

# The Current Status and Prospects of GIF PR&PP and KAERI's Research Activities for Applying PRPPEM

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## 1. Introduction

The Generation IV International Forum (GIF) emphasizes proliferation resistance and physical protection (PR&PP) as one of the main aspects to be considered regarding future nuclear energy systems (NESs). Also, the PRPP Working Group developed an Evaluation Methodology (PRPPEM) which can assess PR&PP characteristics of NESs. It was refined over the years through several case studies. This paper presents the current status of PRPPEM, researches that KAERI has done, and future WG's activities to update them.

## 2. Current Status of GIF PRPP Evaluation

### Methodology

#### 2.1 The Beginning of GIF PRPPWG

Starting in 2002, the Proliferation Resistance and Physical Protection Working Group (PRPPWG) which aims to develop measures for expressing safeguardability of NESs was established by GIF. The group developed a PR&PP Evaluation Methodology (PRPPEM) that was refined over the years through several case studies, such as a hypothetical 'Example Sodium Fast Reactor'. According to the 2002 GIF Roadmap, nine PR&PP R&D areas were identified, including R&D on potential vulnerabilities, safeguards approaches,

protective barriers, material deployed, potential misuse, material protection, accounting and control for each fuel cycle step.

#### 2.2 The current Status of GIF PRPPWG and Interactions with System Steering Committees (SSCs)

In 2007, the PRPPWG and SSCs/pSSCs (provisional SSCs) for each of the six GIF reactor technologies held workshops to discuss about the PRPP characteristics of some system designs and update the PRPP concepts. As a result, a series of internal reports, "White Papers" are published. It reports the six GIF reactor technologies, the main system design options with a mention of the analysts and definition about PR measures. The 2014 GIF Technology Roadmap Update motivated the PRPPWG to assess the progress since the 2011 white paper. By conducting survey with SSCs, in April 2017, the PRPPWG organized a joint workshop in Paris with the participation of representatives of all six SSCs, GIF Senior Industry Advisory Group Panel (SIAP) and IAEA. It gave the opportunity to address some of the comments provided by the SSCs in their reply to the questionnaire, refresh the main aspects of the PRPPEM and of "PR&PP by Design" concept, update the PRPPWG on the evolutions and current status of the six GIF reactor technologies. The update activities are still ongoing and expected to complete the activity in next year.

KAERI has contributed to the development of the proliferation resistance evaluation methodology by taking a leading role in GIF PRPPWG. The PRPP Methodology was applied to evaluate a proliferation resistance for a pyroprocessing facility design. The study identified new metrics and a pathway analysis algorithm based on the GIF PRPP measures and analysis approach. KAERI recognized that the process of safeguards or a PR evaluation should be managed in an iterative manner. The ROK is actively participating in GIF PRPPWG and planning to increase the effectiveness of the research by sharing the results of nuclear nonproliferation studies with the GIF PRPPWG in the nuclear fuel cycle. Also, KAERI recently translated “Evaluation Methodology for Proliferation Resistance and Physical Protection of Gen.IV Nuclear Energy Systems – Revision 6”, which is a technical report by GIF PRPPWG in 2011, into Korean.

### 3. The Prospects and Outlook

With the 2018 GIF R&D Outlook document, the PRPPWG will concentrate its future R&D activities on specific goals with an indication of possible aspects that might have to be investigated. Currently, the PRPPWG and the six SSCs/pSSCs are collaborating to update the document in view of the design evolutions and changes that have occurred in recent years.

KAERI is continuing its nonproliferation research such as the development of safeguard systems and proliferation resistance for the innovative nuclear fuel cycles including spent fuel treatment, which can contribute to enhancing international efforts to secure nuclear nonproliferation.

## 4. Conclusion

The experience in the process of developing and testing the PRPEM formed the basis for a close interaction with the GIF SSCs/pSSCs in 2011 and gave light to a joint document which is emphasizing the PR&PP characteristics of the six GIF reactor technologies. This activity will not only shed light on PR&PP advancements of the current system designs, but also inform the PRPPWG future activities. As one of PRPPWG, KAERI will actively take part in further studies.

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