Nuclear Safety Authority (ASN) Opinion n°2012-AV-0147 of 10 April 2012 on the importance of research to ASN and on identifying the first research topics to be further investigated in the fields of nuclear safety and radiation protection

The French Nuclear Safety Authority,

Having regard to the French Environmental Code (*Code de l'Environnement*), and in particular Articles L591.1 ff;

Having regard to the position taken by Ministers after the meeting of the French Atomic Energy Committee on 22 November 2007,

Having regard to the recommendations of its Scientific Committee on 3 September 2010, 1 February 2011, 23 August 2011 and 3 January 2012,

Considers that the quality of its decisions depends primarily on sound technical expertise, and that this in turn relies on the best current scientific and technical knowledge.

deems in consequence that:

- ASN, like its foreign counterparts, must ensure that the necessary knowledge is available to sustain the expertise it will call on over the next five, ten or twenty years;
- although ASN is not a research body, it is important that it identifies the research areas which contribute to the acquisition of such knowledge.

Judges it necessary to ensure that the requirements thus identified are fully taken into account when defining the guideline for research into nuclear safety and radiation protection undertaken by the French Institute for Radioprotection and Nuclear Safety (IRSN), by operators, by other French key players in research (universities and manufacturers), and in European or even international projects.

Notes the launch of a call for projects "Research into Nuclear Safety and Radiation Protection" in the framework of the "Investments in the Future" programme which enables to take into account the first lessons learnt from the Fukushima accident.

After the first two years of internal work and regarding with the recommendations of its Scientific Committee in the following areas:

- social, organizational and human factors;
- radiobiology;
- ageing of metal materials used in pressurized-water reactor (PWR) ;
- non-destructive examination,

Emphasizes the need to further study the topics listed in the Appendix to this opinion**.**

Paris, 10 April 2012.

The Commission of the French Nuclear Safety Authority,

Signed by

André-Claude Lacoste Michel Bourguignon Marie-Pierre Comets

Philippe Jamet Jean-Jacques Dumont

Appendix to the ASN Opinion n°2012-AV-0147 of 10 April 2012 on the importance of research to ASN and on identifying the first research topics to be further investigated in the fields of nuclear safety and radiation protection

1 – Regarding social, organisational and human factors, ASN:

Reminds that social, organisational and human factors refer to all factors which, at an individual, collective or organisational level, affect the way people carry out their activities in the workplace. These factors play a major role in preventing and managing incidents and accidents and, as such, are a vital part of nuclear safety.

Recommends focusing research activities on the following topics:

- organisation and safety: defining methods to assess the efficiency of an organisation in terms of safety, for example, how robust and reliable it is, how capable it is of responding to changes in situations affecting safety and how it takes safety into account at all decision-making levels and so on;
- emergency response: identifying factors which enable personnel and organisations to respond effectively to emergencies, including dealing with stress factors and the ability of the organisation to manage individual reactions, and to determine the resources and methods to be implemented;
- human performance in new technologies: giving greater consideration to people and their environment right from the design stage in new technologies, throughout the nuclear sector, including medicine. This research should, in particular, include studying and designing human-machine interfaces aimed at guaranteeing the safety of various types of human activity;
- failures in automated operating systems: optimising instrumentation & control and procedures enabling operators to control the facility as effectively as possible, in the event of degraded performance of the operating system and, in particular, a digital I&C system.

2 –Regarding radiobiology, ASN:

Reminds that the objective of radiobiological research is to determine the impact of ionising radiation on living organisms at the molecular, cellular and tissue levels. Its ultimate aim is to provide workers, patients and the public with better protection against the risks of exposure to ionising radiation at the doses usually encountered in the workplace, during medical investigations and in the environment.

Notes that research into medical professional practices to provide radiation protection for both patients and workers takes many forms. These activities are aimed at understanding and quantifying risks as well as improving the use of ionising radiation in terms of security and effectiveness.

Recommends:

- continuing research into the biological effects of internal or external exposure to low-dose ionising radiation, and into developing predictive models to evaluate the risks relating to this exposure;
- identifying molecular markers that indicate and repair DNA damage leading to individual radio sensitivity and susceptibility to cancer, together with high-risk populations for whom diagnostic investigations and treatments must be adapted to their predisposition to stochastic (cancer) or deterministic effects;
- developing techniques based on the use of stem cells to treat the effects of excessive exposure to radiation in the event of radiological accident.

3 –Regarding the ageing of metal materials used in pressurised-water reactors, ASN:

Reminds EDF's intention to extend the operating life of its nuclear power plants to 60 years. This requires the definition of applicable safety requirements; and raises the question of how the compliance of the facilities with this safety reference framework will be achieved and demonstrated. Demonstrating equipment compliance until the scheduled end of operation requires taking into account the ageing issues, especially for non-replaceable equipment such as the reactor vessel and containment vessel. For other equipment (such as electrical cables, electronic components and buried pipes), compliance demonstration relies on operator's ability of repairing or anticipating the need to replace equipment and systems that require it. In all cases, a conservative approach of used justifying methods must be demonstrated, in particular regarding evolution of material properties.

Deems that this approach must be associated with research and development aimed at anticipating, characterising and monitoring ageing phenomena (for metal materials, this includes radiation and thermal ageing, fatigue and corrosion), and developing systems to monitor and, where necessary, treat them. International operating experience feedback will also be taken into account throughout this process.

Recommends:
- enhancing the understanding and modelling of damage mechanisms;
- improving existing monitoring methods and developing new ones that are better tailored to known degradation modes and that are able to identify new modes as rapidly as possible;
- carrying out research and development work to ensure the continued use of conservative methods to justify fitness for service;
- consolidating and maintaining metallurgical skills and knowledge.

4 –Regarding non-destructive examinations (NDE), ASN:

Reminds that the aim of research and development into NDE is to identify and characterise damage to materials, and to assist in the qualification of NDE procedures required by regulation (Articles 8 and 9 of the French Decree of 10 November 1999).

Deems that methods and tools should be developed to improve the interpretation of detected signals and to characterise material defects more effectively. This will ensure that inspection tools are properly suited and guarantee the quality of the equipment used to detect defects in components.

Recommends:
- improving material damage inspection techniques by developing and using new system and equipment, in particular to automate and optimise signal analysis;
- developing new inspection tools capable of inspecting areas that are difficult to access and characterising new phenomena encountered, particularly in steam generators;
- consolidating and maintaining skills and knowledge pertaining to material damage and monitoring means.