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Contamination Control Aspects Of Attaching Waste Drums To The WIPP Waste Characterization Chamber

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Abstract

Argonne National Laboratory West (ANL-W) is verifying the characterization and repackaging of contact-handled transuranic (CH-TRU) mixed waste in support of the Waste Isolation Pilot Program (WIPP) project located in Carlsbad, New Mexico. The WIPP Waste Characterization Chamber (WCC) was designed to allow opening of transuranic waste drums for this process. The WCC became operational in March of 1994 and has characterized approximately 240 drums of transuranic waste. The waste drums are internally contaminated with high levels of transuranic radionuclides. Attaching and detaching drums to the glove box posed serious contamination control problems. Prior to characterizing waste, several drum attachment techniques and materials were evaluated. An inexpensive HEPA filter molded into the bagging material helps with venting during detachment. The current techniques and procedures used to attach and detach transuranic waste drums to the WCC are described.

Background

The waste for the characterization program was generated at Rocky Flats between 1972 and 1987 and is currently being stored at the Radioactive Waste Management Complex (RWMC) on the

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Idaho Engineering and Environmental Laboratory (INEEL). There are approximately 130,000 drums (55-gallon size) of CH-TRU currently stored at the RWMC. The majority of this waste is also contaminated with hazardous constituents. Non destructive examination, including real time radiography, fissile assay, and container integrity inspection is conducted at the RWMC. The drums are then transported to ANL-W for characterization. The methods applicable to Argonne's current role in characterization are headspace gas analysis, sludge sampling, and visual examination. The data generated is used to: validate previous waste certifications; evaluate the potential for gas generation from corrosion, microbial action, and radiolytic decomposition; document payload compliance for shipping containers; verify process knowledge databases; and show compliance with Environmental Protection Agency (EPA) regulations. Following characterization in the WCC, drums are repackaged and returned to the RWMC where they are stored until their eventual shipment to WIPP.

Fifty five gallon drums of waste for characterization at ANL-W must contain less than 200 grams of ^{239}Pu and must be less than 2 mSv/hr (200mR/hr) on the surface of the drum. Due to the age of the material, ^{241}Am is the major alpha emitting isotope in the drums. Removable alpha contamination inside the drums has been observed to 5.7×10^4 Bq/100 cm^2 (3.4×10^6 dpm/100 cm^2). In order to reduce the potential for contamination spread outside the WCC, ANL-W has implemented a control level to reduce the removable alpha contamination level to below 100 Bq/100 cm^2 (6000 dpm/100 cm^2) between drum characterization campaigns on interior surfaces of the WCC.

Contamination control is a key factor in container handling and characterization activities. The WCC has two drum transfer ports used for mating loaded and empty 55 gallon drums. The transfer ports include a bagging ring, drum clamps, an equalize (vent) and exhaust system and a clamping system for holding the drums in position to the bottom of the WCC. A funnel is installed in the port to guide waste into the drum liner and to prevent sharp objects from tearing the transfer sleeve during drum loading. Primary confinement between the waste containers and the WCC is maintained during waste transfers via polyvinyl chloride (PVC) bags/sleeves. When containers are ready to be disconnected from the WCC, the PVC bags/sleeves are sealed using a radio frequency heat sealer. The heat sealer makes a 48"x 1" seam. Finished seals have a cut line formed by a Teflon coated wire between the pressure seal to allow each 1" wide seal to be cut into 2 half inch widths.

Bagging Material Testing

Prior to the WCC becoming operational, the bags and sleeves went through a visual, leak, and heat seal testing. Two bagging materials, polyethylene and PVC in several different weights and surface finish were tested. The bags and sleeves were visually inspected after receipt from the vendor to verify quality of the plastic sheeting and any seams. The bags and sleeves were then inflated and the seams were tested for leakage using a soap bubble test. The different materials were then tested for heat sealing characteristics by heat sealing at various settings until the best seal for the material could be obtained. The best seal for each material was then compared to determine the sealing characteristics of the material.

A number of failures were noted using the polyethylene material. The seams on the bags from the factory were weak and the shelf life was short. The folds in the bags would show degradation and/or holes. Most of the bags would not pass the visual inspections. After air was used to inflate the bag for a leak test, defects would be found. The heat seals were such that they would pull apart with little effort.

The PVC material that had been in use for several years in other facilities at ANL-W did not have these problems. The seams on the bags from the factory were as strong as the original material. The shelf-life was adequate. Most bags passed the leak testing. The heat sealing tests would generate a seal where the bag material would tear before the seal would pull apart. As a result of the testing, the bags and sleeving for the WCC are made of an 8 mil yellow frosted finish type II (temperature range -40 F to 130 F) PVC.

Venting of the bags during bag-out operations was determined to be a significant problem. A vent and exhaust system was installed in the drum bagging ring to allow venting of excess air in the bag or allow air into the bag during mating. This was not sufficient to remove enough air to allow the collapse of a sealed bag into the 55-gallon waste can after bag-out. This problem was solved by the installation of a small round high efficiency (HEPA) filter. Fig. 1 shows a typical filter installation cross sectional view.

Contamination Mock-Up Testing

Prior to operations in the WCC testing was conducted to evaluate the contamination control methods and procedures. A powdered material that fluoresced under black light was obtained

and mixed with flour. This was added to some drums of simulated waste. The drums were then put through the evolution of attaching, "characterizing" then detaching. With the black light we were able to see areas in the glove box and on the drum where contamination migration could pose future problems. Procedures were modified until the material was contained.

Drum Attachment - Detachment Procedure

Loaded drums and empty drums are attached to the WCC. The loaded drums are prepared for attaching by taping a sleeve around the circumference of the drum near the top. Empty drums are prepared by installing a bag in the drum and then putting a 90 mil drum liner in the bag. Both the bag and sleeve have an installed HEPA filter.

The bagging ring on the bottom of the WCC has a bag stub held in place with a large hose clamp over an upper rubber band. A lower rubber band reduces contamination migration up the bagging ring. In preparation for attaching a drum, the upper clamp and rubber band are removed. The stub end held by the upper clamp is folded down over the lower rubber band. This exposes the top of the bagging ring. Contamination is checked for at this stage on the bag stub and the exposed bagging ring.

The new bag or sleeve is carefully slid over the old stub and secured to the top of the bagging ring with a rubber band and a clamp. A rubber band is positioned in a location over the lower rubber band position to compress the bag into the bagging ring as the old stub is removed. The old stub is pulled off the bagging ring and left on top of the drum. The drum is raised into the WCC to complete the attachment.

Drums are removed from the WCC by lowering the drum, stretching the bagging material flat in between the drum and the bagging ring and heat sealing the material. The heat sealer seals and cuts the bag or sleeve in one step. The bag stub on the drum is pushed into the drum with air venting through a HEPA filter installed in the bag. The drum lid is then installed on the drum.

Drums with taped on sleeves still have a section of the sleeving extending from under the lid to where it was taped to the drum. The loaded drums with taped on sleeves are loaded into standard waste boxes for shipment. Empty drums with tapped on sleeves are smeared prior to removal from the WCC and are usually disposed of as low-level waste. Loaded drums where a bag was used meet the current WIPP waste acceptance criteria.

Conclusion

ANL-W has operated the WCC for three years using the current bagging methods. Minor contamination has been detected during this process due to tears and cuts in the bagging material. No failure of a HEPA filter installed in a bag has been detected. No major spills have occurred in the area where drums are mated to the WCC. Respiratory protection was initially used during the bagging operations, but has been discontinued due to the success of this method at controlling contamination and airborne radioactivity.

References

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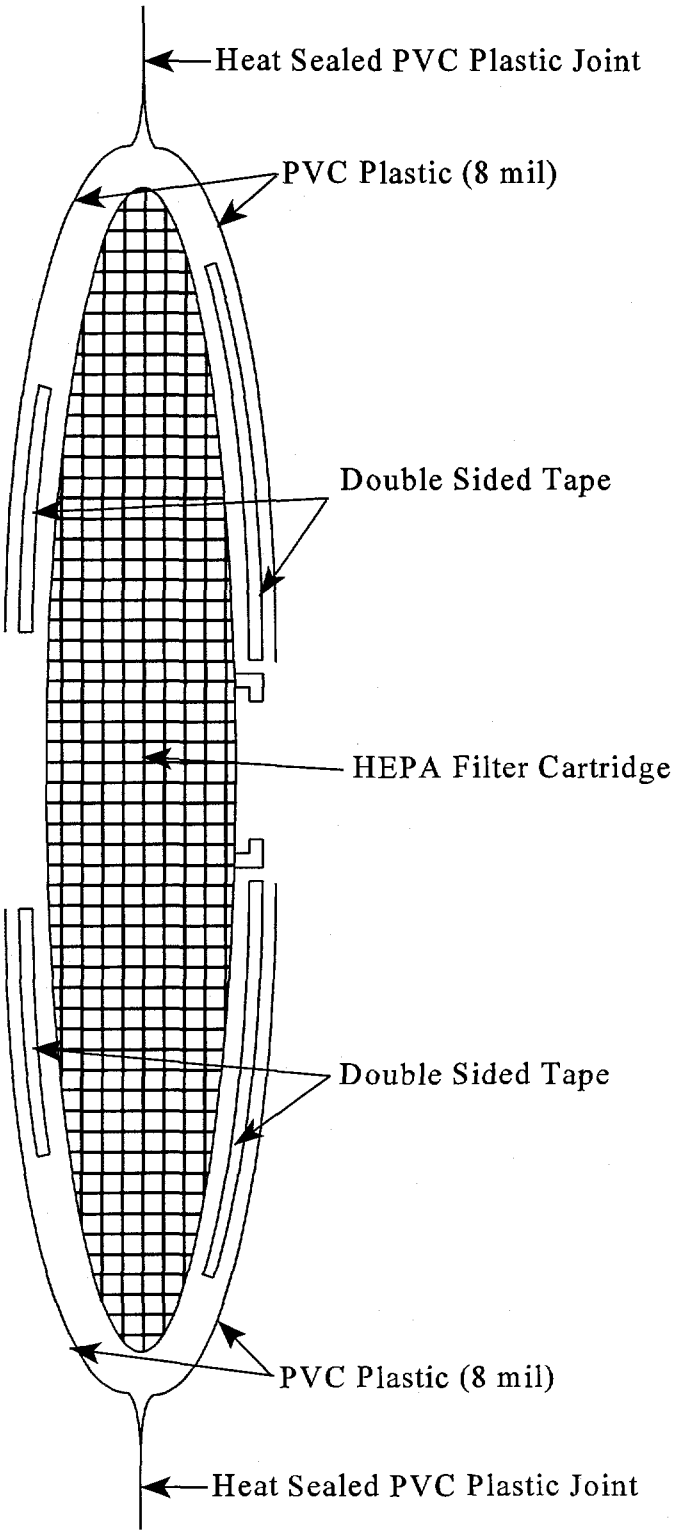

Fig. 1 - HEPA Filter Installation Cross Section View