

Integration of Safety Research into Safety Culture Concepts

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of Regulatory Bodies

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Integration of Safety Research into safety culture concepts

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Why is permanent integration needed? (1)

Requirement for continuous improvement of safety

- In general, nuclear power can refer to an excellent safety performance.
- This success is also based on the results of nuclear safety research [INSAG-16].
- Due to the specificity of nuclear risks, there is a need for continuous safety improvement also of operating nuclear installations.
- The latest IAEA Vienna Declaration on Nuclear Safety [Febr. 2015] underlines:

“Reasonably practicable or achievable safety improvements are to be implemented in a timely manner.”

“... throughout the lifetime of nuclear power plants.”

Why is permanent integration needed? (2)

The link to safety culture

- To comply with this requirement calls for a vigorous safety culture that includes
 - “*an all pervading safety thinking*” [INSAG-3] and
 - a commitment to the highest possible performance in nuclear safety.
 - Good practices alone are not sufficient to implement a vital safety culture [INSAG-4].
 - Nuclear safety requires a **questioning attitude, alertness, and full knowledge**.
 - Questioning attitude and alertness drive safety research, which contributes to the necessary in-depth knowledge.
 - **Transparency and sound judgement**
 - Transparency plays a decisive role in the communication among all stakeholders. The transparent justification of regulatory decisions and actions using research based arguments and data underpins the soundness of the regulatory judgement.
- ⇒ The integration of research into the work of vendors, operators and regulators is an effective means to strengthen their safety culture and such to enhance nuclear safety.

Why is permanent integration needed? (3)

The benefits from integrated safety research

Examples:

- (1) Calculation tools and other methods for **advanced safety assessment**
- (2) Novel techniques for uncertainty and sensitivity analysis allow for a better evaluation of the safety margins
- (3) In the human factors and organizational field, scientific methods help to evaluate the possible effects of changes in the economic boundary conditions upon the safety culture
- (4) Research contributes to identifying and implementing effective means for safety improvements at new and existing plants
- (5) Research indispensable for in-depth evaluation of operational experience and implementation of the lessons learnt
- (6) ...

Why is permanent integration needed? (4)

Interim conclusion

- Safety research is of equal importance
 - for all phases of the lifecycle of a nuclear installation
 - to the safety culture of all organizations having a stake in the nuclear safety system

Who is responsible for the integration and how is the responsibility taken? (1)

General

- Integration of research into safety culture is the responsibility of all major players concerned with nuclear safety,
- most important, it is the government, the regulator, and the operator assisted by their Technical Support Organizations (TSOs).

Who is responsible for the integration and how is the responsibility taken? (2)

Government (1)

- The government
 - should promote the integration of research into the safety culture concepts by the legal demand that the level of protection from the risks of nuclear energy has to comply with the progressing state of the art in science and technology.
 - has to establish the required infrastructure for research, education and training.
- Doing so, the government should
 - elaborate an inventory of necessary research and education.
 - identify the research centers and the universities, which offer or can implement corresponding research programs.
 - close gaps in the national research and education capacity, e.g. by arranging support from international collaboration, maybe with the help of international organizations like NEA, EURATOM, and IAEA.

Who is responsible for the integration and how is the responsibility taken? (3)

Government (2)

- The core inventory of research and education includes e.g.
 - reactor and radiation physics, thermal hydraulics, materials sciences, electrical engineering, etc.
 - geological and hydrological sciences
(in the contexts of environmental protection, seismic analysis and waste disposal)
 - human factor and organizational sciences
 - The research and education inventory will change over the lifetime of a national nuclear power program.
- ⇒ Up-to-dateness of the inventory has to be questioned regularly to prevent significant gaps of expertise

Who is responsible for the integration and how is the responsibility taken? (4)

Government-Regulator-Interface (1)

- The government needs to provide the regulator with sufficient funding for all activities [INSAG-4] including for getting access to research and training capacity to be able to practice a questioning attitude.
- A competent regulator is aware of the fact that safety is best served by combining a customary conservative approach and innovation [INSAG-4].

Who is responsible for the integration and how is the responsibility taken? (5)

Regulatory Research (1)

- Cases in which a regulator may be in need of research include:
 - the establishment or revision of safety criteria or requirements
 - the assessment of new technologies in safety relevant areas
 - the development of tools and methods to improve emergency preparedness
 - the development of methods for the demonstration of the safety case of the geological disposal of radioactive waste
 - etc.

Who is responsible for the integration and how is the responsibility taken? (6)

Regulatory Research (2)

- A competent regulator (maybe assisted by its TSO) establishes a research program, which
 - defines technical and temporal priorities,
 - identifies the resources needed,
 - identifies domestic or foreign research institutions or possible international collaborations that can satisfy the demand.
- The international exchange facilitated by NEA, IAEA, or EURATOM is key to create international collaboration for making efficient use of the scarce research resources.
- The regulator has to have the capability of an intelligent customer [IAEA GSG-4]:
 - has full understanding of the safety issue to be resolved,
 - be able to specify the research task,
 - be able to fully understand the results to properly base regulatory decisions on the outcome of the research work.

Who is responsible for the integration and how is the responsibility taken? (7)

TSOs (1)

- Regulatory bodies need:
 - assistance in maintaining and continuously developing the knowledge base and associated items like computer codes, methods, and data [TSO Conference, Tokyo 2010],
 - sufficient education and training capacity.
- TSOs (having a wide scope view on nuclear safety and security) are well posed to fulfill these functions:
 - early identify issues that deserve research for resolution,
 - do research on their own,
 - are involved in research collaboration,
 - compile all the results and implement them into the research product required by the regulator.

Who is responsible for the integration and how is the responsibility taken? (8)

TSOs (2)

- TSOs are also well posed to provide support, because they created regional and worldwide networks (ETSON, TSO Forum of IAEA).
 - European TSOs have decisively contributed to the strategic research agendas and roadmaps of several European technology platforms (SNETP, NERIS, MELODI).
 - TSOs
 - are represented in the NEA standing committees,
 - contribute to the working and task groups,
 - are involved in many of the NEA joint research projects,
 - work together with the IAEA on the Nuclear Safety Action Plan.
- ⇒ With all these activities they contribute decisively to the effective integration of research into the regulatory practice.

Challenges ahead (1)

- Organizations and mechanisms are in place to make available nuclear safety research to support the regulator's work.
- There is a threat to maintaining that key support,
 - especially in countries where the development of nuclear energy stagnates or even declines:
 - ⇒ research and training will be faced to declining appreciation and to decreasing funding.

Challenges ahead (2)

- Challenges resulting from newly emerging questions and tasks, e.g.:
 1. risk due to low probability / high consequence scenarios,
 2. organizational and cultural influences upon the management of severe accidents,
 3. lifetime extensions of NPPs,
 4. introduction of new technologies also in existing installations,
 5. embarking countries need scientific support and assistance with capacity building from experienced nuclear countries.
- Decreasing funding for research and training but constant or even increasing research demand has the potential of compromising nuclear safety.

Conclusions

1. Integration of nuclear safety research into the safety culture requires permanent efforts by all organizations concerned [see also INSAG-12].
2. Declining funding for nuclear safety research in major nuclear energy countries combined with increasing requests for instance due to lifetime extension, or due to the development of power plants based on novel technologies creates the potential of compromising nuclear safety.
3. National stakeholders together with NEA, IAEA, and EURATOM should early identify gaps in knowledge, research and infrastructure.
4. IAEA should integrate in its services the review of the safety research and TSO capacity available to regulators and operators.
5. International research collaboration and networking represent the best suited instrument to make efficient use of research infrastructures.
NEA in consultation with the IAEA and EURATOM shall continue coordinate major international research programs.
6. NEA, in coordination with IAEA and EURATOM, should continue offering a forum for discussion of safety research and strengthen the efforts to disseminate the results.

THANK YOU !