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## Anchoring TSO expertise by developing a common Safety Assessment Guide

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### Abstract:

Several years ago, three European TSOs, sharing information and experience for a longer time period took the initiative to develop a common Safety Assessment Guide, with the objective to set down the harmonised principles applied in the three organisations to ensure that, whatever the technical analysis could be, the safety assessments are performed according to the same lines and can therefore be used with the same confidence by the people concerned. Later, this initiative was extended to the development of several technical Safety Assessment Guides and the activity was opened towards all EUROSAFE partners. This paper gives an overview of the programme, its objectives, achievements and future prospects.

## 1 EUROSAFE CO-OPERATION PROGRAMME

EUROSAFE is a global and European initiative aimed at promoting the convergence of technical nuclear safety practices in Europe. The initiative finds its expression in three communication media (the EUROSAFE Forum, the EUROSAFE Tribune and the EUROSAFE website) that pool the ideas of various European safety organisations.

EUROSAFE is managed by a Programme Committee composed of seven European nuclear and radiation protection organisations – Bel V (Belgium) (until April 2008, AVN was the Belgian member organisation), CSN (Spain), GRS (Germany), HSE (United Kingdom), IRSN (France), SSM (Sweden) (named SKI before re-organisation in June 2008), VTT (Finland). It is intended to become the approach of all main European nuclear safety and radiation protection organisations.

In the past, three member organisations of EUROSAFE (AVN, GRS and IRSN) worked on a common Safety Assessment Guide, which is described in more detail in § 2. Afterwards, the idea was launched to extent this co-operation by establishing a EUROSAFE Co-operation Programme, focusing around three axes of work:

- Further development of Safety Assessment Guides;
- Identification of research needs;
- Knowledge and information management.

The further development of Safety Assessment Guides is described in detail in § 3. For more information on the two other working groups, the authors refer to [http://www.eurosafe-forum.org/TSO\\_WG.pdf](http://www.eurosafe-forum.org/TSO_WG.pdf).

## 2 DEVELOPMENT OF A GENERIC SAFETY ASSESSMENT GUIDE

For many years the French, German and Belgian Technical Safety Organisations (IRSN, GRS, and AVN<sup>1</sup>) have developed a very close cooperation in the field of nuclear safety.

This cooperation concerns the participation to common research programmes as well as the sharing of information to improve the knowledge about the nuclear installations and associated components behaviour, and consequently to improve the TSOs' capacity to anticipate possible accidental situations and the TSOs' ability to assess the licensees' capacity for accident prevention and mitigation. This cooperation also includes common activities on various technical investigations to reach a better understanding of the phenomena encountered, exchange of opinion and reciprocal safety assessments of nuclear installations in order to get a fully independent assessment and to have as far as possible a stronger safety opinion.

This cooperation has shown that beyond the national and international standards and recommendations, the three organisations have a very similar approach and way of working to ensure an independent, objective and technically strong evaluation of the nuclear installations safety.

In this way, the idea was raised to develop a common Safety Assessment Guide, with the objective to set down the harmonised principles applied in the three organisations to ensure that, whatever the technical analysis could be, the IRSN, GRS or AVN<sup>2</sup> safety assessments are performed according to the same lines and can therefore be used with the same confidence by the people concerned.

In particular, the purpose of this Guide is to provide recommendations to expertise bodies on reviewing and assessing the safety questions related to nuclear activities. It applies to nuclear facilities, the use of sources of ionising radiation, radiation protection, and management of radioactive waste as well as transport of radioactive materials.

This Safety Assessment Guide (SAG) defines the principles and rules for ensuring safety assessment quality, particularly the independence of experts and the objectivity and technical quality of the analysis, both essential factors in assessment credibility. The common Safety Assessment Guide is dealing with:

- Safety assessment objectives
- Requirements of safety assessment of nuclear activities
  - o Expertise body independence, competence and ability to cover its full area of competence
  - o Transparency and traceability of the process
  - o Assessment conducted according to a defined method
  - o Assessment report requirements
- Basis for safety assessment
- Safety assessment process
  - o Request review
  - o Preliminary analysis of the request
  - o Assessment processing
  - o Independent verification of the assessment
  - o Delivery and filing

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<sup>1</sup> Fulfilling the role of Belgian TSO until April 14, 2008

<sup>2</sup> and presently Bel V, from April 14, 2008 on.

This SAG has been announced at the EUROSAFE Forum in November 2004 in Berlin and has been made publicly available through the websites of the three organisations (e.g. [http://www.grs.de/module/layout\\_upload/tso\\_safety.pdf](http://www.grs.de/module/layout_upload/tso_safety.pdf)).

The Guide is used as an internal document in the three organisations, e.g. for explaining the basic principles of an independent safety assessment to new and young staff members.

### **3 DEVELOPMENT OF TECHNICAL SAFETY ASSESSMENT GUIDES**

#### **3.1 Overview of the programme**

After issuing the common Safety Assessment Guide described above, it was judged worthwhile to continue this common effort, by complementing this Guide by more technically oriented assessment guides.

This effort was integrated in the EUROSAFE Cooperation Programme, described shortly in § 1 above. Working Group 1 of the EUROSAFE Cooperation Programme is presently working to develop common technical safety assessment guides for deterministic methods of nuclear power plants safety analyses in specified fields.

The overall structure of the Safety Assessment Guide is foreseen to cover the following main parts:

- A generic part on processing safety assessments, listing the liabilities of each player, assessment approach and available resources (specialist call-up, counter-studies, PSA, etc.), assessment bases (case law, feedback, reference to risks, etc.) and so on. This part can be largely based on the existing Safety Assessment Guide (see § 2). It is proposed to get an agreement on this part in the wider EUROSAFE group, which could lead to further improvements of this part.
- A generic part on technical guidance for safety assessments. This part should cover principles that are (to the extent possible) generic to different types of installations or even different practices (nuclear installations, waste management, transport and radiological protection).
- One or more parts being specific for a given type of installation or practice. In the frame of this project, only nuclear power plants will be covered. Later, it is foreseen to cover other types of nuclear facilities, like experimental reactors, upstream fuel cycle facilities, irradiated fuel reprocessing plants, waste treatment and conditioning plants, radioactive waste interim storage and disposal, dismantling facilities. The specific characteristics of the selected types of nuclear facilities and the risks to be considered in each one will be described, e.g. risks originating externally (earthquake, aircraft crashes, floods, fires, hazards linked to the industrial environment and communication routes both on- and off-site, etc.) or internally (release of radioactive or toxic materials, external and internal exposure to ionising radiation, criticality, flooding, fire, explosion, mechanical risks (handling), loss of auxiliary units on control or fluid circuits, human and organisational factors, etc.).

Presently the main effort is spent on the third part, i.e. to develop technical safety assessment guides for specific topics in nuclear power plant safety evaluations. These guides are intended to provide guidance to TSO staff members on performing the review of

safety assessment files developed by the Licensees in different areas of nuclear power plant safety. The guides presently under development are dealing with the following topics:

- “Mechanical Systems” (leader: GRS)
- “Electrical Systems” (leader: GRS)
- “Incidents and precursor analysis” (leader: IRSN)
- “Environmental Qualification” (leader: Bel V)
- “Severe accidents” (leader: IRSN)
- “Safety systems (fluid and auxiliary systems)” (leader: IRSN)
- “Human Factors Analysis” (leader: GRS)
- “Organisational Analysis” (leader: Bel V)
- “Transient and accident analysis” (leader: Bel V)

It is foreseen to publish one or more of these Guides before the end of 2008 and to continue the effort during 2009.

Besides IRSN, GRS and Bel V<sup>3</sup>, which are the main contributors to the development of these technical assessment guides, the other organisations represented in the EUROSAFE Programme Committee support this activity by providing punctual input.

### **3.2 Example on the development of the Safety Assessment Guide on “Mechanical Systems”**

The technical SAG “Mechanical Systems” (TSAG-MechSys) considers the state-of-the-art in the assessment of nuclear safety and thus takes into account the IAEA guidance and WENRA reference levels related to mechanical systems.

The objective of the document is to provide guidance on the interpretation of the safety assessment principles for nuclear power plants related to the integrity and functionality of passive and active “Mechanical Systems” at nuclear licensed power plant sites.

In the literature, recommendations to this topic still exist, e.g. the Safety Assessment Principles for Nuclear Facilities<sup>4</sup> or the Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants<sup>5</sup>. The proposed TSAG uses these references as a basis and merges it with the expert experience of IRSN, GRS and Bel V together. This was done after an extensive review process within the SAG Working Group.

The document focuses on engineering work and principles and is intended for the use in the assessment of new as well as of existing nuclear power plants. The scope includes systems and components assuring safety functions or supporting safety related functions. Tab. 1 describes the total scope of the Guide and gives some examples of structures and components addressed.

<sup>3</sup> In the past (until April 13, 2008) AVN was participating.

<sup>4</sup> Nuclear Directorate of HSE: <http://www.hse.gov.uk/nuclear/saps/saps2006.pdf>

<sup>5</sup> U.S. NRC NUREG-0800: <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/>

Tab. 1: Scope of the TSAG “MechSys”

| TSAG Mechanical Systems   |   |   |
|---|---|---|
| <b>Mechanical engineering</b> <ul style="list-style-type: none"> <li>• pumps</li> <li>• valves</li> <li>• fittings</li> </ul> | <b>Structural steelwork</b> <ul style="list-style-type: none"> <li>• Piping</li> <li>• heat exchangers</li> <li>• pressure vessels</li> <li>• buildings and structures</li> </ul> | <b>Structural concrete and brickwork</b> <ul style="list-style-type: none"> <li>• buildings and structures</li> <li>• foundation</li> <li>• fastening, bolting and anchoring</li> </ul> |

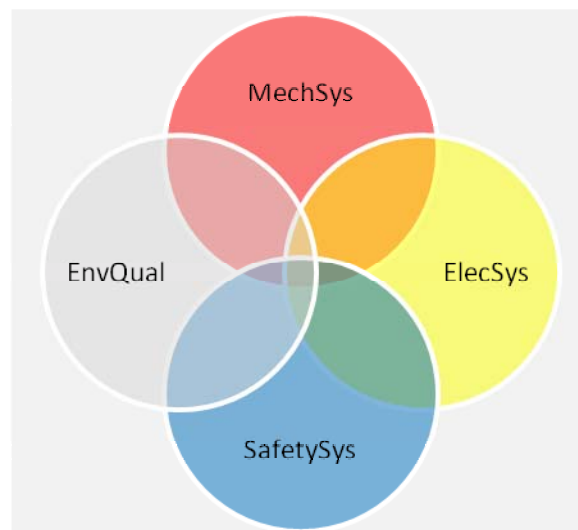


Fig. 1: Relations of the TSAG “MechSys” to other Technical SAGs

*Relations to other technical safety assessment guides*

The Fig. 1 shows the relations of the TSAG “MechSys” to other Technical SAGs. The Guide does not address SSC for instrumentation and control (I & C). These SSC are addressed in the TSAG “Electrical Systems”. Aspects of the assessment concerning the environmental qualification against harsh environment are discussed in the TSAG “Environmental Qualification”. The safety assessment of fluid and auxiliary systems (Safety Systems) is discussed in the Guide “SafetySys”.

*The key elements at a glance*

The topics covered in this Guide for mechanical systems are grouped into the following areas:

- General principles;
- Design;
- Manufacturing and construction;
- Operation, pre- and in-service inspections and
- Additional engineering principles.

The following key elements have been identified, which an assessor should consider in a safety case submission:

- General principles
  - o Design, construction and operation including inspection and maintenance
  - o Identification of deficiencies and weaknesses
- Design
  - o Structural design
  - o Mechanical design
- Manufacturing and construction
  - o Construction materials
  - o Construction methods
  - o Non-conformances
  - o Design changes and improvements
- Operation,
  - o Safe operation envelope
- Pre- and in-service inspections
  - o Pre- and in-service inspection
  - o Inspection techniques
  - o Testing
- Additional engineering principles
  - o Site investigations
  - o Methods of analysis
  - o Consideration of internal and external hazards
  - o Effects of plant ageing
  - o Decommissioning and dismantling

### *Outcome*

The outcome is a document, providing guidance and helping questions and statements for the assessor reviewing his safety case.

Once these documents will be published, the Technical SAGs will be managed as living documents. On the basis of working experience with the Technical SAGs and improvements of the state of scientific and technological knowledge, the paper will be updated periodically.

## **4 CONCLUSIONS**

Within the EUROSAFE Co-operation Programme, an initiative has been undertaken to develop a general Safety Assessment Guide, which is now being complemented by a series of technical SAGs.

This effort is seen as an important step to harmonise important principles of safety assessment and working methods in assessing safety files in different technical areas. The guidance documents are also important to anchor existing knowledge and competence. In that way, they contribute to the transfer of knowledge towards young and new staff members.

## **5 ACKNOWLEDGEMENTS**

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