

Safety Test Verification and Performance Analysis of Medical Radioactive Source Transport Container

The transport of radioactive materials is an indispensable component in the application of nuclear technology, and the safety of transport containers—as critical equipment during transit—has always been a major concern. This study focuses on the GT-CIRP-01 medical radioactive source transport container, aiming to comprehensively verify and evaluate its safety performance under extreme accident conditions through a series of standardized safety tests. The package is designed for the transport of special-form medical sources such as ^{60}Co , ^{192}Ir , and ^{137}Cs . When fully loaded, it is classified as a Type B(U) package, Category III-YELLOW, with a transport index (TI) ≤ 3.0 , making it suitable for road, rail, air, and water transport. The verification tests were conducted in accordance with the “Regulations for the Safe Transport of Radioactive Material” (IAEA SSR-6) and relevant national standards, covering both normal and accident transport conditions. The tests were performed at the Radioactive Material Transport Container Test Center of the China Institute for Radiation Protection, which features a comprehensive 150-ton test platform with 22 test items, fully meeting the requirements for various container tests specified in SSR-6. The accident condition tests included:

- 1) Free Drop Test I: A 9-meter drop in the most severe orientation to verify structural integrity and containment performance when the container impacts a rigid target at its maximum weight and most vulnerable attitude;
- 2) Free Drop Test II: A 1-meter puncture test to evaluate its resistance to sharp object impact;
- 3) Thermal Test: A 30-minute fire test at 800°C to assess thermal insulation performance and shielding effectiveness under high temperatures.

The test results demonstrated that after undergoing these rigorous tests, the container’s overall structure remained intact, the inner cavity was preserved, radiation shielding performance did not significantly degrade, and surface temperatures were strictly within regulatory limits. This study successfully verifies the reliability and safety of the GT-CIRP-01 medical radioactive source transport container design, providing solid data support and compliance justification for its broad application in engineering practice. It also offers valuable insights for the design and testing of similar containers.

Country or International Organization

Instructions

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