Contribution ID: **25275** Type: **Extended Abstract**

Radiation Shielding Analysis of Disused Sealed Radioactive Sources (DSRS) Transport Container Design of ”Gama Container” Using MicroShield and PHITS Software

Monday, 3 November 2025 14:45 (15 minutes)

The increasing number of disused sealed radioactive sources (DSRS), particularly from cobalt-60 (^{60}Co) teletherapy units, poses a significant challenge for radioactive waste management in Indonesia. In accordance with national regulations, these sources must be securely transported and stored by the authorised institution. However, the lack of cost-effective and certified transport containers has led to suboptimal interim storage practices by hospitals, such as using teletherapy machine heads as makeshift containment units.

To address this issue, a specialised transport container, referred to as the Gama Container, has been developed with integrated radiation shielding. This study assesses the shielding performance of the container through simulation using MicroShield and the Particle and Heavy Ion Transport code System (PHITS). The shielding structure, designed in a cylindrical geometry with lead and concrete layers, was evaluated for a 6600 Ci ^{60}Co source. Dose rate calculations were performed across various shielding thicknesses and distances.

MicroShield simulations demonstrated that a 30 cm concrete layer reduced the external dose rate from 17.98 μSv/h to 0.01 μSv/h at 1 metre. PHITS simulation results supported these findings, indicating spatial dose distributions ranging from 0.008 to 0.012 μSv/h outside the container. These values fall well below national exposure limits for both occupational and public safety.

The study confirms that the Gama Container’s design meets regulatory safety standards, ensuring secure transportation of high-activity DSRS. The integration of deterministic and Monte Carlo-based analyses provides a robust evaluation framework, supporting its practical deployment in the field. This approach contributes to enhancing the safety, reliability, and compliance of radioactive waste transport infrastructure in emerging nuclear technology environments.

Technical Track

Safety and Severe Accidents

Primary authors: Dr KUSNANTO, Kusnanto (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mr PUTERO, Susetyo Hario (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Dr PRABANINGRUM, Nunung (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mrs WIJAYANTI, Ester (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mrs MUHARINI, Anung (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mrs PINASTI, Sita Gandes (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mrs WAHYUNI, Laksmi Citra (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mr ANTONIUS, Juandi (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mrs NURBAITI, Wahyu Amalia (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mr PUTRA, Harkamaya Nursetya (PT. Chakra Giri Energi Indonesia, Graha Lestari Office, Jakarta, 10160 Indonesia); Mrs GOLDY, Valerie (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mr KABAN, Ryano Vinsent Sonanta (Department of Nuclear Engineering and Engineering Physics, Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); Mr WIKRAMA, Bedanta Datu Ananta Wikrama (Department of Nuclear Engineering and Engineering Physics,

Faculty of Engineering, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia); ROMLI, Moch (Department of Environment, Faculty of Environmental Sciences, King Abdulaziz University (KAU), Jeddah, 21441, Kingdom of Saudi Arabia); Mrs NURLIATI, Gustri (National Research and Innovation Agency (BRIN), South Tangerang, 15314, Indonesia); Mr SUMARBAGIONO, Raden (National Research and Innovation Agency (BRIN), South Tangerang, 15314, Indonesia); YUSUF, Muhammad (Industrial Nuclear Energy (I) - IRC - General)

Session Classification: Safety and Severe Accidents