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Integrating Safety, Security and Safeguards in Nuclear and Radiological Transport

The safe, secure, and proliferation-resistant transport of nuclear and radiological materials remains one of the most sensitive stages of the nuclear fuel cycle. Transport activities encompass a broad spectrum: sealed radioactive sources for medical and industrial use, fresh and spent fuel assemblies, and, increasingly, prefabricated modules of Small Modular Reactors (SMRs) that may include pre-loaded nuclear fuel. Each modality of transport—road, rail, maritime, and air—presents unique operational environments, vulnerabilities, and regulatory challenges.

The "3S interface"—safety (protection against accidental releases), security (protection against malicious acts), and safeguards (verification of non-diversion of nuclear material)—is particularly complex in the context of modern logistics networks and the internationalization of nuclear supply chains. The objective of this work is twofold: first, to characterize synergies and contradictions among the 3S pillars in different transport modalities; and second, to propose technical and regulatory innovations that could enhance resilience and credibility in the global deployment of nuclear technologies, with emphasis on SMRs.

Country or International Organization

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Instructions

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