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Incorporating International Considerations into Systems Engineering and Regulatory Lifecycle-Based Framework for Security-by-Design

The popularity of advanced and small modular reactors (A/SMR) is driving "security-by-design"(SeBD) efforts. Current approaches range from applying traditional protection strategies "early in the design lifecycle"to seeking "intrinsic security···as an integral part of the organization"to making "security···[a] part of the facility lifestyle."Yet, international A/SMR considerations highlight an opportunity to recharacterize SeBD options.

In response, the U.S. National Nuclear Security Administration's (NNSA) Office of International Nuclear Security (INS) and Sandia National Laboratories have developed a systems engineering and regulatory lifecycle-based framework for SeBD. This framework has two goals. First, it identifies opportunities that exist for achieving security goals at each A/SMR lifecycle stage. Second, it categorizes those SeBD options related to which stakeholder (including the designer or utility) might have primary responsibility. Consider, for example, the International Atomic Energy Agency's safety guide SSG-20. If SSG-20 is considered part of an engineering and lifecycle model of A/SMR development, then this SeBD approach should identify opportunities to claim credit for security performance that align with safety and operations-relevant A/SMR decisions described in SSG-20.

This paper will use demonstration cases to describe this framework, as well as offer lessons insights for incorporating SeBD in—and improving security for—A/SMRs.

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