

# Identifying and Addressing the Support Needs in Member States Intending to Expand Existing Nuclear Power Programmes and Lessons Learned

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# Components of nuclear safety

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- Human factors (sufficient properly qualified and trained personnel to operate the facility, to maintain the equipment, etc.)
- Technical components (facility is designed, constructed, tested, operated, maintained in accordance with the design and safety requirements)
- Organizational components (set of procedures on operating, testing and maintenance, systematic analysis of operational experience, safety assessments of all changes, etc.)



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# Main elements of regulatory activity

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- Authorization of applicants/licensees' activities
- Oversight of licensees' activities
- Analysis of operating experience
- Analytical and research activities
- Developing and updating of safety regulations and regulatory guidance



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# Actual safety challenges

- Constructing of new NPP units after a long time interval
- Increasing work volume for regulators due to constructing of new NPP units
- Shift to multinational subcontractors while constructing of new NPP units
- New countries embarking on nuclear programs
- Keeping effective regulatory tools and personnel competence
- Regulatory requirements, approaches harmonization, knowledge exchange
- Maintaining an effective integrated regulatory framework and transparency in regulatory activities



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# Actual technological safety issues

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- Ageing of equipment
- Life extension of NPP units
- Power uprates of NPP units
- Increasing of a time interval between outages
- Failures of electro-transformers at NPP units
- Safety issues in relation to non-conformance of spare parts



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# Basic principles for regulatory decision making

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- Adequate set of safety regulations that the licensee must follow
- Competence on review and assessment of safety significant issues
- No limitation by the time and no pressure from any interests that may conflict with safety
- Consider how a regulatory decision will appear in retrospect (how stakeholders might view a regulatory decision)



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# Elements of regulatory decision-making process

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- Clearly define the issue for decision and determine the criteria to be applied
- Collect the relevant sufficient information and data
- Determine the analysis to be performed and judge the resources needed for analysis
- Review and assess the significance for safety
- Make and write a well-informed decision (and publish it, if needed)



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# Integrated safety assessment system

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- Main attributes of an integrated system: to be systematic, comprehensive, consistent, transparent; with well-defined guidelines and 'user-friendly' layout.

In order to set up and operate such a system, it is necessary:

- To achieve a consensus among staff on criteria for applying
- To get adequate man-power resources and time for performing analysis of a whole scope of safety information and data
- To have sufficient resources in order to ensure that the system is functioning effectively



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# Estimation of safety information and significance

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- Quantitative safety criteria (e.g. core damage frequency, large early radioactive release frequency, etc.)
- Qualitative criterion like 'level of safety'
- Combination of assessment results on past operating experience, of current engineering judgement, of risk-based insights
- Making the 'periodic safety review'



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# Different technique for event analysis

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- Deterministic safety analysis concentrates
- Probabilistic safety analysis emphasises
- Deterministic transient analysis
- Probabilistic precursor analysis
- Root cause analysis

All these analysis techniques have their limitations, but they complement each other.



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# Challenges arising from uncertainties (1)

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- Actual safety level of a given facility is constantly changing. There are a number of reasons for that:
  - Physically - systems channels and equipment being in operation differ; improvements realizing from economical viewpoint, etc.
  - Organizationally - new personnel & managers, improving operating procedures, etc.
  - Environmentally - site location conditions around of a facility may change due to industrial developments, new sources of external hazards, etc.



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## Challenges arising from uncertainties (2)

- Situations with differing opinions among safety experts  
For such situations, it is necessary to establish an internal regulatory procedure that shall include respectful consideration of all differing expert opinions with clear record of a regulatory decision and its basis.
- Situations with any weak of the safety culture detected  
It is not really possible to measure quantitatively the safety culture of a licensee. Such problems may not be covered by a specific safety regulation. Nevertheless, in several countries there are experts working to understand the influence of safety culture.



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## Challenges arising from uncertainties (3)

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- Ageing of safety information and data
  - How far can old information and data be used (sometimes originated from many years or even year's decades) as the basis of the current safety cases?
  - Ageing of safety assessment results due to new scientific knowledge and background, new safety analysis tools (models, methodologies, accident analysis codes, etc.) and new safety requirements (regulations, standards, even legislation)



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## Decommissioning issues on an early design stage

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- The consideration of decommissioning aspects - prior to granting an operation license
  - The new NPP designs:
    - Incorporate many improvements to plant dismantling
    - Provide for optimal operation and maintenance of a facility with early consideration of decommissioning
    - Foresee systems for records of changes in physical plant configuration and composition of construction materials used - for future estimating the inventory of contaminated materials
  - For new NPP designs, it has become a common practice that the decommissioning plans are developed at an early design stage
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# Russian practice on pre-licensing activities

- Reviewing preliminary safety information and data relating to license applications in the future
- Interacting with a licensee to gain clarification of ‘open questions’ on design or safety justifications in order to avoid additional questions in the future

Pre-licensing regulatory review may be initiated:

- If such a review makes a basis for increasing of regulatory review efficiency in the future, and
- If preliminary information and data deal with safety issues only and contain data enough detailed on specific issues presented by a potential applicant.



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# Conclusions

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- Since the 2006 Moscow International Conference, the nuclear regulators and their TSOs continue to face challenges.
- Sure, this conference allows us to review the achievements, to address current and future challenges through the consistent international dialogue in order to get the nuclear safety and security regime stronger.



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