International Conference on Fast Reactors and Related Fuel Cycles: Safe Technologies and Sustainable Scenarios (FR13)

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Panel 1: Safety design criteria

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There is general consensus in the nuclear community, and more after the Fukushima accident, that the deployment of nuclear energy has to be done at the highest levels of nuclear safety and that safety cannot be compromised by other factors. It is well understood that reactors that are being licensed and the new generations of reactors that will be constructed in the future will need to reach higher safety levels than the existing ones.

Several countries and international organizations or international groups are launching initiatives to harmonise safety goals, safety requirements, safety objectives, regulations, criteria or safety reference levels. There are differences in the meanings of these terms and the working approaches, but the overall purpose is the same: to specify how new plants can be safer.

In this context, the IAEA has an statutory function for developing international nuclear safety standards. The IAEA safety standards are per se not mandatory for IAEA Member States. Regulating safety is a national responsibility, and many States have decided to adopt the IAEA's standards for use in their national regulations in different ways. The IAEA Safety Standards represent international consensus on what must constitute a high level of safety for nuclear installations. In the area of NPP design, IAEA safety standards that are published are intended to apply primarily to new plants. It might not be practicable to apply all the requirements to plants that are already in operation. In addition, the focus is primarily on plants with water cooled reactors.

As such, IAEA SSs in general, and Design requirements for NPPs are of limited application for innovative reactors that use other coolants and materials or operate in very different physical conditions, but can constitute a good basis for the development of requirements and design criteria for them. In fact many requirements are of a general nature (principles and concepts, management of safety) and can be adapted to innovative reactors. For other aspects, e.g. specific plant systems or design features, new requirements would be needed.

IAEA is however doing some work on other category of documents for identifying the safety aspects that relevant to the design of advanced and innovative reactor designs, which could be reflected in the safety standards in the future, when sufficient consensus may exist. (There will be a presentation later this week at the conference on this subject).

A few months after the Fukushima accident, the IAEA approved a new version of safety requirements for NPP design (SSR-2/1) with the note that lessons that may be learned from studying the accident at the Fukushima Daiichi nuclear power plant would need to be considered in a future revision of the guide. The IAEA has embarked in a systematic programme for reviewing the standards in the light of the lessons learned from the Fukushima accidents. As compared with the previous version of the design requirements (NSR-1), the new requirements already introduce the need of design provisions for certain severe accident conditions, the so called design extension conditions, as to reinforce the 4^{th} level of DiD.

IAEA is also compiling lessons learned from the Fukushima accident for reviewing and reinforcing them as appropriate. Many lessons can be found in reports from Japan, safety missions conducted, the meeting of the CNS and other international meetings. In 2012 the IAEA conducted 2 International experts meetings on “Protection Against Extreme Earthquakes and Tsunamis” and on “Reactor and Spent Fuel Safety” in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant, which provided a comprehensive list of lessons learned.

It should be considered that there were not many gaps in the IAEA standards, but the experience should always be used to propose further safety enhancements. In any case, the nature of these lessons, e.g.the adequate assessment of external and implementation of sufficient safety margins, the thorough implementation of independent levels of defence in depth, including provisions for severe accidents, is not restricted to the current LWRs. Their consideration for the design of advance and innovative reactors is also of outmost importance.

The harmonisation of safety goals is very relevant to the enhancement of safety for future reactors worldwide. Starting from the fundamental safety objective of protecting people and the environment from the harmful effects of radiation and the fundamental safety principles it this possible to develop a hierarchical structure of safety goals that can be technology neutral at higher levels (and of broad acceptance) and more technology specific at lower levels. This can constitute the basis for defining safety criteria for innovative reactor designs.

IAEA is currently carrying out activities aimed trying to seek consensus in such an approach and on how to strengthen the implementation of the defence in depth approach. The IAEA is holding a Technical meeting in October on this subject. You are welcome to participate.

While advances are being made in country groups that share common interests (MDEP, GIF), there is a variety of approaches related to establishing and using safety goals worldwide. Some countries consider goals as strict limits, others targets to strive for.

Generation IV for instance has established safety and reliability goals, among other goals for the new generations of reactors, as presented here today. These goals, such as reducing the likelihood of accidents and the elimination of the needs for off-site emergency response(i.e. elimination of early or large releases, as stated also by WENRA), lead to the need for definition of more specific criteria addressing the specific safety issues of each innovative reactor concept, that are required by the designers. A good example of this process is certainly the work being carried out for the design criteria for sodium cooled fast reactors (SFR), with participation of designer and developers. This work shows how a systematic approach based upon the safety pillars, i.e. meeting the fundamental safety objective, the implementing the defence approach and maintaining the fundamental safety functions, concepts that are very well anchored in the IAEA safety requirements for design, can be used to derive a set of requirements of criteria that are specific for SFRs, by taking into account the specific properties of the core, coolant, materials and other aspects of the SFR design.

I consider this approach as a good first step that can be an example for applications to other designs, (not necessarily of generation IV)

Thank you very much for your attention.