project are: involvement in 5th Framework Programme (projects EVITA, IMPAM-VVER, VERSAFE); support analysis for the SAMG preparation devoted to hydrogen production and hydrogen management during severe accidents of VVER-440/V213; feasibility studies devoted to application of in-vessel corium retention concept via reactor cavity flooding for VVER-440/V213 units; involvement in the IAEA activities devoted to accident analysis of VVER NPPs; bilateral co-operation with IRSN on ASTEC assessment (TMI-2 analysis).
The key persons involved are:
Peter Matejovic (PhD), Miroslav Barnak (PhD). Strong experience of VVER-440 type reactors and of ASTEC use. Have actively participated to the EVITA project of the 5th framework programme

JRC:
JRC has strong experience in development, maintenance and training of the scientific database STRESA. An excellent experimental knowledge on core material interactions with irradiated fuel (dissolution and melting points). It is strongly involved in post-test examinations of Phébus bundle degradation and in the interpretation of these tests. All relevant processes on core degradation, the behaviour of fission products and aerosols as well as the FP chemistry in the containment are analysed using SA codes – mainly with ASTEC. Also strong experience exists on the modelling of hydrogen combustion as well as on fuel dissolution, on uncertainty and sensitivity analysis and statistical data analysis in PSA. JRC was involved in all the EU shared cost actions related to the research activities mentioned above.
JRC ISPRA: Development, maintenance and training of the STRESA database.
JRC ITU: Strong experience on experiments on core material interactions with irradiated fuel (dissolution and melting points). Previously strongly involved in CIT, and COLOSS projects. Strongly involved also in post-test examinations of Phébus bundle degradation.
JRC PETTEN: Strong experience on core degradation, on the behaviour of fission products and aerosols, on hydrogen combustion as well as on uncertainty and sensitivity analysis and statistical data analysis in PSA. Very good knowledge of ASTEC, has participated actively to the EVITA project of the 5th FP. Chairs the Bundle Interpretation Circle of the Phébus programme. Involved in the PHEBEN-2, COLOSS, ICHEMM, HYCOM projects.
The key persons involved are:
A. Annunziato, K.Mueller, D.Bottomley

JSI:
The Jozef Stefan Institute is an internationally highly regarded institution in the fields of natural and technical sciences. The Department of Reactor Engineering is engaged in basic and applied research in the fields of nuclear engineering and safety. Topics include modelling of basic thermal-hydrodynamic phenomena, thermal-hydraulic safety analyses of design-basis and severe accidents, structural safety analyses and probabilistic safety assessment. Most research activities are part of international cooperation programs. In the field of severe accidents, researchers from the department are being actively involved in the modelling and analysis of experiments performed in the PHEBUS, QUENCH, QUEOS, KAEVER, TOSQAN and MISTRA facilities. Besides, our own computer code ESE is being developed for simulating the steam explosion premixing phase. The integral computer codes MELCOR and CONTAIN are used for safety analyses of the Krsko (Slovenia) 2-loop Westinghouse PWR NPP.
The key persons involved are :
Dr. Matjaz Leskovar (contact person), Dr. Ivo Kljenak

KTH:
The Royal Institute of Technology (Kungliga Tekniska Högskolan), KTH, is responsible for one-third of Sweden's capacity for engineering studies and technical research at post-secondary level. The university has over 11,000 undergraduate students, 1,500 active postgraduate students and a staff of 3,100 people.
KTH conducts top-notch education and research of a broad spectrum – from natural science to all branches of technology, including architecture, industrial economics, urban planning, work science and environmental technology. Apart from research performed at our departments, a large number of competence centres are housed here at KTH and we contribute to another three national ones. Strategic research foundations are also funding other research programmes or graduate schools. Continuing education is also an important part of our activities. KTH has a strong experience on experiments with simulant materials (SIMECO, FOREVER, POMECO) and modelling on corium molten pool and debris bed coolability, as well as vessel mechanical failure.
The key person involved is:Pr. Raj Sehgal

LEI (Lithuanian Energy Institute):
Lithuanian Energy Institute was established in 1956 as the Institute of Energy and Power Engineering of the Lithuanian Academy of Sciences. At present LEI is a technical research centre dealing with nuclear

safety of Ignalina NPP, energy related research in thermal physics and fluid mechanics, development of energy planning methods, research of safety and reliability of power plants and their effects on thermal behaviour of cooling pools, studies of refectories and chemically resistant materials, simulation of complex energy systems. The Institute encompasses 10 research laboratories, Energy Efficiency and Information Centre, Information Department with library, Metrological Service. Main department carrying out work: Laboratory of Nuclear Installation Safety. Main activity of the laboratory: the deterministic and probabilistic safety analysis of Ignalina NPP, participation in national and international projects related to NPP safety.
The key persons involved are:
Prof. dr. habil. Eugenijus Uspuras, head of Laboratory of Nuclear Installation Safety, chief research associate, chairman of Council of Lithuanian Energy Institute.
Dr. habil. Algirdas Kaliatka, senior research associate.

NNC:
NNC Holding Limited is a leading international and independent engineering consultancy. It is the UK's premier dedicated nuclear services company and is committed to delivering engineering solutions and safety consultancy services throughout the life cycle of nuclear plants. Through its activities NNC developed a large experience in PSAs, including Level 2 PSAs; they are currently carrying on research activities focussed on the incorporation of SAM strategies into Level 2 PSAs.
The key person involved is:
Mr. Ang Ming

NRG:
NRG performs research and provides expertise and services in the field of nuclear technology. For an important part these concern applications in the field of energy supplies and nuclear installations, but also applications in the non-nuclear market as well as in the medical sector.
NRG was established in 1998 by the merger of the nuclear activities of ECN and KEMA. Although NRG is relatively young, it has inherited a mature knowledge and experience of more than 40 years from both parent organizations. NRG participates in international research programmes and offers a large diversity of high-quality services to governmental organizations and industry. NRG's activities are performed independent of vendors and suppliers of installations and components.
With regard to the field of severe accidents NRG has done a lot of things in the past, ranging from implementation of severe accident management guidelines at the Borssele nuclear power plant to performing containment analyses with MELCOR, MAAP, and our own developed code SPECTRA. In the fifth framework program NRG has participated in the TEMPEST, SGTR, and LISSAC projects.
The key persons involved are:
Mareck Stempniecz, Pieter Wakker

PSI:
The Paul Sherrer Institute is multi-disciplinary research centre for natural sciences and thechnology. In national and international collaboration with universities, other research institutes and industry, PSI is active in solid state physics, material sciences, elementary particle physics, life sciences, nuclear and non-nuclear energy research, and energy-related ecology. The institute's priorities lie in areas of basic and applied research. PSI has acquired a large experience in the domain of nuclear reactor safety, in particular through aerosol and iodine separate-effect testing, modelling, severe accident codes (SCDAP/RELAP5 and MELCOR) validation and plant (BWR and PWR) applications. PSI has actively contributed to plant applications in the 5th FP COLOSS project.
The key persons involved are:
Salih Güntay, Jon Birchley

RUB (RUB-LEE, Ruhr-Universität Bochum/Ruhr-University Bochum (RUB), Lehrstuhl für Energiesysteme und Energiewirtschaft/Energy Systems and Energy Economics (LEE)):
RUB-LEE (formerly RUB-NES) has considerable experience in reactor safety related research. Since 1987 projects in the area of plant safety assessment and safety improvements were carried out, and therefore a significant amount of knowledge and experience has been built-up.
The focus in the field of nuclear safety research is on modelling (e.g. source term, aerosols, corium behaviour, containment analyses) connected with code development activities, code validation/interpretation (e.g. ASTEC, COCOSYS, ATHLET-CD) and benchmarking. Furthermore own CFD tools have been developed and commercial tools are used intensively on simulations for various tasks and applications.
RUB-LEE participated in a number of EU projects and CA of the 3rd and 4th FWP. In the 5th FWP RUB-LEE has been involved in the projects ECOSTAR (LEE: analyses of concrete erosion by high pressure melt ejection), LPP (model development on late phase source term phenomena/molten pool fission product release), COLOSS (high temperature oxidation) and EVITA (ASTEC validation).
The key persons involved are:
Prof. Dr.-Ing. Hermann-Josef Wagner
(Professor for energy systems and energy economics at Ruhr-University Bochum, Head of the Department. He has relevant experience in energy systems analysis, renewable energies, energy and emission balances, life cycle analysis, energy modelling and is elected member of scientific councils of different research institutes. He also worked e.g. at the German Parliament for the Enquete-Comission about future energy paths.)
Prof. em. Dr.-Ing. Hermann E. Unger
(With more than 40 years of experience in the field of nuclear reactor science with emphasis on nuclear safety, he issued over 250 technical papers. Until 1987, he was Head of Department at IUSTT-IKE Stuttgart and in charge (among other fields) of the KESS development and TMI post test analyses. From 1987 until 2001, he has been Head of the Department for Nuclear and New Energy Systems at Ruhr-University Bochum (RUB-NES).)
Dr.-Ing. Marco K. Koch
(Deputy Head of department for energy systems and energy economics (LEE) at Ruhr-University Bochum (RUB). At RUB-LEE he is responsible for the research on plant simulation and safety. He has more than 15 years of experience with more than 100 technical papers in reactor safety issues. He has been project manager of the RUB-LEE activities in the EC Framework Programmes and of several national funded project dealing with nuclear reactor safety issues.)

SWEDPOWER:
SwedPower AB is a consultant company owned by Vattenfall AB, which is the biggest utility and electricity supplier in Sweden. SwedPower´s services are focused mainly on the energy sector and heavy civil engineering. One of the divisions of the company is Energy&Industry comprising nuclear power, thermal power and process industry.
In SwedPower there are several groups working with nuclear power. One of them is the group for nuclear safety, where there are specialists on the following areas: PSA, severe accidents, radiology and man/machine issues.
The key person involved is:
Dr. Veine Gustavson

TECHNICATOME:
TECHNICATOME is the French designer of on board nuclear power plants for the French Navy and of the research reactor for CEA. Currently, TA is involved in three major projects. The RES, a PWR located in Cadarache devoted to the navy fuel and components and Navy crews training, the BARRACUDA, future nuclear submarine and the RJH, future French materials test reactor.
TA is involved in the scope of Severe Accidents R&D for navy propulsion in collaboration with the CEA:
- development and qualification of primary depressurisation system and external cooling vessel system (1 scale vessel facility),

- qualification of PARs in inertized atmosphere in KALIH2,
- development of hydrogen distribution 3D code (NAUTILUS) and of MAAP for studying core degradation in vessel.

The key persons involved are: François Arnould, Eric Bachellerie

THERMODATA:

Since 1974, THERMODATA is working on generating thermodynamic databanks and software tools for thermochemistry. The objective is to make thermodynamic calculations fast and easy and to allow chemist and materials engineer to carry out global thermochemical approach of their complex problems. For a long time (10 years), THERMODATA is engaged in the critical compilation and assessment of thermodynamic data for inorganic and metallurgical substances involved in nuclear materials, and has a unique experience and expertise in the evaluation of data for solution phases and thermochemical equilibria calculations. The use of the database NUCLEA, developed the last years (in the frame of the ENTHALPY project of the 5th FWP), already gave really encouraging results confirmed by the few existing experimental results (FP release, solidus/liquidus, viscosity, ... etc). The CALPHAD technique used is adopted by the majority of the thermochemicists in the world and then the data produced can be easily incorporated in many calculation codes. THERMODATA is member of SGTE (GIE) with 12 other international laboratories engaged in thermodynamic data assessment and cooperates in a broader international effort to unify thermodynamic data and assessment methods.

The key persons involved are:
Dr. Bertrand CHEYNET, Dr. Pierre-Yves CHEVALIER, Evelyne FISCHER.

TRACTEBEL:

Tractebel Engineering, a division of Suez-Tractebel SA, a global energy and services business, offers world-wide customer-oriented services covering the full range of engineering, from feasibility studies to engineering, procurement and construction contracts, including operational support services and consultancy in the domains of fossil-fired power generation plants, nuclear power stations and installations, power networks and energy services. Tractebel Engineering is the architect engineer for all 7 Belgian nuclear power plants and is responsible for permanent engineering support to those units including backfitting, accident and transient analysis, licensing, probabilistic safety assessment, simulator development, operator training. The bulk of TE severe accident expertise resides with experienced graduate engineers involved in severe accident analysis both in support of PSA level 2 studies and in support of the development of accident management strategies. On behalf of the Belgian Utility, Electrabel, TE examined in detail specific severe accident topics and provided the Utility with several measures that could be implemented to reduce the risk associated with beyond-design accidents (hydrogen mitigation system, severe accident management guidelines, cavity flooding feasibility). Some relevant experiences in the field are listed below:

- Installation of passive autocatalytic hydrogen recombiners in the 7 Belgian NPP's (including comparative study of possible hydrogen mitigative measures, calculations, dimensionning and installing)
- Cavity flooding feasibility study for Belgian NPP's
- Development and implementation of severe accident management guidelines based on the WOG approach and organization of training course at Belgian Tihange NPP's.
- Development of specific severe accident management guidelines at Doel 1,2,3,4 NPP's (Belgium) during the time period of 1998-2002 (based on particular requirements from the Owner's for the adaptation of plant-specific procedures already in use)
- Training course on MELCOR input deck construction for REP-900 for severe accident simulation and analysis
- Development of severe accident strategies for Kalinin NPP's (units 1&2 – VVER-1000) 1999-2003
- Participation in OCDE international R&D projects (RASPLAV,MASCA, MCCI)
- SAMIME project (Severe Accident Management implementation and expertise in the European Union, European Commission – 4th FP)

- OPTSAM project (Optimisation of Severe Accident Management strategies for the control of Radiological Releases, European Commission – 5th FP)

The key persons involved (in particular in the ASTEC JPA) are:
Ms M Auglaire, senior engineer and Mr F Bertels expert engineer in the field of severe accidents. Their main expertise resides in severe accident analysis with the MELCOR code, PSA level 2 analysis, severe accident management guidelines.

TUS (Technical University of Sofia with Research and Development Sector):
TUS is the biggest higher technical educational and research complex in the fields of thermal- nuclear- and electrical power engineering, computer science and technologies, communications, etc. with national role for the distribution of safety engineering knowledge, and for development of the Nuclear Energy Research Area in Bulgaria.
TUS, together with RTD partners Institute of Energy JSC, Kozloduy NPP plc, etc. has significant experience regarding VVER safety analysis and studies, Environmental Impact Assessment of NPP, etc. TUS collected an experience in the severe accident research in the frame of 5FP Projects PHEBEN2 and RMPS, experimental program PLINIUS, etc. Since 2002 TUS participates in the PHEBUS FP Programme.
The key persons involved are:
Assoc. Prof. Dr. Ivan Ivanov (TUS), Dr. Boris Kalchev (Institute of Energy JSC)

UCL:
The Laboratory of Chemistry of Materials of the Université catholique de Louvain is involved since 1985 in the study of aerosols released by overheated nuclear fuel. Small thermal generators allow to heat reconstituted fuel pellets (UO2 pellets + different fission products) up to 2300°C. Fumes from the generator are collected by filtration and impaction and are submitted to non-destructive physico-chemical analyses (X-ray diffraction, Electron microscopy, Mössbauer spectroscopy, ...) in order to define the chemical speciation of the fission products + UO2 in the aerosols. At the present time studies are devoted to the definition of chemical interactions likely to occur between aerosols and steel surfaces. Three doctoral theses have been produced on this general subject. This research has been integrated in two EC programme (RAFF and ENTHALPY). Collaboration has also started with Russian laboratories (Kurchatov Institute and Khlopin Radium Institute).
The keys persons involved are:
Claude RONNEAU (Prof), Jean LADRIERE (Prof)

ULB (Université Libre de Bruxelles – Service de Métrologie Nucléaire) :
Expertise in PSA. For more than 15 years, ULB has been developing advanced methodologies for probabilistic safety analysis. The "theory of continuous event trees (CET)", which formalizes the interaction between the continuous dynamic evolution of a plant and the discrete branchings between plant configurations in the accident sequence delineation process, was developed here in the early 90's. Efficient Monte Carlo algorithms for the estimation of low feared event probabilities were consequently devised. An extension of the theory of CET was recently developed, in order to account for the impact of phenomenological uncertainties and delays in the generation of accident scenarios. Such an approach can be envisioned for a better modelling of level-2 PSA applications.
The key person involved is:
Pierre-Etienne Labeau

UJD:
UJD is a central administrative state office of the Slovak Republic responsible for the nuclear regulatory activities. An official representative of UJD is a chairperson – Mrs. Marta Ziakova. To the main responsibilities of the Department of Safety Analyses and Technical Support belongs:

- independent safety assessments of the present status and proposed upgrade of the nuclear facilities;
- independent analyses of accidents and operational events;
- preparation of the scenarios for emergency exercises with prediction of courses and consequences of nuclear accidents

The team of this Department has an experience with computational analyses of accident scenarios including severe accidents with various codes, focusing on VVER440 reactors.
The team has been actively participating in various projects, e.g. PHARE P/TS/03, PR/TS/17, EVITA, and has a strong knowledge of specificities of VVER-type reactor, and of ASTEC use (has actively contributed to the EVITA project of the 5th framework programme).
The key person involved is:
Mr. Jan Husarcek

UJV:
The Nuclear Research Institute Rez plc (UJV) is a research and engineering company specialising in research and development of nuclear technologies and radioactive waste management, being a major organisation of this kind in the Czech Republic. Its activities cover nuclear safety, applied material science, radiopharmaceuticals production, and others including non-nuclear applications. UJV provides direct services for the NPP Dukovany and Temelin as well as support for the Czech regulatory body SONS. Among activities relevant to SARNET, UJV participated in the PSA Level 2 for NPP Dukovany and performed its updates, performed severe accident analyses for NPP Temelin and participated in several projects of the EU 5th Framework. UJV also takes part in OECD/CSNI activities including ISP calculation, recent examples are ISP 45 Quench and ISP 46 Phébus FPT1.
Strong experience on severe accident code validation and plant applications (scenario analysis, SAM and PSAs). Strong knowledge of specificities of VVER-type reactors. Experience in corium behaviour and fission products modelling. Close cooperation with IRSN on ICARE/CATHARE code assessment since many years. Has actively contributed to the EVITA project of the 5th framework programme.
The key persons involved are:
Dr. Jiri Dienstbier, Dipl.Ing. Jiri Duspiva

UPM:
The UPM is the largest Technical University of Spain. The Nuclear Engineering Department, with 12 professors, is the only fully specialized in Nuclear Energy of Spain. Inside it, there is a group focused on Nuclear Safety Research, with a small team working on severe accident analysis since almost 15 years ago. This group has been a partner of several EC projects in the Nuclear Fission Safety area of the 4th and 5th Framework Programmes: PHEBEN, COBE, HYMI, VOASM, BE-EJ-PSA2, PHEBEN2, COLOSS, THENPHEBISP, EURSAFE, between them. The group has signed in the past bi-lateral co-operation agreements with the FZK (on applications of the MELCOR code) and the IPSN/IRSN (on the development of models for the ICARE code). The group maintains a close co-operation with the Spanish Nuclear Safety Council in this field, which includes applications of severe accident analysis codes to plant applications, development or refinement of models and code validation calculations.
The team that will participate in the SARNET has a large experience in containment thermal hydraulics analysis and ex-vessel corium behaviour analysis.
The key persons involved are:
Prof. Eduardo Gallego and Prof. Francisco Martín-Fuertes

VEIKI:

Experience in analysis of containment phenomena, in using simulation codes and in assessment of calculation results with experimental data. Strong knowledge of specificities of VVER-type reactors and of ASTEC use. Has actively contributed to the EVITA project of the 5th framework programme

VEIKI Institute for Electric Power Research Co.

Merging the activities of the Research Committee for Electrification and the Institute for Thermal Technology, the Institute for Electric Power Research was founded in 1964. Since 1993 the Institute has been operating as VEIKI Institute for Electric Power Research Company.

At present the research and development activity of VEIKI is related to the following main fields:

- safety assessment of nuclear power plants,
- combustion technology,
- mechanical and power engineering technology,
- systems of control engineering and telemechanics.

Activities of the Nuclear Engineering Division extend from the probabilistic safety assessment to containment analysis and severe accident analysis and management. VEIKI implemented the international quality assurance standard ISO 9001 in 1995. Project team activities are being continuously monitored, in addition periodic quality assurance audits are performed.

VEIKI participated in the AGNES project for reassessment of the safety of Paks NPP in 1991 - 1994 and was responsible for the severe accident analyses and probabilistic safety analyses (PSA). A part of the analyses addressed interventions to stop the development of the accident phenomena or to mitigate the consequences (accident management).

Since the accomplishment of the AGNES Project VEIKI participated in the PHARE 4.2.7a Project entitled VVER-440/213 Beyond Design Basis Accident Analysis and Accident Management project.

The key persons involved are:

Dr. Zs. Téchy, Dr. G. Lajtha, P. Kostka, Dr. G.L. Horvath

(Zs. Téchy has more than 20 years of experience in nuclear safety calculations. He served as project manager of the severe accident analysis team in the domestic AGNES project for the safety reassessment of the Paks NPP. The project addressed accident management strategy definition for the plant. Later, he was project manager of the PHARE 4.2.7.a Beyond Design Basis Accident Analysis and Accident Management project and coordinated MAAP calculations to define an accident management framework for the VVER-440/213 containment.)

(Dr. G. Lajtha has 10 years experience in severe accident analysis. In 1992 he spent 6 month in Cadarache to learn the use of ESCADRE code. He worked two years (1995-96) in Cadarache (IPSN) where he participated in the development of the SOPHAEROS code to include vapour chemistry. He has experience in code calculations, and in analysing experiments (DEMONA, LACE, FALCON, STORM).)

(P. Kostka has 4 years of experience in the field of VVER-440 severe accident analyses. He was involved in a number of national and international projects concerning accident analysis and accident management. He participated in the project of DBA hydrogen removal from the containment of Paks NPP, Unit 3., the PHARE 4.2.7a "VVER 440/213 Beyond design Basis Accident Analysis and Accident Management During Severe Accidents" projects.)

(G.L. Horvath has 12 years experience in fission product transport issues. In 1995-96 he was attached to Brookhaven National Laboratory and worked on the development of MELCOR input for VVER-440 reactors. He participated in the PHARE 4.2.7.a “Beyond Design Basis Accident Analysis and Accident Management” and the PHARE 2.06 “Filtered Venting of the Containment” projects. Acted as Visiting Scientist at JRC, Ispra. He also took part in the development of the SPRINT software, which is the subject of demonstration in this project.)

VTT:

VTT Technical Research Centre of Finland is a contract research organization involved in many international assignments. With its 3000 employees, VTT provide a wide range of technologies and applied research services for its clents, private companies, institutions and the public sector. VTT has a large experience in assessment of severe accident phenomena in BWR and VVER 440; within this domain, VTT’s own experimental research has focussed on aerosol behaviour in the containment and

reactor coolant system and in ex-vessel coolability of particulate debris beds; this work has also involved the development of analytical tools.
The key persons involved are:
Dr. Jorma Jokiniemi (in the area of aerosol behaviour) and Ms. Ilona Lindholm (in the area of debris bed coolability).

VUJE:
Strong experience on severe accident code validation and plant applications (scenario analysis, SAM and PSAs). Perfect knowledge of specificities of VVER-440 reactors. Experience in corium behaviour and fission products modelling. Close cooperation with IRSN on ASTEC code assessment for many years. Has actively contributed to the EVITA project of the 5th framework programme.
VUJE has over 20 years of experience in NPP operation support and research in the field of nuclear industry and provides full scope of tasks for the NPPs in Slovakia. The main scope of work is focused on VVER440/230 and VVER440/213 reactor design NPPs. VUJE is developing the program of modernization of the two V2 units with VVER 440 reactors of the V-213 type.
VUJE provided design work, implementation of the Republic Repository of Radioactive Waste in Mochovce, and commissioned it at the end of 1999. In 1996 – 2000, VUJE carried out the gradual reconstruction of V1 units in cooperation with the SIEMENS company with which VUJE established the REKON consortium.
Regarding international projects, VUJE is taking part in number of international projects, in the field of severe accidents, for example: Project EVITA and there are preparations for participation in project Phebus.
The key persons involved are:
Juraj Jancovic, Albert Bujan.

BTech:
Becker Technologies is an innovative enterprise and works for a wide spectrum of clients offering engineering services as well as design and construction of process technical equipment and complete plants. They developed consulting and engineering services through:

- experiments in laboratory and technical facilities
- studies and numerical simulations

In particular, within the nuclear field Btech operates large-scale containment experiments (ThAI facility, former Battelle Model Containment) specialised on issues such as: thermal hydraulics, hydrogen distribution, combustion, recombination, aerosols, iodine, pool scrubbing. Btech is also experienced in Containment code validation.
The key persons involved are:
Karsten Fisher, Wolfgang Häfner

A few organizations are covering a wide range of competence though not complete, whereas others are specialized in very specific areas and thus complementarities are developing. Overall, it is estimated that the critical mass of competence for performing experiments needed in the severe accident domain, analysing them, developing models and integrating them in the ASTEC code are met for most types of NPPs in Europe. Associated Candidate Countries are appropriately associated to most projects. Furthermore, SARNET will network a strong competence in Level 2 PSAs.

Thus SARNET will be the crucible for an horizontal type of integration of a vast range of multidisciplinary activities with two main end-products: the integral code ASTEC and Level 2 PSA guidelines.

The lists of researchers involved in the network are given in the following tables.

LIST OF RESEARCHERS AND DOCTORAL STUDENTS

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	1
Participating organisation					
Organisation legal name	*Institut de Radioprotection et de Sûreté Nucléaire*				
Organisation short name	*IRSN*				
Internet homepage	http://www.irsn.org/				

List of RESEARCHERS to be integrated

Last name	First name(s)	Professional Status [9]	Gender: male or female	Connection with Joint Programme of Activities (JPA)[10],[11]	Legal name researcher's Employer[12]
Clément	Bernard	Engineer	M	R, S	CEA
Adroguer	Bernard	Dr	M	M, S	CEA
Van Dorsselaere	Jean-Pierre	Engineer	M	I, S	CEA
Gonzalez	Richard	Engineer	M	NDI	IRSN
Jacquemain	Didier	Dr	M	R, S	CEA
Repetto	Georges	Engineer	M	NDI	CEA
Giordano	Patrice	Engineer	M	R, M	CEA
Latché	Jean-Claude	Engineer	M	NDI	CEA
Fichot	Florian	Dr	M	R	CEA
Chatelard	Patrice	Engineer	M	NDI	CEA
Kissane	Martin	Dr	M	R	CEA
Dubourg	Roland	Engineer	M	NDI	CEA
Nicaise	Nicolas	Dr	M	I	IRSN
Cantrel	Laurent	Dr	M	R	CEA
Girault	Nathalie	Engineer	F	R	CEA
Cranga	Michel	Dr	M	R, S	CEA
Plumecoq	William	Dr	M	I	CEA
Layly	Victor	Dr	M	R	CEA
Seropian	Christophe	Engineer	M	I	IRSN
Chaumond	Bernard	Engineer	M	I, M	IRSN
Alpy	Nicolas	Engineer	M	I	CEA

[9] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[10] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[11] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[12] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Pignet	Sophie	Engineer	F	I	CEA
Barrachin	Marc	Dr	M	R, S	CEA
Caroli	Cataldo	Engineer	M	R	IRSN
Raymond	Emmanuel	Engineer	M	I	CEA
Meignen	Renaud	Dr	M	R	IRSN
Cornet	Pierre	Engineer	M	R	CEA
Marchand	Carole	Dr	F	R	IRSN
Micaelli	Jean-Claude	Dr	M	M	IRSN
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**
Lemaître	Pascal	Engineer	M	NDI	INSA/Rouen
Roux	Patrick	Engineer	M	NDI	U. Paris VI
Mun	Christian	Engineer	M	R	U. Paris XI
Lapuerta	Céline	Engineer	F	NDI	U. Aix-Marseille

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	2
Participating organisation					
Organisation legal name	*AEA Technology plc*				
Organisation short name	*AEAT*				
Internet homepage	*www.aeat.co.uk*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [13]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[14],[15]**	**Legal name researcher's Employer[16]**
Dickinson	Shirley	Consultant	female	R	AEA Technology plc
Sims	Howard	Consultant	male	R	BNFL
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[13] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[14] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[15] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[16] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	3
Participating organisation					
Organisation legal name	*KFKI Atomic Energy Research Institute*				
Organisation short name	*AEKI*				
Internet homepage	*www.kfki.hu*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status [17]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[18],[19]**	**Legal name researcher's Employer[20]**
Hozer	Zoltan	Dr	M	I	AEKI
Nagi	Imre	Dr	M	I	AEKI
Matus		Dr	M	NDI	AEKI

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[17] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[18] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[19] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[20] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	4
Participating organisation					
Organisation legal name	*ARC Seibersdorf research GmbH*				
Organisation short name	*ARCS*				
Internet homepage	*http://www.arcs.ac.at*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [21]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[22], [23]**	**Legal name researcher's Employer[24]**
Sdouz	Gert	Dr	M	I	ARCS
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[21] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[22] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[23] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[24] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	5
Participating organisation					
Organisation legal name	*Association Vincotte Nuclear*				
Organisation short name	*AVN*				
Internet homepage	*http://www.avn.be*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status [25]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[26],[27]**	**Legal name researcher's Employer[28]**
Gryffroy	Dries	Nuclear Engineer	Male	I	AVN
Van Haesendonck	Michel	Nuclear Engineer	Male	I	AVN
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[25] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[26] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[27] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[28] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	5099065	Proposal Acronym	SARNET	Participant number	6
Participating organisation					
Organisation legal name	*Budapest University of Technology and Economics Institute of Nuclear Techniques*				
Organisation short name	*BUTE*				
Internet homepage	*www.reak.bme.hu*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [29]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[30],[31]**	**Legal name researcher's Employer[32]**
Légrádi	Gábor	MsC	M	I	BUTE

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Csige	András	MsC	M	I	BUTE

[29] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[30] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[31] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[32] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	7
Participating organisation					
Organisation legal name	*Commissariat à l'Energie Atomique*				
Organisation short name	*CEA*				
Internet homepage	*www.cea.fr*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [33]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [34,35]	**Legal name researcher's Employer** [36]
Bonnet	Jean-Michel	Engineer	m	R-M	CEA
Seiler	Jean-Marie	Dr	m	R	CEA
Froment	Karine	Dr	f	NDI	CEA
Spindler	Bertrand	Dr	m	R	CEA
Journeau	Christophe	Engineer	m	R-S	CEA
Piluso	Pascal	Dr	m	I-R	CEA
Pontillon	Yves	Dr	m	R	CEA
Ducros	Gérard	Dr	m	R	CEA
Pla	Patricia	Dr	f	I	CEA
Studer	Etienne	Engineer	m	R	CEA
Tarabelli	Didier	Dr	m	I	CEA
Deffort	Françoise	Dr	f	R	CEA
Magallon	Daniel	Dr	m	R	EEC
Paillère	Henri	Dr	m	R	CEA
Blumenfeld	Laure	Dr	f	R	CEA
Tourniaire	Bruno	Dr	m	R	CEA
Berthoud	Georges	Pr	m	R	CEA
Cognet	Gérard	Dr	m	M	CEA
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[33] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[34] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[35] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[36] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	8
Participating organisation					
Organisation legal name	*CESI SpA*				
Organisation short name	*CESI*				
Internet homepage	*www.cesi.it*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [37]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [38],[39]	**Legal name researcher's Employer** [40]
Parozzi	Flavio	Senior Researcher	Male	R	CESI SpA
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[37] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[38] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[39] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[40] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	9
Participating organisation					
Organisation legal name	*Chalmers tekniska högskola*				
Organisation short name	*Chalmers*				
Internet homepage	*www.chalmers.se*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [41]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[42, 43]**	**Legal name researcher's Employer[44]**
Sihver	Lembit	Prof.	Male	R	Chalmers
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Glänneskog	Henrik	M.Sc	Male	R	Chalmers

[41] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[42] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[43] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[44] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**10**
Participating organisation					
Organisation legal name	*CENTRO DE INVESTIGACIONES ENERGÉTICAS MEDIOAMBIENTALES Y TECNOLÓGICAS*				
Organisation short name	*CIEMAT*				
Internet homepage	*www.ciemat.es*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [45]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [46,47]	**Legal name researcher's Employer** [48]
Herranz	Luis E.	Head of Research Program	Male	R-I	CIEMAT
Rincón	Ana M.	Researcher (Dr.)	Female	R-I	CIEMAT
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**
L. del Prá	Claudia	Graduate & Master	Female	S (participating in the integration and training)	Polytechnical Univesity of Valencia (SPAIN)

[45] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[46] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[47] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[48] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	11
Participating organisation Consejo de Seguridad Nuclear					
Organisation legal name	*Consejo de Seguridad Nuclear*				
Organisation short name	*CSN*				
Internet homepage	*www.csn.es*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [49]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[50],[51]**	**Legal name researcher's Employer[52]**
Izquierdo	José M.	Head of research unit	Male	I	Consejo de Seguridad Nuclear
Hortal	Javier	Senior Re-searcher	Male	NDI	Consejo de Seguridad Nuclear
Fontanet	Juan	Senior Re-searcher	Male	I	Consejo de Seguridad Nuclear
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[49] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[50] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[51] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[52] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	12
Participating organisation					
Organisation legal name	*National Centre for Scientific Research "Demokritos"*				
Organisation short name	*Demokritos*				
Internet homepage	*www.demokritos.gr*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [53]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[54],[55]**	**Legal name researcher's Employer[56]**
Housiadas	Christos	Senior Scientist	M	R-S	NCSR "Demokritos"
Eleftheriadis	Kostas	Senior Scientist	M	S	NCSR "Demokritos"

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Mitrakos	Dimitrios	Mech. Eng.	M	R	Nat. Techn. Univ. Athens

[53] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[54] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[55] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[56] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	13
Participating organisation					
Organisation legal name	*UNIVERSITA' DI PISA'*				
Organisation short name	*UPI*				
Internet homepage	*www.unipi.it*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [57]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [58],[59]	**Legal name researcher's Employer** [60]
Paci	Sandro		M	R	UPI
Oriolo	Francesco		M	I, S	UPI
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[57] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[58] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[59] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[60] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**14**
Participating organisation					
Organisation legal name	*Empresarios Agrupados Internacional, S.A.*				
Organisation short name	*EA*				
Internet homepage	*www.empre.es*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [61]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[62],[63]**	**Legal name researcher's Employer[64]**
Rubbers	Antoine	Researcher	M	I	EA
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[61] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[62] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[63] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[64] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**15**
Participating organisation					
Organisation legal name	*Electricité de France*				
Organisation short name	*EDF*				
Internet homepage	http://www.edf.fr				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [65]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[66],[67]**	**Legal name researcher's Employer[68]**
MARGUET	Serge	Research project manager	Male	I	EDF
DUTHEILLET	Yves	Research project manager	Male	I,R	EDF
DUPLAT	Françoise	Research project manager	Female	I,R	EDF
ATKHEN	Kresna	Research sub-project manager	Male	R	EDF
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[65] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[66] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[67] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[68] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	16
Participating organisation					
Organisation legal name	*Ente per le Nuove Tecnologie, l'Energia e l'Ambiente'*				
Organisation short name	*ENEA*				
Internet homepage	*www.enea.it*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [69]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[70],[71]**	**Legal name researcher's Employer[72]**
Bandini	Giacomino	Senior Res	M	I	ENEA
Davidovich	Nora	Senior Res	F	I, R	ENEA
De Rosa	Felice	Senior Res	M	I	ENEA
Ederli	Stefano	Senior Res	M	R	ENEA
Tirini	Sandro	Senior Res	M	I	ENEA
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[69] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[70] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[71] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[72] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	17
Participating organisation					
Organisation legal name	*Fortum Nuclear Services Ltd.*				
Organisation short name	*Fortum*				
Internet homepage	*www.fortum.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [73]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[74],[75]**	**Legal name researcher's Employer[76]**
Routamo	Tomi	Design Engineer	male	R, I	Fortum
Lundström	Petra	Manager, Thermal-hydraulics	female	I	Fortum

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[73] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[74] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[75] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[76] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	18
Participating organisation					
Organisation legal name	*FRAMATOME ANP SAS*				
Organisation short name	*FANP SAS*				
Internet homepage	*www.framatome-anp.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [77]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[78],[79]**	**Legal name researcher's Employer[80]**
CAILLAUX	Arnaud	Dipl. Ing.	Male	I	FANP SAS
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[77] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[78] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[79] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[80] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	19
Participating organisation					
Organisation legal name	*FRAMATOME ANP GmbH*				
Organisation short name	*FANP GmbH*				
Internet homepage	*http://framatome-anp.de*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [81]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[82],[83]**	**Legal name researcher's Employer[84]**
EYINK	Jürgen	Dr. rer. Nat	male	I	FANP GmbH
FISCHER	Manfred	Dipl. Phys.	male	R	FANP GmbH
FUNKE	Friedhelm	Dr. rer. Nat	male	R	FANP GmbH
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[81] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[82] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[83] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[84] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**20**
Participating organisation					
Organisation legal name	*Forschungszentrum Juelich GmbH*				
Organisation short name	*FZJ*				
Internet homepage	*www.fz-juelich.de*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [85]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[86],[87]**	**Legal name researcher's Employer[88]**
Reinecke	Ernst-Arndt	Team Leader	male	R	FZJ
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Boehm	Joerg	Dipl.-Ing.	male	R	FZJ
Drinovac	Pere	Dipl.-Ing.	male	R	FZJ

[85] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[86] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[87] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[88] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	21
Participating organisation					
Organisation legal name	*Forschungszentrum Karlsruhe GmbH*				
Organisation short name	*FZK*				
Internet homepage	*www.fzk.de*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [89]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[90],[91]**	**Legal name researcher's Employer[92]**
Alsmeyer	Hans	*)	Male	R	FZK
Cherdron	Wolfgang	*)	Male	I, R	FZK
Dorofeev	Sergei	*)	Male	I, R	FZK
Eppinger	Beatrix	*)	Female	R	FZK
Foit	Jerzy	*)	Male	R	FZK
Hering	Wolfgang	*)	Male	R, I	FZK
Homann	Christoph	*)	Male	R	FZK
Jacob	Helmut	*)	Male	R	FZK
Meyer	Leonhard	*)	Male	I, R, M	FZK
Miassoedov	Alexei	*)	Male	I, R	FZK
Schanz	Gerhard	*)	Male	R	FZK
Schmuck	Philipp	*)	Male	I	FZK
Stegmaier	Ulrike	*)	Female	R	FZK
Steinbrück	Martin	*)	Male	I, R	FZK
Stuckert	Juri	*)	Male	R, I	FZK
Wilhelm	Dirk	*)	Male	R	FZK
	*)Scientific Staff				

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[89] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[90] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[91] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[92] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**22**
Participating organisation					
Organisation legal name	*Forschungszentrum Rossendorf e.V.*				
Organisation short name	*FZR*				
Internet homepage	*www.fz-rossendorf.de*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [93]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[94],[95]**	**Legal name researcher's Employer[96]**
Altstadt	Eberhard	Head of department	male	R, S	FZR
Willschuetz	Hans-Georg	research engineer	male	R	FZR

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[93] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[94] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[95] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[96] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	23
Participating organisation					
Organisation legal name	*Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH*				
Organisation short name	*GRS*				
Internet homepage	*www.grs.de*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [97]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[98],[99]**	**Legal name researcher's Employer[100]**
Allelein	Hans-Joseph	Head of Dep.	M	I, S, M	GRS
Heitsch	Matthias	Researcher	M	R	GRS
Langhans	Jürgen	Researcher	M	R	GRS
Schwinges	Bernd	Project Leader	M	I	GRS
Beraha	David	Researcher	M	I, M	GRS
Trambauer	Klaus	Researcher	M	R, S	GRS
Weber	Günther	Researcher	M	R	GRS
Sonnenkalb	Martin	Researcher	M	I	GRS
Löffler	Horst	Researcher	M	I	GRS
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[97] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[98] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[99] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[100] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**24**
Participating organisation					
Organisation legal name	*Universität Stuttgart*				
Organisation short name	*USTUTT-IKE*				
Internet homepage	*http://www.uni-stuttgart.de*				

List of RESEARCHERS to be integrated

Last name	**First name(s)**	**Professional Status** [101]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [102], [103]	**Legal name researcher's Employer** [104]
Bürger	Manfred	Head of reactor safety division	male	IRS	USTUTT-IKE
Schmidt	Fritz	Professor, head of knowledge engnrg. division	male	IS	USTUTT-IKE
Buck	Michael	Researcher	male	IRS	USTUTT-IKE
Pohlner	Georg	Researcher	male	IR	USTUTT-IKE
Schmidt	Werner	Researcher	male	IR	USTUTT-IKE
Widmann	Walter	Researcher	male	IR	USTUTT-IKE

List of DOCTORAL STUDENTS

Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**
Vujic	Zoran	Dipl.-Ing	male	R	Universität Stuttgart
Ben-Said	Nader	Dipl.Ing	male	R	Universität Stuttgart

[101] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[102] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[103] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[104] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**25**
Participating organisation					
Organisation legal name	*NATIONAL AUTONOMOUS COMPANY FOR NUCLEAR ACTIVITIES – NUCLEAR RESEARCH SUBSIDIARY - PITESTI*				
Organisation short name	*INR*				
Internet homepage	*www.scn.ro*				

List of RESEARCHERS to be integrated

Last name	**First name(s)**	**Professional Status** [105]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [106, 107]	**Legal name researcher's Employer** [108]
TURCU	Ilie	Research Coordinator	Male	I, S	INR
RIZOIU	Andrei	Researcher	Male	I,S	INR
CONSTANTIN	Marin	PhD	Male	I, S	INR
NEGUT	Gheorghe	Senior Researcher	Male	I, S	INR
OHAI	Dumitru	PhD, Head of research unit Nuclear Materials and Corrosion	Male	I, S	INR
RADU	Gabriela	Researcher	Female	I	INR

[105] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[106] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[107] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[108] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**26**
Participating organisation					
Organisation legal name	*Institute for Nuclear Research and Nuclear Energy*				
Organisation short name	*INRNE*				
Internet homepage	*www.inrne.bas.bg*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [109]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [110] [111]	**Legal name researcher's Employer** [112]
Stefanova	Antoaneta	Researcher	F	I	INRNE
Gencheva	Rositsa	Researcher	F	I	INRNE
Grudev	Pavlin	Researcher	M	I	INRNE
Pavlova	Malinka	Researcher	F	I	INRNE
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[109] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[110] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[111] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[112] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	27
Participating organisation					
Organisation legal name	*Inzinierska Vypoctova Splocnost Trnava, Ltd.*				
Organisation short name	*IVS*				
Internet homepage	*http://home.nextra.sk/ivstt*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [113]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [114, 115]	**Legal name researcher's Employer** [116]
Matejovic	Peter	director	male	R	IVS
Barnak	Miroslav	deputy director	male	R	IVS
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[113] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[114] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[115] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[116] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**28**
Participating organisation					
Organisation legal name	*European Commission- Directorate General Joint Research Centre*				
Organisation short name	*JRC-ISPRA*				
Internet homepage	*http://www.jrc.it*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [117]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [118] [119]	**Legal name researcher's Employer** [120]
Annunziato	Alessandro	Researcher	M	I, M	EEC
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[117] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[118] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[119] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[120] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	29
Participating organisation					
Organisation legal name	*European Commission Joint Research Centre- Institute for Transuranium Elements*				
Organisation short name	*JRC-ITU*				
Internet homepage	*http://itu.jrc.cec.eu.int/*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [121]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[122],[123]**	**Legal name researcher's Employer[124]**
Bottomley	Paul-David	Researcher	M	R	EEC
Kopitzke		Researcher	M	R	EEC

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[121] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[122] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[123] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[124] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	30
Participating organisation					
Organisation legal name	*European Commission- Directorate General Joint Research Centre*				
Organisation short name	*JRC-Petten*				
Internet homepage	*www.jrc.cec.eu.int*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [125]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[126],[127]**	**Legal name researcher's Employer[128]**
Kirchsteiger	Christian	Scientific Officer	M	R	EEC
Wilkening	Heinz	Scientific Officer	M	R	EEC
Müller	Klaus	Scientific Officer	M	I-R	EEC
Raison	Philippe	Scientific Officer	M	R	EEC

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[125] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[126] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[127] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[128] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**31**
Participating organisation					
Organisation legal name	*Jozef Stefan Institute*				
Organisation short name	*JSI*				
Internet homepage	*www.ijs.si*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [129]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[130] [131]**	**Legal name researcher's Employer[132]**
Kljenak	Ivo	researcher	male	I, R	JSI
Leskovar	Matjaz	researcher	male	I, R	JSI

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[129] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[130] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[131] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[132] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**32**
Participating organisation					
Organisation legal name	*Kungl Tekniska Högskolan*				
Organisation short name	*KTH*				
Internet homepage	http://www.kth.se/				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [133]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [134] [135]	**Legal name researcher's Employer** [136]
Ma	Weimin	Researcher	M	R	KTH
Giri	Asis	Researcher	M	R	KTH
Nayak	Arun Kumar	Researcher	M	R, I	KTH
Jasiulevicius	Audrius	Researcher	M	R	KTH
Sehgal	Bal Raj	Pr	M	R, S	KTH
Park	Sun	Researcher	M	R	KTH
Hanson	Roberta	Researcher	F	R	KTH
Kubarev		Researcher	M	I	KTH
Karkoska	Krystof	Researcher	M	R	KTH
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**
Stepanyan	Armen	Master	M	R	KTH
Roshan	Sean	Master	M	R	KTH

[133] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[134] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[135] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[136] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**33**
Participating organisation					
Organisation legal name	*Lithuanian Energy Institute*				
Organisation short name	*LEI*				
Internet homepage	*http://www.lei.lt*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status [137]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[138],[139]**	**Legal name researcher's Employer[140]**
Vileiniskis	Virginijus	Researcher	M	I	LEI
Urbonavicius	Egidijus	Post-doc	M	R-I	LEI
Uspuras	Eugenius	Professor	M	S	LEI
Kaliatka	Algirdas	Researcher	M	I	LEI
Augutis	Juozas	Professor	M	I	LEI
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Vaisnoras	Mindaugas	Master	M	S	LEI
Alzbutas	Robertas	Master	M	I	LEI
Tonkunas	Aurimas	Master	M	I	LEI
Matuzas	Vaidas	Master	M	I	LEI
Babilas	Egidijus	Master	M	R-I	LEI

[137] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[138] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[139] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[140] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**34**
Participating organisation					
Organisation legal name	*National Nuclear Corporation Ltd*				
Organisation short name	*NNC*				
Internet homepage	*www.nnc.co.uk*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [141]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [142] [143]	**Legal name researcher's Employer** [144]
Ang	Ming	Consultant	M	I	NNC
Grindon	Elizabeth	Consultant	F	I	NNC
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[141] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[142] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[143] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[144] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**35**
Participating organisation					
Organisation legal name	*Nuclear Research & consultancy Group*				
Organisation short name	*NRG*				
Internet homepage	*www.nrg-nl.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [145]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [146] [147]	**Legal name researcher's Employer** [148]
Stempniewicz	Marek	researcher	male	I,R	NRG
Wakker	Pieter	researcher	male	I,R	NRG
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[145] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[146] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[147] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[148] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**36**
Participating organisation					
Organisation legal name	*Paul Scherrer Institut*				
Organisation short name	*PSI*				
Internet homepage	*www.psi.ch*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [149]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [150] [151]	**Legal name researcher's Employer** [152]
Guentay	Salih	Researcher	M	R-I	PSI
Cripps	Robin	Researcher	M	R	PSI
Suckow	Detlef	Researcher	M	R-I	PSI
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[149] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[150] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[151] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[152] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	37
Participating organisation					
Organisation legal name	*Ruhr-Universität Bochum (RUB), Lehrstuhl für Energiesysteme und Energiewirtschaft (LEE)*				
Organisation short name	*RUB-LEE*				
Internet homepage	*www.rub.de, www.lee.rub.de*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [153]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[154],[155]**	**Legal name researcher's Employer[156]**
Koch	Marco Karl	Deputy Head of Department	Male	R,S	Ruhr-Universität Bochum
Unger	Hermann	Professor em.	Male	R,S	Ruhr-Universität Bochum
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Bendiab	Mohammed	Dipl.-Ing.	Male	R	Ruhr-Universität Bochum
Kleinhietpaß	Ingo	Dipl.-Ing.	Male	R	Ruhr-Universität Bochum
Tilman	Drath	Dipl.-Ing.	Male	R	Ruhr-Universität Bochum

[153] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[154] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[155] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[156] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**38**
Participating organisation					
Organisation legal name					
Organisation short name					
Internet homepage					

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [157]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[158] [159],**	**Legal name researcher's Employer[160]**
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[157] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[158] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[159] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[160] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**39**
Participating organisation					
Organisation legal name	*SwedPower AB*				
Organisation short name	*SWP*				
Internet homepage	*www.swedpower.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [161]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [162] [163]	**Legal name researcher's Employer** [164]
Gustavsson	Veine	Scientist	M	I	SWP
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[161] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[162] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[163] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[164] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**40**
Participating organisation					
Organisation legal name	*TECHNICATOME*				
Organisation short name	*TA*				
Internet homepage	*www.technicatome.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status** [165]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [166, 167]	**Legal name researcher's Employer** [168]
ARNOULD	FRANCOIS	Nuclear Safety Expert	male	R	TA
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[165] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[166] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[167] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[168] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**41**
Participating organisation					
Organisation legal name	*THERMODATA*				
Organisation short name	*THERMODATA*				
Internet homepage	*http://thermodata.online.fr*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [169]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [170] [171]	**Legal name researcher's Employer** [172]
CHEYNET	Bertrand	Dr	M	R S I	THERMODATA
CHEVALIER	Pierre-Yves	Dr	M	R	INPG
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[169] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[170] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[171] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[172] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**42**
Participating organisation					
Organisation legal name	*SUEZ-TRACTEBEL S.A.*				
Organisation short name	*TE*				
Internet homepage	*http://www.tractebel.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status** [173]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [174] [175]	**Legal name researcher's Employer** [176]
AUGLAIRE	Michèle	employee	Female	I	TE
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[173] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[174] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[175] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[176] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**43**
Participating organisation					
Organisation legal name	*Technical University of Sofia – Research and Development Sector*				
Organisation short name	*TUS*				
Internet homepage	*www.tu-sofia.bg*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [177]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)**[178],[179]	**Legal name researcher's Employer**[180]
Ivanov	Ivan	Professor	male	I, R, S	TUS
Lakov	Miko	Professor	male	R, S	TUS
Kalchev	Boris	Head of Research Unit	male	R, S	IE
Kuleff	Ivelin	Professor	male	R, S	SU
Hadijev	Vasil	Head of department	male	I, S	Kozloduy NPP
Botev	Georgi	Professor	male	R	Academy of MoI

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**
Bogoeva	Tcvetelina	Master	female	I, R	TUS
Neykov	Boian	Master	male	R	IE

[177] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[178] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[179] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[180] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	44
Participating organisation					
Organisation legal name	*Université Libre de Bruxelles*				
Organisation short name	*ULB*				
Internet homepage	*http://www.ulb.ac.be*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status [181]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[182] [183]**	**Legal name researcher's Employer[184]**
Labeau	Pierre-Etienne	Professor	male	R	Fonds National de la Recherche Scientifique (FNRS) + ULB
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Peeters	Agnès	Physics engineering	female	R	ULB

[181] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[182] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[183] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[184] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**45**
Participating organisation					
Organisation legal name	*Université Catholique de Louvain*				
Organisation short name	*UCL*				
Internet homepage	*www.ucl.ac.be*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [185]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[186, 187]**	**Legal name researcher's Employer[188]**
Ronneau	Claude	Professor	Male	I	UCL
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[185] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[186] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[187] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[188] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	46
Participating organisation					
Organisation legal name	*Urad Jadroveho Dozoru SR (Nuclear Regulatory Authority of the Slovak Republic)*				
Organisation short name	*UJD*				
Internet homepage	*www.ujd.gov.sk*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [189]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[190],[191]**	**Legal name researcher's Employer[192]**
HUSARCEK	Jan	head of department	Male	I	UJD
KUBISOVA	Lubica	safety analyst	Female	I	UJD
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[189] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[190] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[191] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[192] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	47
Participating organisation					
Organisation legal name	*Ustav jaderneho výzkumu Rez a.s. (Nuclear Research Institute Rez plc)*				
Organisation short name	*UJV*				
Internet homepage	*www.ujv.cz*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status [193]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[194] [195],**	**Legal name researcher's Employer[196]**
Dienstbier	Jiri	senior researcher	male	I, R	UJV
Duspiva	Jiri	researcher	male	I, R	UJV
Kujal	Bohumir	senior researcher	male	R	UJV
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**
Skop	Jiri	Dipl.Ing.	male	NDI	CVUT-FJFI*

* Czech Technical University – Faculty of Nuclear Sciences and Physical Engineering

[193] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[194] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[195] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[196] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**48**
Participating organisation					
Organisation legal name	*UNIVERSIDAD POLITÉCNICA DE MADRID*				
Organisation short name	*UPM*				
Internet homepage	*www.upm.es*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [197]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [198] [199]	**Legal name researcher's Employer** [200]
MARTÍN-FUERTES	Francisco	Interim Titular Professor	Male	I, R, S	UPM
JIMENEZ	Miguel Angel	Senior Researcher	Male	I, R, S	UPM

List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[197] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[198] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[199] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[200] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	49
Participating organisation					
Organisation legal name	*VEIKI Institute for Electric Power Research Co.*				
Organisation short name	*VEIKI*				
Internet homepage	*www.veiki.hu*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional status [201]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[202], [203]**	**Legal name researcher's Employer[204]**
Kostka	Pal	Senior res.	Male	R-I	VEIKI
Lajtha	Gabor	Senior res.	Male	R-I	VEIKI
Techy	Zsolt	Project manager	Male	R	VEIKI
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[201] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[202] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[203] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[204] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**50**
Participating organisation					
Organisation legal name	*Technical Research Centre of Finland*				
Organisation short name	*VTT*				
Internet homepage	*www.vtt.fi*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [205]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[206],[207]**	**Legal name researcher's Employer[208]**
Ilvonen	Mikko	reseach scientist	male	I	VTT
Lindholm	Ilona	Senior research scientist	female	R	VTT
Backman	Ulrika	research scientist	female	R	VTT
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[205] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[206] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[207] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[208] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**51**
Participating organisation					
Organisation legal name	*VUJE Trnava a.s.*				
Organisation short name	*VUJE*				
Internet homepage	*www.vuje.sk*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status [209]**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)[210],[211]**	**Legal name researcher's Employer[212]**
Jancovic	Juraj	Researcher	male	I	VUJE Trnava a.s.
Bujan	Albert	Senior Researcher	male	I	VUJE Trnava a.s.
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA) [2,3]**	**Organiser of course doctoral Student is enrolled in**

[209] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[210] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[211] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[212] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

Proposal Number	509065	Proposal Acronym	SARNET	Participant number	**52**
Participating organisation					
Organisation legal name	*Becker Technologies GmbH*				
Organisation short name	*BTech*				
Internet homepage	*http://www.becker-technologies.com*				

List of RESEARCHERS to be integrated					
Last name	**First name(s)**	**Professional Status** [213]	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [214] [215]	**Legal name researcher's Employer** [216]
Fischer	Karsten	Researcher	M	R	BTech
Häfner	Wolfgang	Researcher	M	R	BTech
List of DOCTORAL STUDENTS					
Last name	**First name(s)**	**University degree**	**Gender: male or female**	**Connection with Joint Programme of Activities (JPA)** [2,3]	**Organiser of course doctoral Student is enrolled in**

[213] e.g. Professor, Post-Doc, Research Director, Head of Reseach Unit xxx,

[214] If the researcher is intended to be directly involved in the JPA, indicate in which of the activities of the JPA the researcher will be involved in (can be more than one). Insert

I for Integration Activities'
R for Jointly Executed Research Activities,
S for Spreading of Excellence Activities), and
M for 'Management Activities'

[215] If the researcher, while intended to be integrated, will not be directly involved in the JPA, insert

NDI for 'not directly involved'

[216] A 'researcher' must either be an employee of the contractor or be working under its direct management authority in the frame of a formal agreement between the contractor and the 'researcher's employer. Insert here the legal name researcher's employer if different from the contractor, otherwise insert <*Organisation short name*>

A.2 Sub-contracting

The activity consisting in supporting ASTEC users will be sub-contracted. The reason is that experts in ASTEC will be mostly involved in tasks aiming at improving and assessing the code.
The company that which is contractually in charge of supporting ASTEC users will carry the corresponding activity. After a call for tenders in 2001, the contract has been initiated in December 2001 and will last up to December 2004. In order to support the SARNET ASTEC users, an amendment of this sub-contract has already been decided to extend the duration of 1 year, thus covering the whole year 2005. Thus, the contract will finish in December 2005. During the year 2005, a new call for tenders will thus have to be set up for the following years, with the milestone of sub-contractor selection end of 2005.
IRSN will be responsible for the subcontracting, the amount of the sub-contract is around 125 k€/year.

The development of the ACT might require a subcontract. Nevertheless, no decision will take before a detailed analysis of the needs and of the already existing and available tools. Such a development could be initiated one year after the beginning of SARNET.
GRS will be responsible for the subcontracting, the amount of the sub-contract is around 50k€.

A.3 Third parties

The participation of AEA-T to SARNET will be co-funded by BRITISH ENERGY, and by BNFL (in-kind contribution in Joint Executed Research Activities).
The participation of VTT to SARNET will be co-funded by the State Nuclear Waste Management Fund (VYR), the Nordic Nuclear Research Programme (NKS) and Finish Nuclear Safety and Radiation Authority (STUK).
The participation of GRS to SARNET will be financially supported by the German Federal Ministry of Economy and Labour.

A.4 Third country participants

There is no plan to fund third country.

Appendix B - Reporting Procedures (Integrated Projects and Networks of Excellence)

Introduction

The Contract and its Annexes set out the main reporting requirements of the Consortium towards the Commission. These are summarised here to provide a readily accessible check list for both the Consortium and the Commission services. In addition, a number of other reports/documents are identified which should be furnished at the times indicated to enable effective and timely monitoring of project progress by the Commission services. A brief description of the nature of the respective reports/documents is also provided.

Report/Document	Deadline
Agendas of meetings concerned with management of the project[217]	2 weeks in advance of meeting
Minutes of meetings concerned with management of the project[217]	1 month after meeting
Statement on signature of the Consortium Agreement	Ideally before contract start – at latest 3 months after contract start
Project Presentation	Within 3 months of contract start
Communication Action Plan	Within 6 months of contract start
Periodic Management Report	Every 6 months after contract start (ie, 6, 12, 18, 24, 30, 36, 42 and 48 months)[218]
Periodic Activity Report, including - where appropriate, detailed implementation plan for the next 18 months - plan for using and disseminating of knowledge	Every 12 months after contract start (ie, at 12, 24, 36 and 48 months)[218]
Final Reports - final management report - final activity report - impact of gender action plan	At end of project (ie, at 48 months)[218]
Financial statements	Every 12 months after contract start (ie, at 12, 24, 36 and 48 months)
Publications/Conferences/Press Releases[219]	1 month before publication

[217] To be strictly limited to meetings concerned with management of the project, eg, meetings of the project management team, meetings of the co-ordinator with work package leaders, meetings of advisory/steering committees, meetings for evaluation/selection of contractors after open calls, etc

[218] Report to be delivered within 45 days of the end of the respective reporting period

[219] Limited to those which may have social, economic or political impact or could trigger significant media interest

Agendas and minutes of meetings concerned with management of the project

In order to enable timely and effective monitoring of the project, the Commission services need to be informed of any significant meetings concerned with the management of the project and of their outcomes. Meetings which fall within this category include those of the project management team/group, of the coordinator and work package leaders, of an advisory/steering committee, of committees established to evaluate responses to open calls, etc. Agendas of these meetings should be provided to the Commission services at least 2 weeks in advance and minutes within one month after each meeting. The Commission services may wish to participate in these meetings, generally in an observational capacity.

Statement on signature of a Consortium Agreement

A 'Consortium Agreement' is a mandatory requirement for this project. On behalf of the Consortium, the Co-ordinator must inform the Commission in writing that a "Consortium Agreement" has been concluded and signed by all contractors (see Article 1.4 of the contract).

This statement should ideally be provided before contract start and not later than 3 months thereafter.

Project Presentation

A brief presentation of the project should be prepared of approximately 2-3 pages in English and other language versions if wished. It should be written in a style which is comprehensible to the non-specialist, avoiding technical language, mathematical formulae and acronyms as far as possible. The inclusion of photos, diagrams and other illustrative material is encouraged. The presentation may freely use material included in Annex I. Publication should be via the World Wide Web and any other media agreed in consultation with the Commission services. The Commission services may publish the project presentation. Periodic updates of the project presentation may be requested.

The project presentation should be provided not later than 3 months after contract start.

Communication Action Plan

In addition to the provisions of Art. 10, 11 and 12 of Annex II, and in the context of raising public participation and awareness, the Consortium will prepare a realistic, coherent and consistent Communication Action Plan to be implemented by the Consortium during the lifetime of the project. Where appropriate, the project should aim to communicate with actors beyond the research community in order to help spread awareness, in particular where the research and its outcomes may have broader socio-economic or political implications.

The Communication Action Plan should be delivered within 6 months of contract start. A summary of activities carried out as part of the Communication Action Plan, together with their impact, should be included in the project's Final Report.

Periodic Management Reports

In line with the provisions of Art. 7 of Annex II, at the end of each 6-month period (also including the last one), a Periodic Management Report should be prepared by the Consortium. This should, inter alia, provide a justification of resources deployed by each contractor, linking them to activities implemented and justifying their necessity. It should address the specific objectives for the period and the extent to which they have been achieved; in addition, it should provide further comments and information on project co-ordination activities such as communication between partners, meetings, conference attendance, possible co-operation with other projects/programmes, publications made or notified, etc.

These reports are due within 45 days of each reporting period.

Periodic Activity Report

In line with the provisions of Art. 7 of Annex II, at the end of each 12-month period (also including the last one), a Periodic Activity Report should be provided. This report provides the main basis for an evaluation of progress made during the period against the objectives and milestones set out in Annex I. It should contain an overview of the activities carried out by the Consortium during that period, a description of progress towards the objectives of the project, a description of progress towards the milestones and deliverables foreseen, and the identification of problems encountered and corrective action taken.

The Project Activity Report should be accompanied by an updated outline implementation plan for the whole project and a detailed implementation plan for the next 18 months.

The **Plan for using and disseminating knowledge** and how it is being implemented should be included as a separate item in each Periodic Activity Report. This Plan should be drafted at the beginning of the project and updated periodically. The Final Report should describe the participants' actual achievements in dissemination and their plans for further exploitation of their results - for the Consortium as a whole and/or for individual participants or groups of participants. It will, where appropriate, refer back to interim versions of the Plan identifying which of the foreseen activities took place, which were modified in the light of the circumstances, or where other actions were introduced.

These reports are due within 45 days of each reporting period.

Final reports

In addition to the Periodic Management Report and the Periodic Activity Reports corresponding to the last reporting period of the project, the Consortium shall, in line with the provisions of Art. 7 of the Annex II, submit to the Commission the following two reports:
- a Final Management Report covering the full duration of the project, and
- a Final Activity Report covering the totality of RTD carried out

The Final Activity Report should also address the plan for using and disseminating knowledge and its implementation and the impact of the Gender Action Plan, ie, the Consortium should describe the results of implementing the Gender Action Plan, present an analysis of its impact and relevance, and make recommendations for further action. The general conclusions of the outcome of the Gender Action Plan will be made publicly available by the Commission.

These reports are due within 45 days of the end of the contract.

Publications/Conferences/Press Releases

The Commission services should be informed, one month in advance, of any publications or initiatives (eg, articles in Journals, press releases, conference papers, etc) by the Consortium which may have social, economic or political impact or could trigger significant media interest.

Project contributions could also be requested for specific official EC conferences where the co-sponsored projects (results, achievements, etc.) are presented to the international nuclear community, eg FISA.

Guidance on Report Preparation

Additional guidance on the preparation of the reports identified above (eg, format, structure, outline content, etc) will be developed by the Commission services in **"Guidelines for Reporting FP-6 / Nuclear Fission"** and will be made available on the programme web site.