Contribution ID: **2** Type: **POSTER**

Practices and Challenges in the International Transport of Radioactive Material: Addressing Post-Storage Shipments, Transitional Arrangements, and Special Approvals

The international transport of radioactive material plays a critical role in supporting peaceful applications of nuclear technology in energy, medicine, industry, and research. Ensuring the safe and secure movement of such material, especially after periods of storage or during transitional arrangements, presents specific operational challenges. Despite the existence of comprehensive international frameworks such as the IAEA's Regulations for the Safe Transport of Radioactive Material (SSR-6) and harmonized practices embedded within national regulatory frameworks, persistent gaps and challenges in practice continue to require attention, particularly for cross-border shipments involving multiple stakeholders. The paper explores the operational practices and challenges associated with the transport of radioactive materials under three specific conditions: (1) shipments conducted after periods of storage or transit, (2) transitional arrangements between modes of transport (e.g., road to sea or air), and (3) the use of special arrangements in cases where deviations from standard regulatory conditions are necessary.

Post-storage shipments introduce unique challenges related to package integrity, regulatory compliance, and safety verification. Extended storage durations may lead to deterioration of packaging materials, requiring re-assessment, re-certification, or repackaging before transport. These issues can result in additional time, cost, and coordination burdens for consignors, operators, and regulatory authorities. Furthermore, evolving transport regulations may necessitate new compliance measures even for material that was previously certified. International shipments involving transitional arrangements bring about logistical complexities, particularly regarding the synchronization of regulations between countries and modes of transport. Points of entry and exit, transshipment ports, and customs clearances often face bureaucratic delays, primarily due to differences in national implementation of international regulations. Variability in the application of security measures can further complicate coordination, especially for high-activity sources or nuclear material. In some instances, special arrangements become necessary for shipments that cannot fully comply with established regulatory requirements, often due to unique material properties, specialized package designs, or operational constraints. While these arrangements ensure safety through alternative measures, the approval process tends to be lengthy and resource-intensive. It requires demonstrating an equivalent level of safety, which can be challenging for smaller consignors or those in developing countries.

Through examination of case studies and practical experience from national and international stakeholders, this paper identifies key bottlenecks and proposes actionable strategies for improvement. Among these are recommendations to enhance early coordination between consignors, regulators, and carriers; to promote greater harmonization of approval processes for special arrangements; and to leverage digital solutions for real-time tracking and document management. Ensuring the continuity of safe and secure international shipments of radioactive material will depend on strengthening collaboration among all parties involved, addressing regulatory discrepancies, and embracing technological innovation to streamline administrative processes. These efforts will support not only the operational effectiveness of radioactive material transport but also the broader goal of sustaining global applications of nuclear technology in a safe, secure, and efficient manner.

Country or International Organization

Instructions

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Track Classification: Track 3 Safety and Security during Transport Operations