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Recommendations for Design-Stage Safety and Security Probabilistic Risk Assessment Co-Development

As many advanced and small modular reactor developers are entering the licensing process and looking to expand their commercial offerings internationally, nuclear security is a critical but often overlooked element as part of the design process. Probabilistic risk assessments are being used to support risk-informed safety assessments but have not gained significant awareness as highly effective multi-purpose tools for a broad range of nuclear security applications. Designing a plant protection system, and other barriers which may serve a security function, after a conceptual or basic design phase may lead to higher total security costs and/or redesign of other buildings, structures, system placements or components. This motivates for a "security-by-design"approach. Probabilistic risk assessments can aid in this approach by supporting the identification and quantifying the risk importance of various target sets and assessing the impact or consequences of security scenarios which will lead to an improved protection strategy that adequately addresses the risks due to all design basis threats. However, there are many fundamental differences between a probabilistic risk assessment used for safety and used for security events (i.e., sabotage events). When these differences are identified and included in the development processes, a safety and security probabilistic risk assessment can be effectively constructed in tandem without significantly more burden placed on the design and analysis teams.

Using traditional probabilistic risk assessment elements as a guide, this paper will provide technical recommendations for the integration of security and plant protection features into a safety probabilistic risk assessment, which can be easily turned on or off depending on the application. The goal is to create an effective and integrated safety and security probabilistic risk assessment model without having separate models leading to version control and consistency problems to which design phase risk assessments are vulnerable.

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