Western European

WENRA

Nuclear Regulator's Association

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WENRA STATEMENT ON SAFETY OBJECTIVES FOR NEW NUCLEAR POWER PLANTS

Foreword

One of the objectives of WENRA, as stated in its terms of reference, is to develop a harmonized approach to nuclear safety and radiation protection issues and their regulation.

A significant contribution to this objective was the publication, in 2006[1], of a report on harmonization of reactor safety in WENRA countries. This report addresses the nuclear power plants that were in operation at that time in those countries; it includes about 300 "Reference Levels"[2].

Since then, the construction of new nuclear power plants has begun or is being envisaged in the short term in several European countries.

Hence, it has been considered timely for WENRA to define and express a common position on the safety objectives of new nuclear power plants, so that:

- new nuclear power plants to be licensed across Europe in the next years will be safer than the existing ones, especially through improvements of the design;
- regulators press for safety improvements in the same direction and ensure that these new plants will have high and comparable levels of safety;
- applicants take into account this common position when formulating their regulatory submissions.

A report "Safety objectives for new power reactors – study by RHWG – December 2009" has been published by WENRA in January 2010 for stakeholders' comments. Comments received were considered one by one either in establishing the present statement (e.g. comments on the safety objectives themselves) or as an input for the ongoing WENRA work related to new nuclear power plants. In particular, some clarifications were made to the safety objectives stated in the December 2009 study. These seven safety objectives in their final wording (November 2010), as decided by WENRA, are stated below. They will be the basis for further harmonization work.

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[1] Harmonization of Reactor Safety in WENRA countries, report by RHWG, January 2006

[2] These "Reference Levels" were updated in January 2008

Improving the protection of people and of the environment

WENRA considers that the design of new nuclear power plants shall take into account the operating experience feedback, lessons learnt from accidents, developments in nuclear technology and improvement in safety assessment.

The safety objectives for new nuclear power plants have been defined on the basis of a systematic investigation of the Fundamental Safety Principles (SF-1 document issued 2006 by the IAEA). Grounding the safety objectives on the fundamental safety principles has been explained in the December 2009 study[3].

The safety objectives address new civil nuclear power plant projects. However, these objectives should be used as a reference for identifying reasonably practicable safety improvements for "deferred plants"[4] and existing plants during periodic safety reviews.

These safety objectives are formulated in a qualitative manner[5] to drive design enhancements for new plants with the aim of obtaining a higher safety level compared to existing plants. For instance,

- to be able to comply with the qualitative criteria proposed in following safety objective O3, the confinement features should be designed to cope with core melt accidents, even in the long term;
- these safety objectives call for an extension of the safety demonstration for new plants, in consistence with the reinforcement of the defence in depth. Some situations that are considered as "beyond design" for existing plants, such as multiple failures conditions and core melt accidents, are considered in the design of new plants.

Based on these safety objectives, WENRA is currently developing positions on selected key issues for the design of new nuclear power plants.

WENRA considers that these safety objectives reflect the current state of the art in nuclear safety and can be implemented at the design stage using the latest available industrial technology of nuclear power plants.

However, since nuclear safety and what is considered adequate protection are not static entities, these safety objectives may be subject to further evolution. As technology and scientific knowledge advance, WENRA deems these safety objectives should be reviewed no later than 2020.

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[3] In particular, in line with fundamental safety principle 5 "optimization of protection", the safety of new reactors will have to be improved as far as reasonably achievable starting from the design stage, taking into consideration the state of the art and by taking into account all circumstances of individual cases, as defined in SF-1, para. 3.23 (related objectives are O1 to O4 and O6)

[4] Plant project originally based on design similar to currently operating plants, the construction of which halted at some point in the past and is now being completed with more modern technology

[5] WENRA considered quantitative safety objectives but concluded that they would not be more informative than qualitative objectives with associated safety expectations. It was also recognized that the use of quantitative safety goals needs some prerequisites, such as the development of standardized methodologies. Furthermore, compliance with a numerical value may not be enough.

WENRA Safety Objectives for New Nuclear Power Plants

Compared to currently operating nuclear power plants, WENRA expects new nuclear power plants to be designed, sited, constructed, commissioned and operated with the objectives of:

O1. Normal operation, abnormal events and prevention of accidents

- reducing the frequencies of abnormal events by enhancing plant capability to stay within normal operation.
- reducing the potential for escalation to accident situations by enhancing plant capability to control abnormal events.

O2. Accidents without core melt

- ensuring that accidents without core melt induce[6] no off-site radiological impact or only minor radiological impact (in particular, no necessity of iodine prophylaxis, sheltering nor evacuation[7]).
- reducing, as far as reasonably achievable,
  - the core damage frequency taking into account all types of credible hazards and failures and credible combinations of events;
  - the releases of radioactive material from all sources.
- providing due consideration to siting and design to reduce the impact of external hazards and malevolent acts.

O3. Accidents with core melt

- reducing potential radioactive releases to the environment from accidents with core melt[8], also in the long term[9], by following the qualitative criteria below:
  - accidents with core melt which would lead to early[10] or large[11] releases have to be practically eliminated[12] ;
  - for accidents with core melt that have not been practically eliminated, design provisions have to be taken so that only limited protective measures in area and time are needed for the public (no permanent relocation, no need for emergency evacuation outside the immediate vicinity of the plant, limited sheltering, no long term restrictions in food consumption) and that sufficient time is available to implement these measures.

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[6] In a deterministic and conservative approach with respect to the evaluation of radiological consequences.

[7] However, restriction of food consumption could be needed in some scenarios.

[8] For new plants, the scope of the safety demonstration has to cover all risks induced by the nuclear fuel, even when stored in the fuel pool. Hence, core melt accidents (severe accidents) have to be considered when the core is in the reactor, but also when the whole core or a large part of the core is unloaded and stored in the fuel pool. It has to be shown that such accident scenarios are either practically eliminated or prevented and mitigated.

[9] Long term: considering the time over which the safety functions need to be maintained. It could be months or years, depending on the accident scenario.

[10] Early releases: situations that would require off-site emergency measures but with insufficient time to implement them.

[11] Large releases: situations that would require protective measures for the public that could not be limited in area or time.

[12] In this context, the possibility of certain conditions occurring is considered to have been practically eliminated if it is physically impossible for the conditions to occur or if the conditions can be considered with a high degree of confidence to be extremely unlikely to arise (from IAEA NSG1.10).

O4. Independence between all levels of defence-in-depth

- enhancing the effectiveness of the independence between all levels of defence-in-depth, in particular through diversity provisions (in addition to the strengthening of each of these levels separately as addressed in the previous three objectives), to provide as far as reasonably achievable an overall reinforcement of defence-in-depth.

O5. Safety and security interfaces

- ensuring that safety measures and security measures are designed and implemented in an integrated manner. Synergies between safety and security enhancements should be sought.

O6. Radiation protection and waste management

- reducing as far as reasonably achievable by design provisions, for all operating states, decommissioning and dismantling activities :
  - individual and collective doses for workers;
  - radioactive discharges to the environment;
  - quantity and activity of radioactive waste.

O7. Leadership and management for safety

- ensuring effective management for safety from the design stage. This implies that the licensee:
  - establishes effective leadership and management for safety over the entire new plant project and has sufficient in house technical and financial resources to fulfil its prime responsibility in safety;
  - ensures that all other organizations involved in siting, design, construction, commissioning, operation and decommissioning of new plants demonstrate awareness among the staff of the nuclear safety issues associated with their work and their role in ensuring safety.