

DEVELOPMENT OF AN OVERPACK-TYPE CONTAINER FOR THE SECURE STORAGE AND TRANSPORT OF DISUSED SEALED RADIOACTIVE SOURCE HEADS.

The management of disused sealed radioactive source heads requires packaging systems that ensure both radiological safety and structural integrity during transport. Guidelines established by the International Atomic Energy Agency (IAEA), along with national regulations, mandate rigorous testing under impact, pressure, and extreme environmental conditions. In response to these requirements, the overpack concept has emerged as a reinforced solution that supplements the primary container with additional layers of mechanical protection and shielding, addressing critical gaps in the design and experimental validation of containment systems tailored to deactivated source heads.

The use of radioactive sources in medical and industrial applications generates residual materials which, upon losing operational effectiveness, remain exposed and pose significant safety risks. To mitigate these risks, an overpack-type container has been developed in accordance with IAEA recommendations, featuring a geometric configuration adaptable to various head models. The selected materials provide the necessary mechanical strength, deter unauthorized access, secure the load to the transport vehicle, and facilitate handling with pallet jacks and jib cranes until the source is relocated to a secure facility.

International experience with overpack containers lacks detailed technical data, yet demonstrates effective design solutions. Based on a Czech model validated in Uruguay, the containers incorporate an adjustment plate, a sealed body, a lid with locking mechanisms, reinforced trusses, and stacking ports. Another Argentine proposal employs a simple structural design using steel sheets.

This design is based on solid principles of mechanical engineering load and stress analysis, deflection and stiffness, failure due to static loading, bolts, fasteners and the design of non-permanent joints, welding, adhesion, and the design of permanent joints.

In this context, two overpack containers were successfully modeled and constructed: one for the Theratron 80 head and another for the Picker Advance Tele Cobalt (ATC) C/9. Both feature a truss-type structural configuration with cross-mounted uprights to optimize stress distribution.

At the top, four (4) lifting lugs facilitate secure handling and hoisting operations. The main support area includes threaded holes designed to accommodate optional hooks for enhanced anchoring. Finally, the lid is opened and closed using non-permanent bolted elements. For their construction, polished steel and IPN (double-T) beams were used, selected for their durability and mechanical strength.

The bolted joints have been designed to incorporate security seals that guarantee physical traceability and provide evidence of any unauthorized tampering throughout the entire journey.

Through the construction of these overpack containers, internal capabilities in CAD modeling and structural simulations have been strengthened, while handling procedures and inspection protocols have been optimized—resulting in reduced loading times and enhanced physical security. By employing an overpack secured with bolts, strapped with tension belts, and equipped with tamper-proof security seals, a delay function is ensured, providing the necessary response time for security forces in the event of theft, sabotage, or accident.

This development has been conceived to meet the technical requirements established for transport under the Special Arrangement regime, in accordance with UN 2919 classification. This modality allows for the shipment of radioactive sources that do not fully comply with conventional packaging standards, provided that radiological and structural safety conditions are demonstrated through technical evaluation and competent authority approval. The proposed overpack container represents a robust and validated solution that supports such authorization, offering a safe and adaptable alternative for the containment and transport of deactivated source heads. Venezuela has successfully collected more than twenty (20) disused sealed radioactive source heads (DSS), utilizing overpack containers constructed by Venezuelan labor.

Country or International Organization

Instructions

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