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# Terms of Reference for APSA European Network on Use of PSA for Evaluation of Ageing Effects to the Safety of Energy Facilities. Revision 2

**Mirela Nitoi, Andrei Rodionov**

APSA

***Network on Use of PSA for Evaluation of Ageing Effects***
***APSA Network Task 1***
***POS Task 4***

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**APSA Network Task 1**
**POS Task 4**

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***Abstract***

*The Terms of Reference specifies the background, objectives, scope, main tasks and organization of European Network on Use of Probabilistic Safety Assessment (PSA) for Evaluation of Ageing Effects to the Safety of Energy Facilities (EC JRC IE APSA Network).*

*The Network was initiated under the JRC FP6/ 7 Institutional Action "Analysis and Management of Nuclear Accidents" (AMA) and is now operated within the framework of the JRC-IE Institutional project "Plant Operation Safety" POS no. 52103.*

*This document updates the JRC-IE report EUR 22645 EN, issued in 2007.*

*The document is prepared in accordance with the requirements of JRC QA Work Instruction "Management of Partnerships and Networks" W400 1.*

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# CONTENTS

# ABBREVIATIONS

| | |
|---|---|
| PSA | Probabilistic Safety Assessment |
| APSA | European Network on Use of PSA for Evaluation of Ageing Effects to the Safety of Energy Facilities |
| AMA | Analysis and Management of Nuclear Accidents |
| POS | Plant Operation Safety |
| IAEA | International Atomic Energy Agency |
| INSAG | International Nuclear Safety Group |
| CCF | Common Cause Failure |
| AM | Ageing Management |
| LTO | Long Term Operation |
| PSR | Periodic Safety Review |
| SSC | Systems, structures and components |
| JRC IE | Joint Research Centre Institute for Energy |
| CS | Case study |
| SC | Steering Committee |
| OA | Operating Agent |
| NC | Network Coordinator |

# Chapter 1 INTRODUCTION

## 1.1 JRC IE FP6/ FP7 framework

A Network on Use of Probabilistic Safety Assessment (PSA) for Evaluation of Ageing Effects to the Safety of Energy Facilities (EC JRC IE APSA Network) was initiated within the framework of the JRC FP6 Institutional Project Nr. 3131 "Analysis and Management of Nuclear Accidents" (AMA) and it was decided to continue these activities in the frame of new FP7 program. Starting with 2009, the activities of the Network are performed in the frame of JRC-IE Institutional Project no. 52103 “Plant Operation Safety” POS.

Network preparation activities were started from the kick-off meeting held in JRC Petten, on 16-17 September 2004 [1]. After the kick-off meeting the main objectives, list of potential network participants, as well as the short terms activities of the Network were identified.

The following tasks were implemented up to now:

- preparation, review and publishing on the web site of network deliverables (technical and scientific reports) [1-11]
- conducting and realization of case studies [5], [6], [8], [16-21]
- organization of International Workshops [12], [13], [14], and training on data analysis [15]
- annual network meetings (October 7$^{th}$ 2005 in Paris, France; October 4$^{th}$ 2006 in Bucharest, Romania; 16 November 2007 in Budapest, Hungary, and in 4-5 December 2008 in Prague, Czech Republic)
- creation and updating of APSA network website.

## 1.2 Background

According to IAEA statistics (ageing profile of worldwide nuclear generation), worldwide, in December 2009 were 437 operational units reactors. The figure below shows that 132 reactor units have already between 30 and 40 years in operation and 222 are between 20 and 30 years old. Having as target to extend the reactor operation life up to 60 years or even beyond, the ageing impact on plant safety needs to be taken into account.

It can be seen that 81% of operational reactors have more than 20 years of operation, which means that in the next decade ageing management and long term operation issues will became one of the key points of nuclear safety, and the evaluation of ageing effects on the overall plant safety will become a necessity.

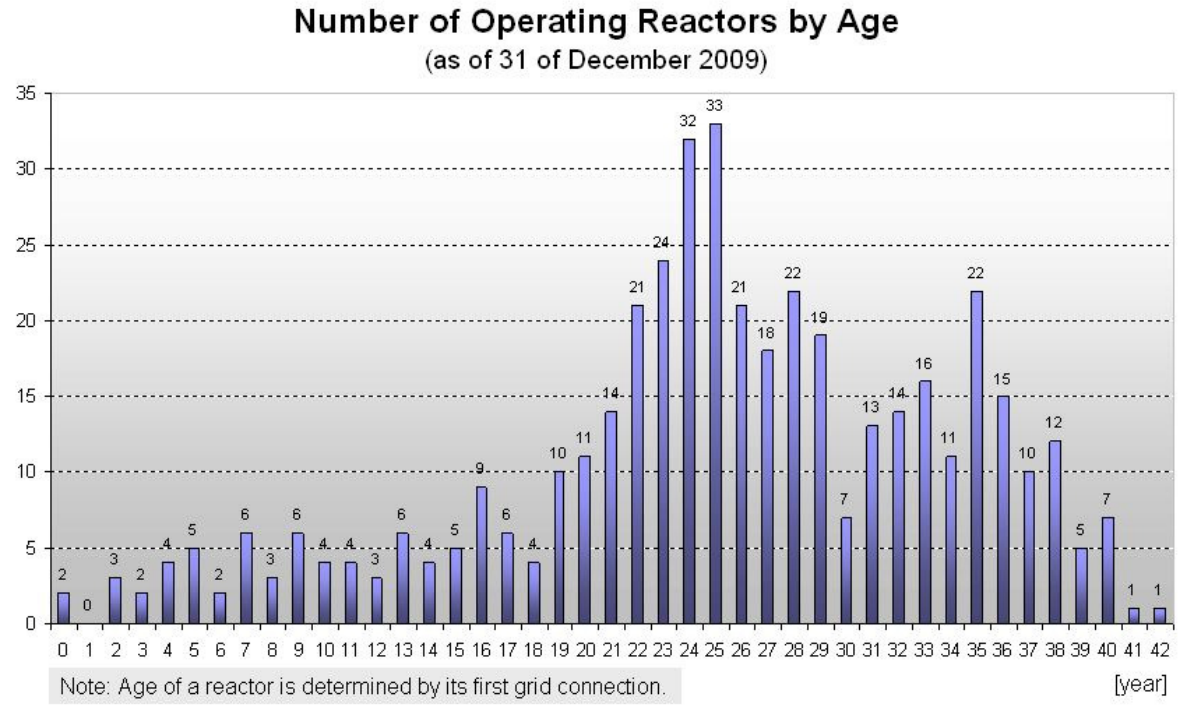


***Figure 1: Ageing profile of nuclear power reactors (IAEA).***

The basic concern to use the PSA for ageing evaluation comes from the requirement to accomplish the safety goals during the whole lifecycle of the nuclear installation (including the extended lifetime). In probabilistic terms, INSAG12 [3] specifies a safety goal as follows: *"The target for existing nuclear power plants consistent with the technical safety objective is a frequency of occurrence of severe core damage that is below about $10^{-4}$ events per plant operating year. Severe accident management and mitigation measures could reduce by a factor of at least ten the probability of large offsite releases requiring short term offsite response."*

So, for the units which have approached the end of initial design lifetime and especially for those which are planning to extend the lifetime, it has to be demonstrated that the plant safety level will remain in accordance with this target until the end of operation, and to do that, is necessary to evaluate the effects of ageing phenomena on the plant performance. On system availability level, ageing can induce the modification of system success criteria, can increase the CCF probability for highly redundant systems, the occurrence of inter-systems CCF, and can change the list of contributors into system unavailability and overall plant risk.

Additional argument to use the PSA for ageing assessment proceeds from significant limitations of the deterministic approach and from the need to prioritize the Ageing Management or Long Term Operation actions to maintain established safety goals. There are many standards and guidelines available on the national and international level [2], but all of them in general are based on the deterministic approach. Since in the last years, the PSA tools have been reached a certain level of maturity, they can bring important issues to successfully complement deterministic analysis results; as consequences, the PSA results were increasingly being used as an integral part of the safety related decision making process.

The motivation for initiation of APSA Network is the fact that current standard PSA tools do not adequately address important ageing issues, which could have a significant impact on the conclusions made from PSA studies and applications, especially in case of plants which operate in advanced aged conditions or long term operation conditions.

The main differences between a standard PSA and an age-dependent PSA are as follows:

- APSA could explicitly models ageing effects in component failure rates, which generally cause the failure rates to increase with age, while a standard PSA assumes that component failure rates are constant
- APSA could explicitly model the effects of test and maintenances in controlling the ageing of components while a standard PSA does not
- Standard PSA neglects the components that have small failure probabilities, not taken into account the fact that these probabilities could suffer dramatic changes in time; passive components are typically not included in the models
- APSA could explicitly calculate the ageing effects and age dependence on the core damage frequency and system unavailabilities, while a standard PSA does not and, instead, it calculates constant values for the core damage frequency and system unavailabilities.

Currently, activities related to ageing evaluation are performed in the frame of the following programs:

- Periodic Safety Review,
- Ageing Management,
- Maintenance Optimization,
- Long Term Operation.

The resulting knowledge from the project running should help PSA developers and users to incorporate the effects of equipment ageing into current PSA tools and models, to identify and/ or develop most effective corresponding methods, to focus on dominant ageing contributors and components and to promote the use of PSA for ageing management, Long Term Operation activities and for risk-informed decisions.
APSA model can be used as a demonstration of current safety level (monitoring) and/ or evaluation of risk profile for prioritization of ageing issues (predictive extrapolation).
The main tasks of the APSA are strongly related to the deterministic ageing assessments tasks (ageing management, long time operation, maintenance optimization), and it should be noted that even intermediate APSA tasks results could be used in mentioned deterministic assessments (trend analysis, system reliability analysis).

APSA requires more data and more extended models than PSA. In the process of incorporating ageing effects into PSA models, the following issues should be considered:

- system fault trees need to be developed in sufficient level of detail, to permit the modelling of ageing effects
- component unavailability should include age dependent failure contributors
- the impact of ageing on CCF should be taken into account
- the modelling of passive component failures in the system logic should be included and improved in order to allow sensitivity evaluations
- component test and maintenance models should include the effects of test and maintenance in terms of “good as old” and “good as new” cases, and should include replacements and renewals of components
- any additional dependency caused by age related degradation of components and structures should be included
- appropriate computer packages should be developed and used

# Chapter 2 OBJECTIVES AND SCOPE OF THE NETWORK ACTIVITIES

Main objective of the APSA Network is, by using common resources of Network participants, to identify, develop and demonstrate methods and approaches which could help PSA developers and users:

- to promote the use of PSA for ageing management and risk-informed applications of Nuclear Power Plants in Long Term Operation (LTO),
- to incorporate the effects of equipment ageing into current PSA models to perform engineering analysis,
- in case where age-dependent PSA couldn't be applied (absence or non-adequacy of ageing probabilistic model, lack of data, etc.), to specify and prioritize reliability monitoring actions/approach to assure that potential decreasing of reliability of SSC would be identified and corrected in time.

More detailed technical objectives are:

- ✓ Evaluation of available methods and approaches on incorporation of ageing effects into PSA;
- ✓ Identification of necessary information on ageing issues to be addressed in PSA tools for specific PSA applications;
- ✓ Discussion of reliability models and data and development of approaches/ models to be used for modelling of ageing effects in PSA models;
- ✓ Prediction of future level of plant safety;
- ✓ Demonstration of feasibility of the proposed approaches and models via case studies;
- ✓ Demonstration of the impact of different levels of ageing information included in a PSA model on the overall PSA results;
- ✓ Identification of further research needs.

# Chapter 3 MAIN TASKS AND DELIVERIES

## 3.1 Issues identified from previous activities

It was identified that the main issues of Ageing PSA development are related to the following:

- qualitative/ quantitative assessment of ageing impact,
- reliability data analysis and parameters estimation for active components,
- application of physical reliability models for passive components,
- review of initiating events frequencies,
- data sources: operating experience, expert judgments and accelerated ageing tests,
- ageing impact on Common Case Failures (CCF) probabilities,
- modification/ adaptation of computer codes for the APSA applications,
- predictive extrapolations (sensitivity and uncertainty analysis),
- application in risk informed decision making process.

These considerations were taken into account for the APSA network actions plan presented below.

# 3.2 Action plan

Task 1. Organization and coordination of network activities

The status of the Network and conditions for participation (criteria, project tasks, contribution modalities, confidentiality and intellectual property issues) were defined in the Network Agreement [3]. The present document contains small changes, which do not affect the basic conditions, just additional specifications related to achieved results, on-going activities, responsibilities and rights. The coordination of network activities, maintaining the web-site updated and dissemination of results is a continuous activity, and is responsibility of NC.

*Deliverables*: updated Web-site, Annual meeting reports, Meeting Minutes, Workshops Proceedings and Executive Summaries.

*Execution mode*: IE R&D, Workshops, network and task meetings

*Resources needed*: JRC IE institutional program (POS) budget, experts travels

Task 2. Analysis of main PSA tasks with regards to APSA

This task is necessary for identification of needs and discussion of potential applications of APSA results for risk assessment and management activities. There will be discussed and specified the necessary modifications of current PSA models in order to use them for specific applications, together with the issues of related data sources, computer codes, resources, limitations and uncertainties.

*Expected results*: the results will help to identify the main areas where the results of the research can be applicable. The report issued will be used as a reference document, mainly for task 8 activities. Important issues necessary for project results applicability directions and prioritization of the project activities will be identified.

Examples about how APSA results can be used in support of ageing management activities, or in preparation to LTO could be included.

*Deliverables*: Report – technical opinion paper about the potential application of APSA results

*Execution mode*: IE R&D, experts meetings and reviews

*Resources needed*: JRC IE institutional program (POS), experts contracts

Task 3. Selection of the SSC to be considered in APSA

*Achieved results*

In the frame of this task was developed a guideline for selection of NPP SSC sensitive for ageing and important from risk and safety point of view. [11] The guideline provides a practical approach and makes recommendations about the methods to be used in selection/ prioritization of components, systems and structures (SSC) sensitive to ageing and important from risk point of view in operating nuclear power plants. The methods suitable for selection were briefly presented, together with their advantages and disadvantages. The list of ageing mechanisms susceptible to appear, the factors favorable for their occurrence and related sensitive materials to ageing mechanisms were also included.

A qualitative method for identification of SSC sensitive to ageing was developed, and data and information sources that could be used in analysis were specified. The applicability of the guideline for selection of SSC susceptible to ageing was demonstrated by results of case study which had used as examples the systems of TRIGA research reactor. [8]

*Expected results:*

- Proved feasibility of the guideline for selection of SSC sensitive for ageing and important from risk and safety point of view. A detailed comparison of the approaches used in case studies and results obtained will be made.
- Technical opinion paper about the use of SSC selection guideline in the plant life management program
- Investigation of synergetic effects influence on the results

*Deliverables*: Reports – technical opinion paper

*Execution mode*: IE R&D, experts meetings and reviews

*Resources needed*: JRC IE institutional program (POS), CS contract, experts contracts

Task 4. Reliability and data analysis for active components

*Achieved results*
In the frame of the task was developed a guideline, which provides practical methods for analyzing component and system reliability data, with focusing on the identification and modelling of ageing. [10] The emphasis was on frequentist and Bayesian approaches, implemented with MS EXEL and the open-source software package WinBUGS, but the methods described can be implemented with other software packages.
A case study that used operational data from VVER-440 reactors [17] was performed to demonstrate the applicability of methods for reliability parameters estimation presented in the guideline.
It was also developed a report which presents the state of the art of existed NPP component reliability data collection systems [7] which aimed to elaborate components reliability parameters to be used in Probabilistic Safety Assessments (PSA); main conclusions and recommendations are addressed to the data availability and accessibility, as well as to possible improvements of data collection. A specific emphasis was done to the possible application of data in time-dependent reliability analysis.
Other case studies focused on the reliability models and data that could be used for assessing the ageing of systems, structures and components including statistical and physical ones. [5], [6] The results obtained in case of I&C and electrical components by application of statistical evaluation methods of ageing trend [5] and those obtained by application of inversion criteria test were presented.
In [6], several cases of Generalized Linear Model were proposed and were investigated in case of continues and discrete data. The Fisher Chi2 minimization approach was applied for goodness of fit test and parameters elaboration, and uncertainty analysis was done for estimated parameters and model extrapolations. The results were analyzed and compared with other approaches.
In relation to this task, it was organized a training [15], with the goal to introduce the methods and approaches for Advanced Time-dependent Reliability Data Analysis which could be used in NPP ageing effects evaluation and management. The training included lessons and practical exercises on computation techniques using available software tools and data examples.
*Expected results*:
This research work will demonstrate the validity of the proposed methods to elaborate the reliability parameters for Ageing PSA model. The results will be useful for:

- improvement of reliability and maintenance data collection system to fit with specific requirements of age and maintenance dependent reliability models for the purpose of APSA,
- choosing the appropriate reliability model for the parameters estimation,
- addressing ageing and maintenance effects in component failure models,
- evaluation of model uncertainties.

*Deliverables*:

- Updated Data Guideline, according to issues raised by the case studies
- Development of recommendations for using ageing generic data in the analysis, discussion about data sources
- Training proceedings

*Execution mode*: IE R&D, case studies, collaboration agreements, experts meetings and reviews
*Resources needed*: JRC IE institutional program (POS), case study contracts, collaboration agreements, expert travels

Task 5. Investigation of ageing impact on Common Cause Failures
*Achieved results*
A case study related to analysis of available CCF data from ageing effect point of view was performed [18], and conclusions regarding CCF coupling factors and CCF preventive means from point of view of CCF-ageing relation were made. The common cause failures coupling factors and mechanisms from point of view of connection with ageing phenomena were discussed. The impact of new intersystem CCF caused by ageing was demonstrated using a generic VVER PSA model.
*Expected results*:

- Extended analysis on CCF coupling factors and CCF preventive measures (using a questionnaire)
- Sensitivity analysis of intersystem CCF for selected systems and initiating events in PSA level1

- Discussion of applicability of selected parts of "Guidelines for analysis of data related to ageing of nuclear power plants components and systems" for analysis of CCF related ageing impact (data collection and processing, trend assessment, assessment of parameters of component/ system reliability models, Bayesian inference).
- Proposed methods (data, parameters, models) how to treat common cause failures in system and plant reliability/ APSA models; development of recommendations for data and models requirements
- Development of practical approach about incorporation of ageing CCF in PSA model

*Deliverables*:

- Report which presents the method of CCF analysis and examples of practical applications
- Guideline for incorporation of ageing effects on CCF in PSA model

*Execution mode*: IE R&D, case studies, collaboration agreements, experts meetings and reviews
*Resources needed*: JRC IE institutional program (POS), case study contracts, collaboration agreements, expert travels.

Task 6. Reliability and data analysis for passive components

*Achieved results*

A case study was performed for derivation of the plant specific frequency in case of Loss of Coolant Accident, using two models (EPRI methodology of pipe section, with data from a detailed review of licensee event reports, and Markov modelling for piping reliability assessment). [20]
Another case study presented the methods used for definition of destruction probability of the equipment and pipelines and technology of their application for safety maintenance in the nuclear power plant and optimum volumes of non-destructive test, repair and maintenance service. [19]

*Expected results*:

- Provide a feasible and practical approach how to treat aged passive components (pipes, supports, etc.) in system reliability models for use in APSA applications. The results will help to address ageing effects in estimations of IE frequencies and system unavailabilities.
- Review and summarize the available structural integrity assessment and lifetime prediction tools
- Assessment of limitation of passive components modelling in PSA
- Development of recommendations for data and models requirements for passive components ageing assessment
- Improvement of risk-based methodologies in order to optimize inspection and maintenance of NPP systems
- Promotion of best practice and a more integrated approach to inspect and assess NPP passive components

*Deliverables*:

- Guideline for assessing ageing effects of passive components
- Reports which present the methods for assessment of ageing passive components and examples of practical applications

*Execution mode*: IE R&D, case studies contracts, experts meetings and reviews
*Resources needed*: JRC IE institutional program (POS), grant 2008, case study contracts

Task 7. Incorporation of age-depended reliability parameters and data into PSA model. Interpretation of quantification results

*Achieved results*

Several case studies were performed on incorporation of ageing effects into the PSA model and discussions on the use of PSA to evaluate the SSC ageing effect on overall plant safety.
The mathematical models of components ageing and their renewal were specified, along with their practical applicability in the probabilistic safety assessment. [6]
The possible impact of age-related degradation on the component reliability and on the plant risk profile was demonstrated using the PWR Large LOCA PSA model [9] and fault trees developed for EWS from Cernavoda NPP [21] as examples. Practical insights, recommendations and limitations were also discussed.

In [16], the developed procedure for the consideration of ageing within existing probabilistic safety assessment model was described, and the developed method was applied on the containment spray system of the nuclear power plant. The obtained results were presented, together with the major findings.

*Expected results*:

- Demonstration of techniques to introduce ageing effect to the existed PSA model
- Development of reports which present practical applications examples
- PSA code improvement

The results will help to evaluate what we need to modify in selected PSA software codes (for example Risk Spectrum) to improve effectiveness of treatment for ageing reliability models, support development of modified software or appropriate interfaces.

*Deliverables*:

- Reports which present the approaches for incorporation of ageing effects in PSA models and examples of practical applications
- Recommendations for PSA code improvements

*Execution mode*: IE R&D, case studies, experts meetings and reviews, collaboration agreements

*Resources needed*: JRC IE institutional program (POS), case study contract, collaboration agreements, expert travels.

Task 8. Applications of APSA results

This task is dedicated to practical applications that use the addressing of ageing effects in PSA in order to evaluate the impact of ageing on the overall plant safety. Applications could be related to:

-prioritization of ageing management issues, LTO activities using APSA findings;

-predictive evaluation of plant safety level;

-prioritization of maintenance activities using APSA results;

*Expected results*:

- Practical guidelines on APSA development and applications of the results
- Development of optimized approaches to Plant Life Management, LTO, including maintenance optimization
- Development of practical guideline for prediction of plant safety level

*Deliverables*:

- Final project report which summarizes and concludes the project activities
- Report which presents the approach and examples of practical applications
- Technical opinion papers for optimization of Plant Life Management, LTO, risk informed decision making activities
- Guideline for prediction of plant safety level

*Execution mode*: IE R&D, case studies, collaboration agreements, experts meetings and reviews.

*Resources needed*: JRC IE institutional program (POS), case study contracts, collaboration agreements, experts contracts.

# Chapter 4 NETWORK ORGANIZATION

To joint the Network, interested organization has to sign the Network Agreement [3] which specifies in details modalities and conditions related to Network organization and operation.

The list of Network partners is presented in Appendix 1. The network will aim to work with scientific networks to share resources and be mutually supportive.

Members will receive regular e-mail updates and invitations to meetings.

Network meeting topics and other network activities will be agreed in consultation with network members.

A developed web page will be updated as much as possible to act as a focal point for the network and to include supporting information for the Network members. The Network Coordinator will be responsible for updating the website information.

# 4.1 Network participants

The membership of the Network is open for European and non-European Institutions (Utilities, Regulatory Authorities, Research and Scientific organizations) which have a certain experience or an interest and allocated resources for PSA applications on ageing assessment and system reliability optimization approaches, and have the good will to share this experience with partners and to undertake new initiatives in this particular field.
The membership of APSA should be confirmed by the leaders of the institutions partners which also nominate their official representatives in the Network, one representative from each institution.
The membership can be withdrawn upon the request of institution-member of APSA to be addressed to the Steering Committee or upon the decision of the Steering Committee.
In particular, it is supposed that each network participant:

- has or plans to have ongoing research and/ or expertise in the area,
- is ready to share the results and/ or participate in reviews and expertise of network deliverables,
- is available for network meetings.

# 4.2 Network Structure

The APSA Network consists of:

1. Steering Committee

Steering Committee (SC) is the ultimate decision-making body of the APSA Network.
It consists of the representatives (experts in the field) of all Network partners (one representative from each member-institution), which have one vote each. In addition, each partner may send others representatives to the meetings of the SC, however, without any voting rights.

2. Operating Agent

To ensure an impartial operation of the APSA network, the Operating Agent (OA) is the Institute of Energy IE, Petten. IE is responsible for the support to the execution of the tasks under the general direction of the SC.

3. Network Coordinator

The Network Coordinator (NC) assures the Network operations during the period between the sessions of the Steering Committee. Being the intermediary to the OA, it is authorized to execute the Network management and is in charge of the overall coordination of APSA.

4. Working Groups

There is defined one working group for each task specified on the action plan, approved by the SC, composed of specialists with active participation and desire to develop/ review the Network deliverables. The task can be subdivided into sub-working tasks, according to specific topics.
The Working Groups can invite experts in the field from institutions which are not members of the Network, if necessary.

5. Task leaders

Each working group has a task leader, nominated and approved by SC.
Task leader coordinates and integrates the expertise relevant to the field in question. Task leader is responsible for the execution of relevant task activities according to the annual approved plans of activities.
The organizational scheme of the Network is presented in Appendix 2. The duties and responsibilities of the Steering Committee, Network Coordinator, task leaders and of the Working Groups are specified below.

# 4.3 Steering Committee

The control of the APSA network is vested in a Steering Committee (SC). As a general rule the SC consists of one representative of each participating organization that signed the Network Agreement. Local engagement with SC members is considered critically important to encourage active participation, capacity building and commitment to the Network.
The SC has the following responsibilities:

- Approve, annually, the working program for the following year, with clear objectives, tasks activities, associated deliverables and responsibilities,
- Review the execution of tasks ensuring that they are carried out in line with the objectives laid down in this Agreement and giving general directions to the Network coordinator,
- Provide help for the technical arrangements for the execution of the tasks,
- Approve the creation and constitution of groups necessary for the implementation of the Agreement, generally called working groups,
- Approve the plan for publications and dissemination of knowledge/ results,
- Support the Coordinator in fulfilling his/ her obligations,
- Nominate and approve the task leaders,
- Inform the interested industrial partners, the regulatory bodies and other national and international organizations about the results obtained and conclusions of the tasks,
- Approve reports for publication upon proposal of the NC.

The SC will advise the IE on the resources needed for the actions of the Network.
The SC will elect every two years, by formal and secret votes, a Chairperson. Re-election of the same officers for two more years will be accepted only if obtained by a two thirds majority of the votes cast. Members not attending the SC meeting may vote by regular post or electronic mail sent to NC, within three weeks from the vote.
The SC operates and reaches its decisions to the greatest extent possible by unanimous agreement. However when a formal vote is requested by a party or is part of the rules, each party, with the exception of the Operating Agent (OA), have one vote. Voting will be organized by the NC, and decisions of the SC will be adopted by a two thirds majority of the votes cast, the quorum being 50% of all the parties. The prior agreement of the IE is necessary for decisions directly affecting the IE facilities, personnel, programs and budget.
If between two SC meetings, is necessary a decision that will impact on all APSA members, NC will take care of the voting, after the complete information of partners. The vote will be made by electronic mail or by regular post, within three weeks from receiving the notification.

# 4.4 Operating Agent

In principle, the Operating Agent (OA) is the IE. This choice is made to ensure an impartial operation of the APSA network. The SC has the right to review this Agreement if the required resources of the OA cannot be made adequate to support the actions required by the network.

The OA is responsible for the support to the execution of the tasks under the general direction of the SC.
The OA responsibilities are the following:

- Help with the organization of the tasks,
- Handle the management of the network and of its activities,
- On behalf of the SC maintain liaison (or help the officers to) with other international or national organizations carrying out tasks similar to the APSA network ones.
- Maintain the archives of the SC and APSA website

NC is responsible for negotiating the necessary administrative support arrangements for the Coordination of the Network.

# 4.5 Network Coordinator

A Network Coordinator (NC) is appointed from among the IE staff with the approval of the SC. The NC, who is a nonvoting member of the SC, is responsible for the overall technical coordination of the work to be carried out in support of the Network activities, and her activities are related to the following:

- Providing support for identification of the resources (facilities, persons and materials) available for carrying out the network programs,
- Collection and organization of data and analysis of results when applicable,
- Maintaining the time schedules,
- Contribution to and supervision of the drafting of reports in cooperation with the SC Chairman,
- Coordination of all technical information to be brought to the attention of the SC.

NC can take any and all decisions required for the proper conduct of APSA.
NC duties and responsibilities are as follows:

- coordination and management of the overall Network activities;
- elaboration of annual working plans and budget estimations for approval;
- evaluation of recommendations elaborated by the Working Groups and making proposals addressed to the Network members on specific actions;
- preparation of the meetings and decisions of the SC;
- timely collection and, with the support of the SC, preparation and development of Network deliverables;
- alert of the SC in case of non-delivery and/or default;
- distribution of any documents and information connected with the Network performance among the partners concerned;
- establishment of APSA reports/ publication plan and results dissemination plan;
- supervision and report of evolution of all integration activities;
- conducting an annual review of the network operation against its objectives;
- dissemination of the results, deliverables and outcome of the Network activities.

In case of contracted work (case study contracts or purchase order), Network Coordinator has the right to retain any payment if a partner is late in submitting or refuses to provide deliverables, as it was agreed.
The NC will be supported by the task leaders, in the proper management and coordination of the task activities.

# 4.6 Working groups

Working groups will cover all technical expertise areas relevant to needs according to the Network action plan. The main activities of the working groups are:

- Develop advanced technical methods within disciplines relevant to the task
- Verify validity of proposed approaches and models, by performing case studies
- Develop recommendations for the improvement of approaches developed, activities performed,
- Elaborate proposals for case study
- Elaborate proposals of further activities, taking into account the dissemination of the results
- Elaborate/ provide comments/ review the Network deliverables
- Share the results with others groups within the network
- Provide assistance and expertise, if necessary, for training new engineers and scientists as experts for a specific issue

Each working group is responsible for its own organizational arrangements, work procedures and time schedule, providing that such arrangements, work procedures and time schedule do not conflict with the Collaboration Agreement, the description of work, or requests made by the Coordinator and the SC.
Each partner participating in a task is responsible for the carrying out of the activities allocated to such task in the annual work plan.
Overall management of each task will be carried out by a highly qualified researcher from a member organization. The person shall have excellent and deep knowledge of the expertise area relevant to the activities accompanied by leadership skills. The task leader coordinates and integrates the available expertise between different organizations within the scope of the task.
The task leader is responsible for the execution of relevant task activities according to the approved plans.
The leaders of the tasks coordinate each task activities and maintain the documentation of these activities, together with NC. Each task leader will give inputs and recommendations to NC in developing the annual working plan.

# 4.7 Meetings

In the frame of APSA Network could be organized annual Network meetings, SC meetings, task meetings and technical workshops.

*SC Meeting*
The SC meets as a matter of principle once a year. The NC/ Chairperson of the SC will propose an agenda to all the members not later than 15 days in advance of the relevant SC meeting. The agenda must give full details and background to any proposed decision.
The NC/ Chairperson may invite any expert or qualified person to attend meetings of the SC with a role of advisor.
The NC and the Chairperson will convene the SC meetings. Each party can bring observing nonvoting persons (experts) to the SC meetings.

*Task Meeting*
Task meetings should take place as required in accordance with the plan of activities. The task leaders may request a meeting if they consider that one is necessary.
The task leader will give each of the members at least ten (10) calendar days written notice of such meetings including an agenda.

*Technical workshop*

To disseminate the results obtained by the APSA participants, technical workshops could be organized. The NC/ Chairperson of the SC will propose a theme for the workshop not later than two month in advance of the event. The NC will be responsible with the workshop organization, in cooperation with any partner of the Network (if his organization will host the event). The NC may invite any expert or qualified person to attend the workshop and depending of the budget, IE could support participation for some speakers/ invited experts.
The NC will be responsible of Workshop Proceedings and of displaying the information on the APSA site.

Minutes of Meetings

The minutes for all APSA meetings should be displayed on the APSA site.

*SC Meeting Minutes*
Minutes of the SC meetings will be submitted to all partners without delay. The minutes will be considered as accepted by the participants if, within fifteen (15) calendar days from receipt, no participants has objected in a written form to the NC.

*Task Meeting Minutes*
The task leader will draft the minutes of each meeting to formalize in writing all decisions taken and shall dispatch them to all members of task Group and to the NC within ten (10) calendar days of the meeting concerned. The minutes will be considered as accepted by the members of the working group if, within fifteen (15) calendar days from receipt thereof, none of them has send comments in writing to the task leader or NC.

# 4.8 Obligations and rights

Each partner hereby undertakes with respect to other organization partners to use all reasonable endeavours to perform and fulfil, actively and on time, all of its obligations under the Agreement, including in particular the submission to the NC of the deliverables.
There are two kinds of contributions to APSA Network:

- the activities performed under contracted work (were requested by the NC using a contract frame or a purchase order, and agreement on financial terms exists)
- in-kind contributions, when the costs related to carrying out the Network activities are bear by the partner organization.

Each partner undertakes to use all reasonable endeavours to supply promptly to the Coordinator via the task leader with all such information or documents as the NC need to fulfil obligations pursuant to this Agreement. More specific,

- Each partner undertakes to use all reasonable endeavours:
    - to notify the Coordinator promptly of any significant problem and delay likely to affect the success of the Network activities and
    - to inform the NC and other partners of relevant communications it receives from third parties in relation to the Network activities.
- Each partner will use reasonable endeavours to ensure the accuracy of any information or materials it supplies as deliverables or part of deliverables, under contracted work or as in-kind contribution and promptly to correct any error therein of which it is notified.
- Each partner agrees not to use knowingly, as part of a deliverable or in the design of such deliverable or in any information supplied under the contracted work or kind contribution, any proprietary rights of a third party for which such partner has not acquired the right to grant licenses and user rights to the other partners.

- Each partner agrees to act at all times in good faith and in a manner that reflects the good name, goodwill and reputation of the other partners and in accordance with good business ethics.
- Each partner agrees to participate in a cooperative manner to the Network meetings

The APSA members in accordance with rules and procedures at national level will assure:

- active participation in the Working Groups and Steering Committee of the Network;
- acceptance of the recommendations of the Steering Committee and NC related to their activities;
- facilitation of the access of the Network members to available material, laboratory and practical work facilities, where possible, at their institutions;
- focal point role in their countries for the dissemination of information, including technical materials and methodological recommendations;
- provision of regular inputs to the web-site;
- undertaking of initiatives in their group;
- permanent liaison with national organizations which may be interested by the subject in order to promote the official recognition of Network results at national level.

The APSA members have the rights to:

- have free access to all materials and information sources of APSA Network;
- make proposals regarding the contents of annual work plans;
- make proposals for performing case studies as contracted work (in the frame of a contract or using purchase order);
- make proposals addressed to the NC and Steering Committee regarding the modalities of operations, the contents of draft recommendations and technical materials as well as regarding the information sources;
- request the NC and Steering Committee support for information and services which are of a particular need to a respective APSA member.

# 4.9 Performance indicators

The NC, SC Chairman and task leaders are responsible for knowledge management performance evaluation of the project. An annual review of the network operation against its objective should be performed. The performance monitoring will be based on periodic assessment of progress and on delivery of specified project results, and shall take into account the project objectives and expected results.

NC, SC Chairman and task leaders shall define and propose suitable key performance indicators for monitoring project progress, and for evaluation of the quality of the project deliverables.

# 4.10 Intellectual property

Scientific quality of the Network documents will be checked by the Network coordinator and SC Chairman and approved by the SC.

In case of contracted work, the knowledge gained and the results obtained are property of the contract beneficiary/ sponsor.

Subject only to restrictions applying to patents, copyrights and proprietary information, the parties shall have the right to publish information arising from the tasks after agreement given by the sponsor of the task and the SC.

For the purposes of this article, proprietary information means information acquired prior to or outside the tasks of a confidential nature such as trade secrets and know how (for example, computer

programs, design and test procedures, processes or treatments) which is appropriately marked, provided such information

- is not generally known or publicly available from other sources,
- has not previously been made by the owner to others without obligation concerning its confidentiality,
- is not already in the possession of the recipient party without obligation concerning its confidentiality.

Reports of all work performed under this Agreement and the results thereof, including studies, assessments, analyses, evaluations and other documentation will be produced and compiled in the way and format decided by SC. Such reports will be provided by the OA to the other parties for their own use.
Publications rules will be the EC JRC IE ones; final Network reports will be published as EUR reports.
The provisions of this article relating to information derived from APSA network shall survive termination of the project for a period of 5 years.

# 4.11 Liability

All parties will use all reasonable skill and care in carrying out their duties under this Agreement and will be responsible for ensuring that the tasks are conducted in accordance with the applicable laws and regulations.
Each party regards the other parties as free from all liability for any loss, damage or injury caused totally or partly by acts or omission of itself or its subcontractors during the execution of the work carried out under this Agreement. Each partner is in charge of its own personnel insurance coverage according to the applicable law including social security law and accident at work and occupational diseases regulations. Each party is solely liable towards third parties for damages caused by itself. Each employer performs its own formalities.
The IE will not answer for any possible consequences arising out of the use of the results of the work carried out under this agreement. Any problem arising concerning liability shall be dealt with under the law of the country in which the event occurred which has given rise to such problem.

# 4.12 Working Languages

The working language of APSA Network is English.
The additional costs related to the use of other European languages for meetings, proceedings, publications, etc. will be born by particular APSA member which might wish to use other languages.

# 4.13 Duration of the Terms of Reference

The validity of the text of the present Terms of Reference is not limited.
The amendments to this text may be introduced by the Steering Committee upon the request of two thirds majority of APSA members.

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# APPENDIX 1 – NETWORK PARTNERS

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# APPENDIX 2 – NETWORK ORGANIZATIONAL SCHEME

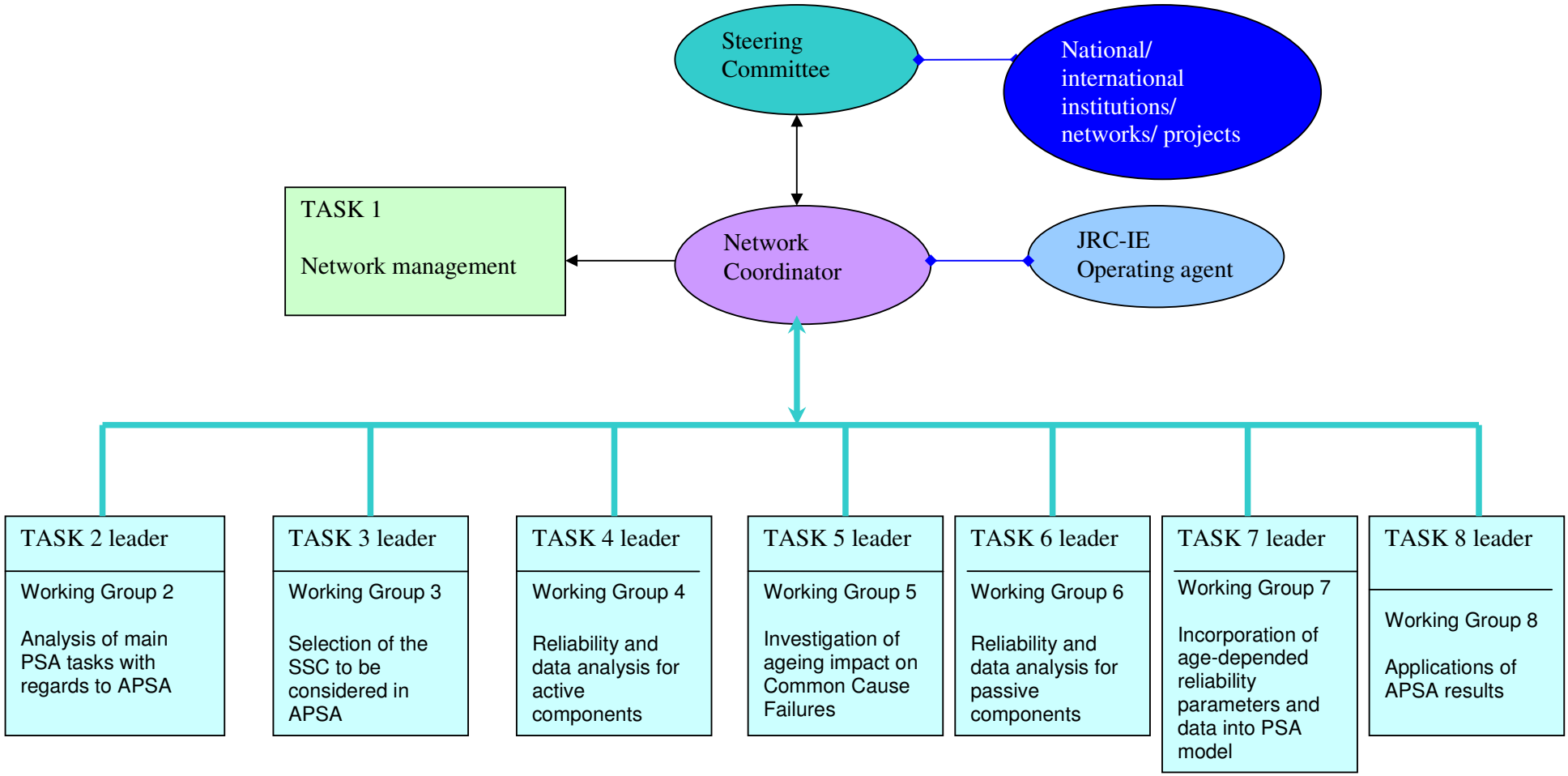


Figure 1 – APSA Network organizational scheme

European Commission

**EUR 24582 EN – Joint Research Centre – Institute for Energy**
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**Abstract**
The Terms of Reference specifies the background, objectives, scope, main tasks and organization of European Network on Use of Probabilistic Safety Assessment (PSA) for Evaluation of Ageing Effects to the Safety of Energy Facilities (EC JRC IE APSA Network). The Network was initiated under the JRC FP6/ 7 Institutional Action "Analysis and Management of Nuclear Accidents" (AMA) and is now operated within the framework of the JRC-IE Institutional project “Plant Operation Safety” POS no. 52103.
This document updates the JRC-IE report EUR 22645 EN, issued in 2007.
The document is prepared in accordance with the requirements of JRC QA Work Instruction “Management of Partnerships and Networks” W400 1.

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