Preliminary Risk Assessment of Nuclear Security Considering the Potential for Future SMR Developments in Thailand

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EXTENDED ABSTRACT

Thailand is exploring the development of Small Modular Reactors (SMRs) to diversify energy sources and meet growing sustainability demands. As part of this process, it is essential to assess and mitigate the security risks related to transportation, operation, and storage of nuclear materials, as well as the protection of reactor facilities. This report examines the current nuclear security landscape in Thailand, identifies key challenges, and offers practical recommendations to strengthen nuclear security for the potential deployment of SMRs. The two primary areas addressed are the policy and regulatory framework and personnel-related risks, both of which are crucial for ensuring a robust nuclear security system. The study concludes with recommendations aimed at addressing existing gaps and enhancing the sustainability of current security measures. Key proposals include aligning the regulatory framework with international standards, strengthening personnel training and risk management, and integrating advanced technologies to secure nuclear materials. Furthermore, strategies are outlined to improve and maintain long-term protection and resilience. Special attention is given to optimizing existing human resources and fostering institutional collaboration, alongside a training framework that supports technical competence across relevant stakeholder groups. The report aims to assess Thailand's readiness for nuclear security in the context of potential SMR development.

- **Key Risk Areas Identified**

The preliminary risk assessment highlights several nuclear security challenges associated with future SMR deployment. These include gaps in current policies and regulations—particularly the lack of SMR-specific provisions—along with a shortage of personnel trained in nuclear security. Additionally, coordination between safety and security authorities remains limited. Cybersecurity threats and the potential for insider actions, particularly with the adoption of digital systems, are also growing concerns. Transport vulnerabilities—such as the physical protection of nuclear and radioactive materials—further emphasize the need for targeted and systemic improvements.

- **Human Resource Risk & Competency Matrix**

TABLE I. Nuclear Security Competency Matrix

Role	Core	Safety	Security	Target Audience / Stakeholders	IAEA Ref.
Regulator	Legal, inspection	Licensing review	Physical-protection oversight	OAP, Energy regulators	NSS 20[1], GSR-Part 1[2]
Operator	Basic radiation protection, culture, communications	Reactor O&M, nuclear safety	Insider threat, awareness on computer-based system for operation	Power utility operators, Plant Managers	NSS 11[3],13[4] 17[5]
Security Officer	Access control, communication	Evac & safety interface	Physical protection system, detection and assessment, cyber security	Facility-security teams	NSS 11[3], 13[4], 17 [5], 18[6], 33-T[7]
First Responder	Coordination	Dose limits	Threat response	Police, firefighters, medical team	NSS 11[3], 13[4]
RPO	Monitoring	Radiation protection	MORC/Illicit material	Health physics staff, environmental labs	GSG-7[8], NSS 14[9]
Maintenance	Preventive plan, system diagnostics	Calibration	Tamper detection, secure config	Engineers and technicians	NSS 1[10]
Transport	Route, transport plan	Packaging	Secure convoy	Land transport Dept., couriers, Customs	NSS 9[11], 46-T[12]

A critical priority is developing and sustaining human resource capacity. Rather than establishing entirely new security teams, Thailand could enhance efficiency by expanding the roles of existing safety personnel through additional training in security functions. This cross-functional approach supports better integration between safety and security responsibilities. It is equally important to strengthen inter-agency cooperation among regulatory bodies, operators, emergency responders, and law enforcement. A role-specific competency matrix based on IAEA guidelines has been developed to support training efforts as summarized in Table I. Currently, Thailand has collaborated with the World Institute for Nuclear Security (WINS) on a train-the-trainer program for transport security. In partnership with the Land Transport Department, this initiative aims to develop the first pilot training course that focuses on the interface between safety and security in dangerous goods transport, including radioactive and nuclear material.

CONCLUSION

SMR deployment requires a proactive approach to nuclear security risk assessment and workforce development. The integration of a role-specific competency matrix—built upon the utilization of current safety personnel—supports cost-effective and sustainable readiness. Strengthening inter-agency collaboration and aligning with IAEA guidelines will be essential to securing Thailand's future in nuclear energy.

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