VENT HOOD CONCEPT FOR SAFELY UNLOADING TRUPACT-IIs*

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- In Memory of Ormand Cordes -

ABSTRACT

Receipt of transuranic (TRU) waste in the Transuranic Package Transporter-II (TRUPACT-II) shipping package, implies a potential of receiving waste packages contaminated with only alpha emitters or emitting hazardous gases. Due to the difficulty of rapidly detecting low-level alpha contamination, a strict contamination control system has been developed to check incoming waste packages in a controlled environment. A part of this control is the use of a vent hood system for the TRUPACT-II shipping container unloading process.

A clear vinyl shroud with a monitored/filtered exhaust system has been designed and fabricated to permit direct surveillance of TRU waste packages prior to exposing personnel or facilities to possible radioactive contamination or hazardous gases. This concept has also been adapted to similar evolutions in which packages are exposed that hold TRU or hazardous materials but cannot be directly monitored prior to opening.

The TRUPACT-II vent hood is installed on the TRUPACT-II after the outer lid is removed. The vent hood fits over the inner lid as it is lifted to expose the shipment of waste packages.

The vent hood permits monitoring of airborne radionuclides and loose surface contamination while directing the effluents to the building exhaust systems. The vent hood has an installed Eberline ALPHA-6 air monitor, which samples airborne activity while the waste packages are surveyed for loose surface contamination. The survey for loose surface contamination is conducted inside the clear vinyl vent hood, which has openings that allow technicians to insert sampling devices for obtaining surface smears while maintaining a minimum air influx of 150 linear feet per minute. The effluents are directed through high efficiency particulate air (HEPA) grade prefilters to the Waste Handling Building HEPA-filtered exhaust system.

The TRUPACT-II vent hood is removed, and the TRUPACT-II inner lid is placed in its rack when both monitoring samples show that the waste packages are contamination-free; that is they meet the WIPP Waste Acceptance Criteria (WAC) surface contamination criteria of < 450 pCi/100 cm^2 for beta-gamma emitting radionuclides and < 50 pCi/100 cm^2 for alpha emitters. After this, the waste packages are removed and placed into the dock area. Waste packages are then prepared for underground emplacement. Although gases are not monitored, sufficient time is allowed for fresh air to circulate over the packages and remove any hazardous gases that might have accumulated during shipment.

Once the waste containers are shown to be free of contamination, the vent hood is removed. The unloading of the TRUPACT-II continues in a normal manner.

If the contamination checks (either airborne or surface) show contamination, the lid of TRUPACT-II is replaced with the vent hood still attached. The entire unit is moved to an HEPA-filtered overpack and repair room. The plastic vent hood is removed and placed into a plastic container for disposal as site-generated waste.

* Work supported by the U.S. Department of Energy Assistant Secretary for Defense Programs, Office of Defense Waste and Transportation Management, under DOE Contract No. DE-AC04-86AL31950 DOE/WIPP 90-034C

The vent hood has been tested several times with smoke, showing complete containment of the smoke, even with several access ports open. The flow through the hood is maintained by a unique series of respirator type flow valves which open or close as needed to maintain the required pressure drop.

Use of the enclosed vent hood provides the opportunity of thoroughly testing and overlooking the conduct of a waste shipment prior to opening it to the environment. This thorough checking allows adjusting the precautionary actions to those needed. Clean shipments can be handled in a routine fashion without special personnel protective equipment.

INTRODUCTION

The purpose of the TRUPACT-II, Type B container, is to safely transport TRU wastes and mixed wastes from Department of Energy (DOE) facilities within the U.S. to the Waste Isolation Pilot Plant (WIPP) Project. The fact that the design precluded a quantitative method of sampling the container prior to exposing the waste packages to personnel and facilities led to the construction of the "Vent Hood." It allows for sampling and controlling the atmosphere using conventional equipment without greatly impacting the unloading process.

The procedures that control TRUPACT-II operations provide a good assurance that the packages are loaded in accordance with the TRUPACT-II Safety Analysis Report for packaging (SARP), DOE regulations, and WIPP Waste Acceptance Criteria. There were no engineered controls for assuring that the waste packages were still intact when they arrived at WIPP. The first attempts at rectifying the problem revolved around designing equipment to sample the effluent prior to removing the inner lid. This consisted of an elaborate sample cart which was complicated and ineffective for sampling alpha particulates. In parallel with this effort, Radiological Health Physics attempted to characterize the air currents that circulated around the TRUPACT-II when it was opened. Even with smoke tests that predicted the best location to place monitors, it was painfully obvious that, by the time even the most sensitive of detectors alarmed, this would only tell you that you were already releasing contaminated effluents to the work area. The operational requirements were increased to provide as much protection to the worker as possible, when administrative controls failed to prevent a release. Safe operations required a person to be fully dressed in anti-contamination clothing (Anti-C's), carrying a personal gas detector for work in a potentially contaminated area. The answer to the problem was finally realized in response to a DOE Environmental Safety and Health audit finding that stated the "building ventilation system was not designed to direct effluents away from personnel or the operating areas." As redesigning the entire heating, ventilation, and air conditioning (HVAC) system was not considered a practical solution, focus was centered upon the area around the TRUPACT-II. As the area one tried to control became smaller, the ability for reduced personnel or facility exposure became greater.

The vent hood chamber basically isolates the TRUPACT-II inner vessel from the rest of the waste handling facilities, while allowing the inner lid to be raised approximately two feet above the main vessel. In this configuration, technicians can easily inspect the waste packages for obvious damage by viewing through the clear vinyl shroud. Radiological samples in the form of 100 cm smears can be taken through ports in the shroud. The effluent is directed past an Eberline Alpha 6 detector such that 100 percent of the exhaust must pass by the detector. The detector mounting bracket hangs on the TRUPACT-II vessel. The flexibility of the vinyl shroud allows the lid to be placed back on the TRUPACT-II without exposing any of the waste handling facilities or personnel to potential contamination. In-line HEPA filters essentially separate each hood unit from the exhaust system and reduce the possibility of contaminating a clean exhaust system.

EQUIPMENT DESCRIPTION

The ventilation system became known as the TRUPACT Vent Hood System (VHS). Its design was based on very simple concepts. TRUPACT-II headspace may contain radiologically contaminated airborne particles. These small micron size particles, of health significance, will follow air currents. Head removal will immediately expose headspace to prevailing air currents induced by the HVAC system. If contamination is present, a potential mechanism exists to spread contamination in the immediate contact-handled (CH) waste handling area. To prevent contamination spread, a portable (and stowable) Heating and Ventilation Containment Chamber (HVCC) shall be provided (attached to TRUPACT-II lid), to contain atmospheric contamination at its source. This containment shall be a lower pressure than the surrounding environment. Forced air flow shall be provided by a blower. A HEPA filter shall be provided upstream of the blower to capture any airborne particles. The filtered air, in turn, shall be directly ducted into the HVAC system. When it is determined by radiation monitoring that contamination is not present, the portable Vent Hood Confinement Chamber shall no longer be required for the remainder of a given CH waste unloading sequence, and shall be removed and stored. Additionally, several system functional requirements were incorporated to support the design concepts. They were as follows:

A. The VHS shall function as a temporary local exhaust system to effectively control at its source radiologically

contaminated airborne particles at atmospheric pressure conditions, with minimum air flow and power consumption.

B. Supply air shall be arranged and regulated to provide general air flow from clean areas toward more contaminated areas.

C. Potentially contaminated air generated from the TRUPACT-II inner lid opening shall be captured and caused to exhaust through the VHS HEPA filter assembly (HFA).

D. The HFA effluent shall be exhausted through the waste handling HVAC system.

E. The portable VHCC shall be conveniently and expeditiously stowable, adhering to As Low As Reasonably Achievable (ALARA) principles, to provide unrestricted access by technicians to the TRUPACT-II inner lid area after the initial phase of contamination control and monitoring.

F. Exhaust air from the VHCC shall be monitored for airborne alpha contamination prior to transport through the building ventilation system.

EQUIPMENT OPERATIONS

The operations involved with unloading TRUPACT-IIs have been revised to incorporate the VHS. No changes were made to the removal of the outer lid because this process did not expose personnel or facilities to the possible source of contamination. To remove the inner lid, the atmosphere inside the vessel is pumped out through a sample filter. This allows technicians to count the filter paper for signs of gross contamination. Simple tests indicate that airborne particulates could be detected on the sample materials, but the amounts were never quantified or minimum detectable levels determined. The VHCC is constructed of thin flexible plastic sheet material, into a basically cylindrical (or cone frustum) sheath, open at top and bottom. A Velcro fastener is provided on the cylinder sheath which extends fully from top to bottom, parallel to the vertical axis of the "cylinder," for assembly/disassembly purposes. In the assembled condition, the top end interfaces to the TRUPACT-II lid and at the bottom end to the TRUPACT-II container outer skin. An elastic band member is supplied both top and bottom to ensure adequate conformity with respective mating surfaces of the TRUPACT. The VHCC is provided with an exhaust outlet port (connected to flexible hose assembly) and multiple access ports (with closure flaps). Combined leakage paths function as a flow inlet to the chamber.

Prior to lid opening, the VHCC is installed. During the initial lid opening phase, with inner lid removed and incrementally separated, the VHCC 1) draws air around potential contamination source; and 2) captures potentially contaminated air and exhausts captured gases through the HFA. Ultimately, the once filtered gases exhaust through HVAC system and its HEPA filters.

When it can be ascertained that no radiological contamination exists, the VHCC is removed to permit more unrestricted access for subsequent operational steps.

If contamination is detected, the hood provides the needed confinement until the entire TRUPACT-II can be moved to a more suitable location. Upon indication of a damaged waste package, whether by visual indication, an alarm on the hood exhaust monitor, or when one of the smears taken by the health physics technicians indicates levels greater 50 pci/100 cm^2 for alpha, the inner lid is placed back onto the inner vessel. This is possible because the hood is very flexible and is equipped with breathe ports to allow sufficient air flow through the system with the TRUPACT-II closed. Once the vessel has been closed, the hood is sealed shut in place on the TRUPACT-II. The ventilation blower is de-energized. The ducting between the HEPA filter and the hood is removed by isolating each joint or union with a thin umbilical sleeve. This allows for a tie off of each piece as it is removed from the system. When the contaminated TRUPACT-II has been separated from it, the VHS is moved to a decontamination enclosure for recovery actions.

The capture velocities for radiological control are more than sufficient to direct and dilute any hazardous gases that may be present in our waste form, so no special consideration had to be incorporated to support controlling hazardous effluents. However, as of this writing, plans are being formulated to incorporate a carbon sorption bed and Volatile Organic Compound (VOC) monitor in system exhaust to ensure that TRUPACT-II operations do not release unacceptable amounts of VOCs to the atmosphere during the testing phase of operations.

The success of the design and ease of operation have led to one more use for the vent hood. During the test phase at WIPP we will be receiving special waste packages called "bins." These bins provide a laboratory for monitoring the effects of gas generation on the repository. They arrive at WIPP sealed inside a standard waste box (SWB), because they in themselves are not a type "A" shipping package. After the SWBs are unloaded from the TRUPACT-IIs, the lids must be removed to allow inspection and reconfiguration of the bin. This operation presented the same potential for an uncontrolled release as opening the inner lid of the TRUPACT-II. The answer was simple: build a smaller version of the vent hood that fits an SWB and connect it into the existing exhaust system. This system should be operational in March of 1991.