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# Incorporation of Risk Analysis for an Advanced Transparency Framework*

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Proliferation resistance features that reduce the likelihood of diversion of nuclear materials from the civilian nuclear power fuel cycle are critical for a global nuclear future. A framework that monitors process information continuously can demonstrate the ability to resist proliferation by measuring and reducing diversion risk, thus ensuring the legitimate use of the nuclear fuel cycle. The automation of new nuclear facilities requiring minimal manual operation makes this possible by generating instantaneous system state data that can be used to track and measure the status of the process and material at any given time.

The term "transparency" is used in many different applications. In the context of the nuclear fuel cycle, transparency can be defined as:

> "…a high-level concept, defined as a confidence building approach among political entities, possibly in support of multi-lateral agreements, to ensure civilian nuclear facilities are not being used for the development of nuclear weapons. Additionally, nuclear fuel cycle transparency involves the cooperative sharing of relevant nuclear material, process, and facility information among all authorized parties to ensure the *safe and legitimate use* of nuclear material and technology. A system is considered *transparent* when the parties involved feel that the *proliferation risk* is at an acceptable level. For this to occur, proliferation risk should be monitored in a continuous fashion." (Love et al., 2006)

The automation of new nuclear facilities requiring minimal manual operation provides an opportunity to utilize the abundance of process information for monitoring proliferation risk. A framework that monitors process information continuously can lead to greater transparency of nuclear fuel cycle activities and can demonstrate the ability to resist proliferation associated with these activities. Using the process data inherent to the plant, has been developed a methodology for calculating the diversion risk of the plant based on a comparison of expected and observed operations.

The "expected risk" is the risk introduced by the existence of the facility based on planned and declared operations. This risk represents the normal baseline risk and is dependent upon plant design and processing capabilities. The "observed risk" is measured instantaneously when the plant is operating and is based on the plant process data transmitted by sensors during the completion of declared operations.

Sandia National Laboratories (SNL) and the Japan Atomic Energy Agency (JAEA) are working in cooperation to develop an advanced transparency framework capable of assessing diversion risk in support of overall plant transparency. The "diversion risk" quantifies the probability and consequence of a host nation diverting nuclear materials from a civilian fuel cycle facility. This framework is currently being demonstrated at the Monju Fuel Handling Training Model at the International Nuclear Information and Training Center in Tsuruga City, Japan.

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