

# **Radiation and Physical Protection Challenges at Advanced Nuclear Fuel Cycle Facilities**

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## **Abstract**

The purpose of this study is to examine challenges and opportunities for radiation protection in advanced nuclear reactors and fuel facilities proposed under the Generation IV (GEN IV) initiative which is examining and pursuing the exploration and development of advanced nuclear science and technology; and the Global Nuclear Energy Partnership (GNEP), which seeks to develop worldwide consensus on enabling expanded use of economical, carbon-free nuclear energy to meet growing energy demand.

The International Energy Agency projects nuclear power to increase at a rate of 1.3 to 1.5 percent a year over the next 20 years, depending on economic growth. Much of this growth will be in Asia, which, as a whole, currently has plans for 40 new nuclear power plants. Given this increase in demand for new nuclear power facilities, ranging from light water reactors to advanced fuel processing and fabrication facilities, it is necessary for radiation protection and physical protection technologies to keep pace to ensure both worker and public health.

This paper is based on a review of current initiatives and the proposed reactors and facilities, primarily the nuclear fuel cycle facilities proposed under the GEN IV and GNEP initiatives. Drawing on the Technology Roadmap developed under GEN IV, this work examines the potential radiation detection and protection challenges and issues at advanced reactors, including thermal neutron spectrum systems, fast neutron spectrum systems and nuclear fuel recycle facilities. The thermal neutron systems look to improve the efficiency of production of hydrogen or electricity, while the fast neutron systems aim to enable more effective management of actinides through recycling of most components in the discharged fuel. While there are components of these advanced systems that can draw on the current and well-developed radiation protection practices, there will inevitably be opportunities to improve the overall quality of radiation detection through research and technology development, as well as regulation and education.

Based on the review, this paper outlines key challenges and opportunities for radiation protection and detection technology development, and concludes with a proposal for international cooperation on radiation protection for advanced nuclear power generation facilities.

***KEYWORDS: nuclear energy, radiation protection, physical protection***

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