Risk and Safety Working Group

The Risk and Safety Working Group (RSWG) has been an active methodology working group since 2005, with a mission to establish a harmonized approach to, and provide assessment tools for, the risk and safety of Gen-IV systems. RSWG membership currently includes representatives from Canada, China, the European Union, France, Japan, Korea, South Africa, Russia, the United Kingdom and the United States as a forum of advanced reactor designers and regulators. The IAEA also participates as an observer. Prior to 2020 the RSWG:

- proposed a set of broad safety principles and attributes based on GIF safety and reliability goals as input to R&D plans for specific Gen-IV design tracks;
- developed a technology-neutral, comprehensive, integrated safety assessment methodology (ISAM) as a toolkit to evaluate risk and safety for all six systems based on a consistent framework, and supported its implementation for specific Gen-IV design tracks;
- established technical interfaces with the IAEA and the NEA Working Group on the Safety of Advanced Reactors (WGSAR) under the NEA Committee on Nuclear Regulatory Activities (CNRA).

Ongoing RSWG projects include the development of white papers on: 1) a pilot application of ISAM to assess its impact on the design and licensing of select, Gen-IV design tracks; and 2) preparation of system safety assessments as summaries of high-level safety design attributes and remaining R&D needs. Both of these white papers will be elaborated in close co-ordination with the respective GIF System Steering Committees (SSCs). Published white papers and system safety assessment reports can be downloaded from the GIF RSWG web page: www.gen-4.org/gif/jcms/c_9366/risk-safety. Development of safety design criteria and guidelines for specific Gen-IV systems are also an ongoing collaborative effort between the RSWG and SSCs to establish the basic requirements for design, fabrication, construction, testing, and operation of Gen-IV systems.

As a result of the ongoing COVID-19 pandemic, the RSWG held both of its 2020 semi-annual meetings in virtual format through online meetings. A major RSWG accomplishment in 2020 was the update of the *GIF Basic Safety Approach* report (www.gen-4.org/gif/jcms/c_9366/risk-safety). The updated report captures post-Fukushima recommendations and requirements to ensure a level of safety for Gen-IV systems compatible with the expectations of safety authorities. It also provides common definitions for the plant states considered in a design and their alignment with levels of defence in depth, reinforces the independence of prevention/mitigation features at different defence-in-depth levels, and clarifies the concepts of design extension conditions and practically eliminated accidents.

Efforts also continued in 2020 towards a new RSWG-WGSAR joint initiative on the development of a risk-informed approach to the selection of licensing basis events and the safety classification of systems, structures and components. Novel aspects of numerous Gen-IV systems make the identification of hazards, initiating events and event sequences a challenge, requiring a systematic approach for their design and licensing. Critical examination of these designs, their safety behavior, and all aspects of their operations is key to addressing uncertainties, mainly due to initially limited information. The proposed risk-informed approach offers a process that combines both deterministic and probabilistic input in a complementary way for a systematic search of accident scenarios, which enables a classification of the responding plant equipment based on their risk significance.

It aims to establish event sequence categories that must be included in design assessments and reviews, integrate the deterministic inputs and risk insights so as to identify axnd classify initiating events and event sequences in each category, evaluate the event sequences against the regulatory criteria based on defined frequency-consequence targets, classify the plant equipment to identify risk-significant items, and define design-basis accidents and design extension conditions.

Having completed most of its missions, in 2019, SFR Safety Design Criteria Task Force (SDC TF) members joined the RSWG to contribute to the drafting of safety design criteria for other Gen-IV systems, including the lead- and gas-cooled fast reactors, as well as very-high-temperature reactors. The RSWG will inherit the remainder of work on updating the Safety Design Guidelines Report for SFR structures, systems and components based on comments received from the IAEA and WGSAR in October 2020. IAEA and WGSAR comments will be addressed and incorporated into the next version of the report in 2021. SDC TF members also support the implementation of the proposed risk-informed approach for GIF SFR design tracks in an effort to develop best-practice guidelines for its application and to ensure its consistency with the SFR SDC and *Safety Design Guidelines* (SDGs) completed in earlier years.

The RSWG, with the support of new SDC TF members, plans a more proactive participation in the new IAEA initiative on the development of safety standards for small modular reactors (SMRs) since non-LWR SMRs have many technical similarities to GIF systems. Reflecting GIF experience in the development of safety design criteria and guidelines for specific Gen-IV systems, in 2020, the RWSG already made some important contributions to the IAEA initiative by supporting the development of a safety approach/methodology for non-LWR SMRs, assessing the applicability of design requirements in safety considerations, and making direct contributions to the IAEA's new safety document: *Towards a Technology Neutral Nuclear Safety and Regulatory Framework: Applicability of IAEA Safety Standards to SMRs.*

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Chair of the RSWG, with contributions from RSWG members