TRUPACT-I IS A TECHNICALLY VIABLE PACKAGING FOR TRANSPORTING DOE'S CONTACT-HANDLED TRANSURANIC WASTE

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ABSTRACT

The implementation of Public Law 96-164 authorizes the Secretary of Energy to proceed with the Waste Isolation Pilot Plant (WIPP) for "the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission." A development program has resulted in a tested, safe, and efficient packaging for transport of DOE's contact-handled transuranic waste.

INTRODUCTION

Since September 1983 the U. S. Department of Energy (DOE) has been constructing a unique laboratory, the Waste Isolation Pilot Plant, in southeastern New Mexico. Scheduled to go into operation in October 1988, WIPP will be the world's first large-scale, underground facility for demonstrating the safe disposal of long lived transuranic (TRU) wastes. Through the utilization of a full-scale pilot plant, the WIPP is intended to demonstrate the technical and operational methods for the safe, permanent, deep geological isolation of DOE-generated defense wastes. The need for a safe, efficient system for transporting these transuranic wastes from their present aboveground or shallow land burial sites to the WIPP was identified. A new transportation system was deemed essential to assure that: 1) spinoff technology from both aerospace and weapons programs were utilized with proven methods of engineering analysis and testing, 2) maximum safe payloads would be transported with each shipment, and 3) handling interfaces between transportation systems, the shipping sites, and the WIPP would support timely cost effective operations. Further, the people of New Mexico were assured by DOE that a safe, certified system would be utilized in this transportation campaign. The result is an advanced packaging design known as TRUPACT-I, that is consistent with the WIPP Final Environmental Impact Statement, DOE/EIS- 0026, which shows that radiation exposure to the public resulting from transportation of TRU wastes to the WIPP is significantly less than the background radiation of the environment.

RESULTS

In anticipation of the needs of the WIPP, development of the TRUPACT-I system was initiated in 1978 under the technical direction of Sandia National Laboratories with the intent of designing an entirely new packaging for the express purpose of safely transporting transuranic wastes to the WIPP. These contact handled (CH) transuranic wastes (TRU) are nonradioactive items contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 n Ci/g of waste. These everyday items used at DOE facilities include rags, rubber gloves, shoe covers, cloth lab coats, plastic bags, and discarded laboratory glass and metalware that are placed in metal Type A packagings and then loaded into a Type B packaging, TRUPACT-I. This development process has spanned several modifications to the program goals and objectives and has produced a safe, thoroughly tested Type B packaging meeting the current DOT, NRC, and DOE regulatory requirements for loss or escape of radioactivity to the environment. The TRUPACT-I transportation system shown in Fig. 1 consists of: 1) inner steel frame and stainless steel containment liner, 2) steel inner door, 3) outer steel frame and Kevlar/steel puncture protection system, 4) steel outer door, and 5) rigid thermal resistant and shock protective foam. An inner door seal and four filtered pressure equalization systems are additional containment components not shown in Figure 1. TRUPACT-I is some 8 ft. wide, 9 ft. high, and 25 ft. long weighing about 33,000 pounds with a cargo capacity of 35 drums weighing some 15,000 pounds.

Specially designed protections are included in the thick walls to isolate the containment liner from any damage imposed by impact, puncture, and fire required by 10CFR71 . The 11-inch side walls (35 inches on the ends) include foams with stainless steel honeycomb in the ends to provide cushioning under impact conditions. Thus, extensive damage can be imposed upon the outer structure while the inner containment liner remains protected. This same foam, in conjunction with other insulating materials, protects the contents and their containment boundary from the damages of intense fire. Finally, the walls and ends incorporate a tested system to protect against puncture utilizing stainless steel panels working in conjunction with bonded Kevlar panels.

Testing was used extensively in the development process to confirm analysis. This included tests of: 1) foams, 2) the puncture system, 3) the mitigation of impact forces, 4) the response of contents, and 5) the interactions of contents and package. The CH-TRU wastes are typically placed in plastic bags, which in turn are often placed within cans or other containers and are subsequently placed in metal drums or boxes that may also contain liners that are then loaded into the inner containment cavity of TRUPACT-I. These multiple protective barriers for the waste packages, coupled with the fact that the CH-TRU wastes must be solid and that the steel-framed inner sealed containment liner and outer protective system are rugged, assures that TRUPACT-I will contain its radioactive contents consistent with applicable regulations. It was considered essential to establish what the potential release fractions from the drums would be when the TRUPACT-I is subjected to the hypothetical accident tests of 10CFR71; so, Type A containers were placed in a prototype TRUPACT-I and subjected to a regulatory

accident drop test which resulted in release fractions to the TRUPACT-I containment cavity of 7 x 10^{-6} for simulated TRU wastes acceptable for receipt at WIPP. Note that plastic bags containing the simulated waste were damaged by sharp objects in the Type A containers and were, therefore, not essential for assuring containment of radioactivity in an actual shipment.

Should any particulate material be released to the containment cavity of TRUPACT-I, it is precluded from further release to the environment by the inner door seal and High Efficiency Particulate Air (HEPA) filters to a level prescribed by 10CFR71. A Filtered Pressure Equalization System (FPES) with four filters is used to capture radioactive particles should any escape the multiple barriers in the drums. Radioactive particulate is the only material of significance which must be contained in TRUPACT-I for waste that is acceptable at the WIPP. The high filtration efficiency (0.99995) of the HEPA filters for all size particles assures compliance with activity release limits required by regulations. The HEPA filters are well used for containment in the nuclear reactor industry, and their use in TRUPACT-I required modifications to accommodate the unique transportation environments (temperature, shock, etc.). A modified HEPA filter, Matheson Model SP1984-A, can withstand both normal transportation and accident environments, such as the mechanical shock and temperature extremes experienced in a Type B packaging. A combination of analyses and tests have been used to demonstrate that rugged HEPA type filters located in a protective steel filter housing will survive and function without degradation following the Type B regulatory tests of 10CFR71.

Six quarter scale models of TRUPACT-I were constructed for the sole purpose of testing. These were subjected to over 100 mechanical tests to evaluate the structural design. Finally, a full scale prototype was constructed utilizing the results of previous testing and analysis. This full scale system was subjected to a full range of tests, exceeding those required by the existing regulations. These included a 1-foot drop, two 30-foot drops, four 40-inch puncture tests, and two fire tests. The extensive use of quarter scale models and a full scale prototype in the development of TRUPACT-I demonstrates that this packaging design meets the strict regulatory testing requirements and can provide for safe transportation of TRU wastes to WIPP.

When WIPP is operational, a fleet of approximately 20 Type B packagings will be required to move the wastes by highway and rail to the facility. This will support the emplacement of up to 250,000 cubic feet of TRU wastes per year at a receiving rate of four to six shipments per day, five days per week. Since TRUPACT-I was designed to safely haul a maximum number of waste drums, the total number of shipments will be minimal, thereby reducing the overall risk to the public.

Mounted on trailers coupled to available tractors, TRUPACT-I will provide a legal weight, legal size highway system for transport of these wastes. Since these shipments will contain "Highway Route Controlled Quantities," all of the DOT rules (under HM164) on routing and notification will apply. For rail shipments two TRUPACT-Is could be mounted on a single rail car which would be within all AAR size and weight restrictions. Transportation of TRU wastes to the WIPP will involve removal of stored wastes from 12 sites nationwide and will traverse some 30 of the contiguous 48 states. Some 25,000 shipments of TRU waste will be made to the WIPP during 25 years, and approximately 80 percent of these shipments will be made from the Idaho National Engineering Laboratory in Idaho, the Rocky Flats Plant in Colorado, and the Hanford Reservation in Washington.

CONCLUSION

TRUPACT-I is a well designed, thoroughly tested, safe, efficient means of transporting large volumes of CH-TRU wastes.

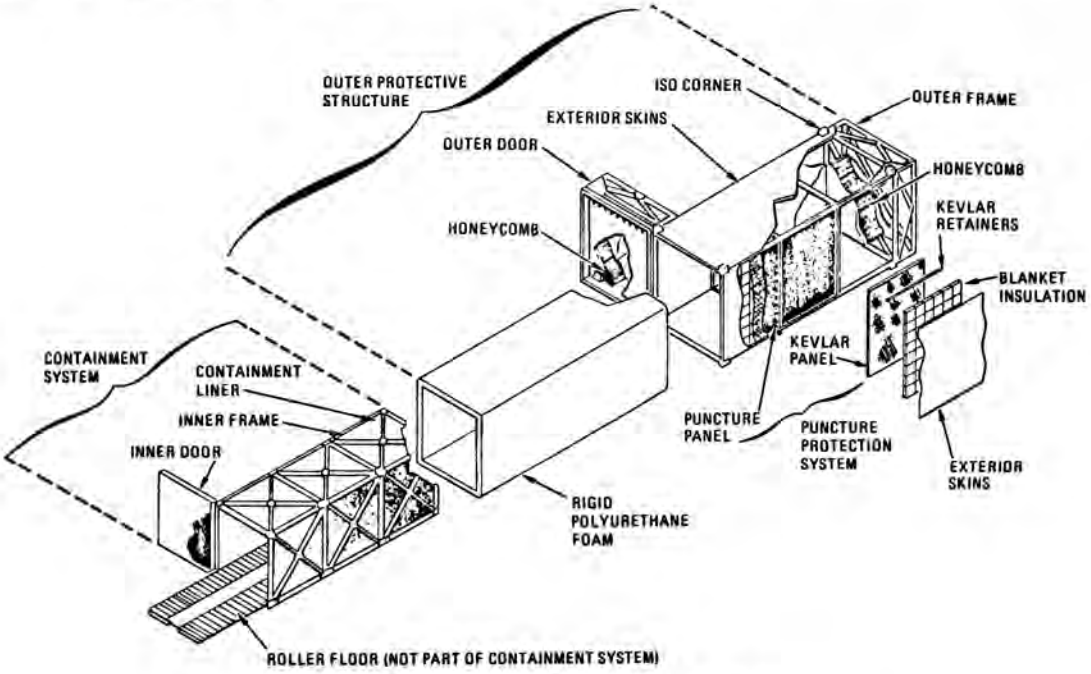

Fig. 1. TRUPACT-I Transportation System.