SPRAY-ON POLYUREA COATINGS FOR USE AS HAZARDOUS & RADIOACTIVE WASTE SHIPPING CONTAINERS

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ABSTRACT

Decommissioning activities at radiological and hazardous waste facilities often requires the removal of large pieces of contaminated tanks, equipment, and machinery. Size reducing these large objects for disposal in standard waste containers presents major challenges. The use of a spray-applied polyurea coating has the potential to eliminate the need for size-reduction activities and reduce worker risk. Cost savings to the decommissioning project are an added benefit to using this alternative waste packaging system.

INTRODUCTION

If the object slated for size reduction is grossly contaminated, engineering controls often require the object to be contained in a plastic tent. Construction of this containment structure may require work on elevated platforms or scaffolds increasing the risk for worker injury. Once contained, personal protective equipment (PPE) requires layers of anti-contamination clothing, respiratory protection, and the use of dangerous cutting tools; all factors in increasing risk of worker injury, dose/exposure to contaminants, and cost or schedule overrun to the project.

Size reduction activities are also extremely labor intensive. The work involves cutting, rigging, and removal activities that have the potential to expose many workers to significant industrial safety, chemical, and radiological hazards. The industrial safety hazards associated with size-reduction are varied and sometimes difficult to anticipate. The best planning and PPE cannot predict what actually happens on the floor. Decommissioning workers have various levels of experience, with many coming from a construction-oriented background rather than a work environment that stresses radiological/chemical exposure safety. Equipment and facilities cannot be easily disassembled using the traditional, non-hazardous demolition approach due the levels of contamination and the potential for re-suspension of contaminates into the environment.

Planning this work requires focus on concerns for re-suspension and exposure as well as traditional health and safety issues. Therefore, reducing the size of contaminated equipment to a size that will accommodate today's standard waste container dimensions presents challenges that are dangerous, expensive and time consuming. No standard method of size reduction technique exists; each item requires a unique approach that inevitably increases cost and schedule for final closure of the facility.

SOLUTION

The use of a spray applied polyurea coating, combined with innovative waste characterization and contamination control methods, has allowed many closure projects at the Rocky Flats Environmental Technology Site (RFETS) to stay on schedule and budget. The first step in decommissioning a contaminated facility is to characterize the object to insure it is properly

categorized for waste acceptance criteria (e.g., LLW, Surface Contaminated Object Category I or II, Transuranic, etc.).

PROCESS

Once characterized, the object then is stabilized prior to removal from the facility. Stabilizing the removable contamination is an engineering control that insures worker exposure is reduced or eliminated when handling or rigging the object for removal from the facility. Stabilizing the object involves wetting the surfaces and/or applying a hard, permanent fixative agent that "locks down" the contamination.

Once stabilized, the object then can be removed or transferred to a location in preparation for disposal using the spray applied polyurea packaging system. Since this waste packaging system reduces or eliminates the need for size reduction to occur, hoisting and rigging the object for safe transfer becomes an important aspect of this decommissioning approach. Objects that were traditionally cut into smaller, more manageable pieces now have to be handled intact. This results in the increased need for engineered hoisting and rigging plans that insure workers will not be injured from the movement of large, industrial objects.

Once removed and staged for disposal, the object is placed on a constructed base. Once constructed, the object(s) is placed onto the base. The object(s) to be packaged are shrink-wrapped prior to application of the polyurea coating. The shrink-wrap provides a smooth substrate to which the polyurea coating can be easily applied. A specially designed two-way HEPA filter is installed in the shrink-wrapped cover and protected/sealed from over spray during the polyurea coating application. This HEPA filter is installed to allow for the package to equalize pressure with the environment during transport, especially during travel through various elevations across the country. Metallic "buttons" are also affixed over the surface of the shrink wrap to provide verification of the thickness of the applied coating.

TECHNICAL

The Polyurea coating is a two-part polymer plastic product that is applied with a special spray system. In the delivery system, the two parts (e.g., Parts A & B) are heated to approximately 180 degrees Fahrenheit. Once heated, the product is delivered under pressure through hoses to a spray gun. At the spray gun, the two parts are mixed when sprayed and an instantaneous chemical reaction occurs. The material exiting the spray gun can be described as a solid, gelatinous coating that rapidly cures as it is applied to the surface. The curing of the product occurs rapidly (minutes). The polyurea coating is applied to a minimum layer of 0.25 inches.

Visual inspection and measurement of the magnetic attenuation of pre-applied metallic buttons assure the thickness of the coating. The attenuation of the magnetic field as it passes through the polyurea coating is measured prior to shipment. The attenuation of the magnetic field is correlated to the thickness of the applied polyurea coating over several areas of the package to ensure compliance with shipping regulations and waste acceptance criteria of the disposal facility.

The physical properties of a well-formulated polyurea plastic are ideal to function as a surface packing container. The polyurea coating currently meets the definition of a Strong-Tight IP-1 package. The chemistry and physical properties of the polyurea coating were specifically

engineered to be very resistant to punctures and tears. The coating is impermeable to moisture and other environmental stresses. The product is engineered to have a 100-percent modulus of 1700-1900 pounds per square inch (psi), tear strength ply of 410 pounds per linear inch, stress tensile strength of 2500-2800 psi, and an elongation value of 280 percent. The polyurea coating is extremely tough, with a Shore Durometer Hardness of 54 (Shore D scale). The resulting package is impermeable to extreme environmental conditions, with stability at 350°F and no thermal shock effect at minus 65°F.

CONCLUSION

After technical review of this method of waste packaging, the Department of Transportation and the Nevada Test Site approved the use of polyurea plastic coatings for packaging low-level waste for shipment. Since approval in 2002, RFETS has shipped several large, bulky contaminated objects resulting in significant cost savings to decommissioning and environmental remediation projects at the Site.

When used to support the decommissioning of radiological and hazardous waste facilities, this packaging system serves as a much-needed alternative to traditional disposal options. This "spray-on package" forms a very strong, penetration resistant coating that meets or exceeds transportation regulations and waste acceptance criteria at the final disposal facility. This approach can be easily modified and engineered to provide solutions to a wide range of waste disposal problems inherent in the packaging and transport of hazardous materials.