QUALIFIED AIR TRANSPORT PACKAGING FOR METALLIC PLUTONIUM*

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A radioactive materials package has been developed, tested, and certificated (licensed), for the air transport of up to 3.15 kg of metallic plutonium or uranium in solid form, and in any isotopic composition not exceeding 25 W thermal activity.

This package, a modification of the Plutonium Air Transportable Model 1 (PAT-1) package, differs from the original package in that the earlier one was designed to contain PuO_2, and the package herein described is designed to contain metallic plutonium or uranium. The chief difference is the ability of the modified PAT-1 to contain metallic plutonium at an elevated temperature. In a required accident modelling jet fuel fire test, the plutonium within the packaging rises to a conservatively bounded temperature of 582°C, which is above the Pu/Fe eutectic point (410°C). Both the primary and secondary containment vessels are fabricated of precipitation hardened martensitic stainless steel, hence the Pu/Fe eutectic is of concern. The eutectic is prevented by the use of a copper plated secondary containment vessel and a supplementary copper canister. The Pu/Cu eutectic occurs at 625°C.

At the onset of this work, it was thought that a welded tantalum can would be required to adequately contain the plutonium within the steel containment vessels. This would be very costly and was not compatible with the handling and processing methods available within the using facility; a requirement for welding within a plutonium glovebox environment was especially problematic. The design solution of utilizing a reusable copper canister, backed up by copper plating of the interior of the secondary containment vessel, was proven in elevated temperature testing with a 3.15 kg mass of solid plutonium.

The modified package, designated as the PAT-1 MOD 1, meets the 10 CFR 71 Fissile Class 1 requirements and the very severe US air transport requirements of NUREG-0360. The package is resistant to severe accidents, especially the crash of high speed jet aircraft. The package is designed to withstand such environments as impact with an unyielding target at 129 m/s, a one hour 1010°C hydrocarbon fueled fire, extreme crushing, puncturing and slashing, and deep underwater immersion, all with no loss of contents. The accident environments may be imposed on the package singly or sequentially.

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Information concerning the design of the packaging, structural analysis, pressurization, normal and accident modelling tests and test results, thermal evaluation, containment surety, radiation shielding, and nuclear criticality evaluation was presented in a safety analysis report (SAR). The US Department of Energy issued a Certificate of Compliance USA/9509/B(U)F(DOE-AL) for the PAT-1 MOD 1 on July 11, 1983 (non-expiring).