HANDLING AND SEGREGATING SYSTEM FOR 55-GALLON DRUMS PROJECT— CURRENT PROGRESS ON TESTING AND INTEGRATION AT THE WESTERN ENVIRONMENTAL TECHNOLOGY OFFICE

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ABSTRACT

The Savannah River Site (SRS) along with other U.S. Department of Energy (DOE) sites have thousands of drums of mixed transuranic (TRU) waste that are being stored awaiting transfer to the Waste Isolation Pilot Plant (WIPP). The SRS drums contain noncompliant items that must meet WIPP waste acceptance criteria (WAC) before being accepted.

A system is being developed by the DOE Transuranic and Mixed Waste Focus Area (TMFA) under the Robotics Crosscut Program to repackage drummed, mixed TRU waste to meet WIPP WAC. This system, the Handling and Segregating System for 55-gallon drums (HANDSS-55), will economically and remotely open, sort, and segregate noncompliant components of the waste inside the drums and repackage the compliant components in a new drum suitable for shipment and acceptance by WIPP in New Mexico. HANDSS-55 is scheduled to be deployed for operation at the SRS Solid Waste Division by September 30, 2004. Other versions of HANDSS-55 may later be deployed at other DOE sites.

MSE Technology Applications, Inc. (MSE) was selected to integrate and demonstrate the HANDSS-55 modules being developed by the Idaho National Engineering and Environmental Laboratory (INEEL) and the Savannah River Technology Center (SRTC). This paper reports progress on integration and testing to date.

INTRODUCTION

HANDSS-55 (Fig. 1) will address a major DOE mixed TRU waste drum problem. The DOE has thousands of noncompliant (per U.S. Department of Transportation and WIPP WAC) 55-gallon drums containing mixed TRU waste. Examples of materials that cause a drum to be noncompliant are free liquids, pressurized containers, and heavy/unpadded items that could shift during movement and damage the drum's interior.

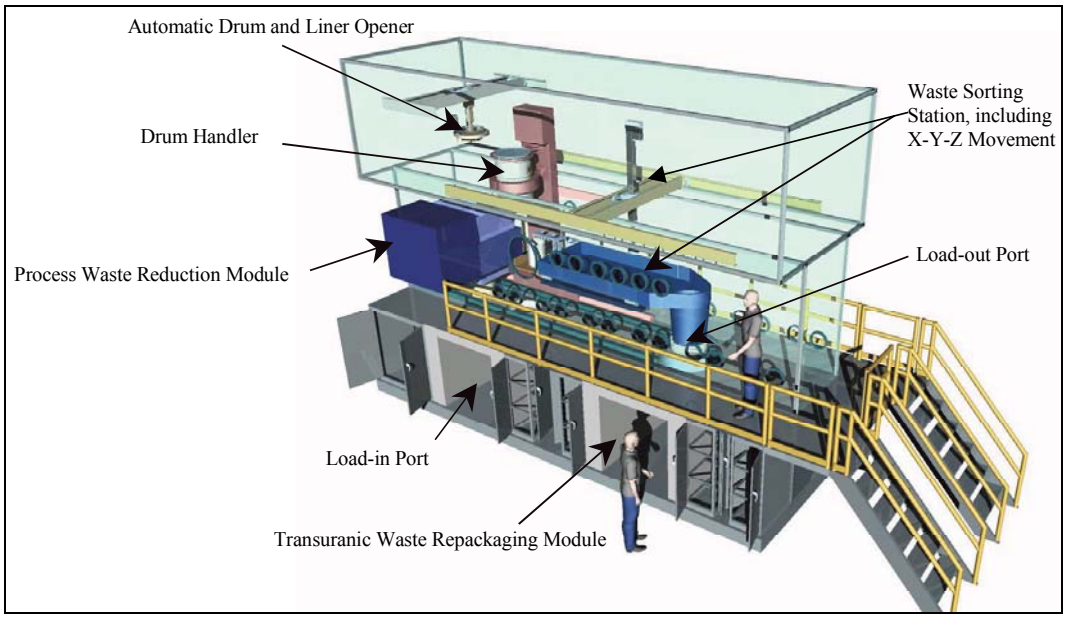

Fig. 1. HANDSS-55.

Subsystems that were developed by the SRTC through the TMFA at the INEEL are being integrated and tested as a full system at MSE. Integration and testing of HANDSS-55 will begin at MSE during fiscal year (FY) 2002 and continue through FY04 with shipment to the SRS for installation and cold startup by early FY04. The SRS is scheduled to begin hot operations by the end of FY04.

Many facilities within the DOE are generating and/or storing radionuclide-contaminated hazardous waste (mixed waste) that is classified as Land Disposal Restricted under the Resource Conservation and Recovery Act (RCRA). The Federal Facilities Compliance Act of 1992 (FFCA) requires each facility at which the DOE generates or stores mixed waste to develop plans for treatment, or for cases where no treatment technology exists, to generate plans for developing such a technology. The act provides the incentive for accelerating efforts to develop, design, and construct facilities that will render DOE mixed waste into a form that can be disposed of legally and inexpensively. Disposal of mixed TRU waste must meet the approval of both the U.S. Environmental Protection Agency and the Nuclear Regulatory Commission.

The waste conditioning needs of DOE sites require that new technologies be developed to fill the various needs for remote, automated equipment to protect human health and the environment. Due to the hazardous and radiological components found in TRU and mixed TRU waste, many problems are difficult and time consuming to solve, or even impossible to complete safely without automated technologies. Currently, if the needs of a waste handling organization require waste conditioning, a person must suit up in personal protective equipment to guard against contamination. There may be additional costs associated with releases to the environment or high dose rates to workers. HANDSS-55 provides this automated, modular waste conditioning function to solve the difficult waste handling issues.

HANDSS-55 will economically and remotely open, sort, and segregate noncompliant components of the waste inside the drums and repackage the compliant components in a new drum suitable for shipment and acceptance by WIPP. Presently, hands-on drum repackaging is approximately two barrels per 10-hour day, while HANDSS-55 will process four barrels per 10-hour day, decreasing the time it takes to qualify barrels to be shipped to WIPP, while even more importantly, greatly minimizing the risk of radioactive exposure to workers.

END USER

The SRS has thousands of drums of mixed TRU waste that is being stored awaiting certification and transfer to WIPP (1). This waste comes under the auspices of both the RCRA and the Atomic Energy Act, and these drums must meet WIPP WAC before being transferred to WIPP. The SRS committed to the State of South Carolina, through its FFCA, to submit a plan outlining the schedules and activities required to prepare mixed TRU waste for shipment from the SRS to WIPP by January 1999. This commitment was subsequently renegotiated, and waste was shipped to WIPP in 2000. The plan is to ship waste to WIPP for approximately 30 years.

TECHNOLOGY DESCRIPTION

HANDSS-55 provides a robotically operated technology to process TRU and mixed TRU waste for shipment to WIPP in New Mexico. The technology incorporated in HANDSS-55 is both automated and modular, allowing individual modules to be used with a multitude of other applications. The separate HANDSS-55 modules provide a unique ability to satisfy special needs at any of the many waste generator sites. Specifically for this work, the system will be used to address the need of the SRS to repackage its noncompliant drums for shipment to WIPP.

The four primary modules of HANDSS-55 are the Waste Sorting Module, the Transuranic Waste Repackaging Module (TWRM), the Process Waste Reduction Module, and the Systems Integration and Control Module. The modules may be used individually or as an integrated system. Each module will be self functioning and will be demonstrated separately during development. Following separate demonstration tests, control and hardware integration will be completed to make the modules function as a single integrated system.

Waste Sorting Module

The Waste Sorting Module is comprised of two components: the automatic drum and liner opener and the waste sorting station.

1. Automatic Drum and Liner Opener

This component is automated and functions remotely to open 55-gallon metal drums and their accompanying polyethylene liners that contain waste (Fig. 1). Personnel are removed from the hazardous environment of accessing waste inside the drums. The automated drum and liner opener was tested in a noncontaminated environment and is operational.

2. Waste Sorting Station

Drums that are radiologically screened and shown to contain noncompliant items will be set aside for HANDSS-55 treatment. This subsystem receives waste from the opened 55-gallon drums and provides visual identification of items (Fig. 1). An end effector (not shown) sorts and removes noncompliant items for bagout. Each item will be classified as acceptable or not acceptable for WIPP. The noncompliant items that are removed from the waste stream are then tracked in a database and set aside for final disposition. The remaining waste is classified and weighed for disposal records.

Transuranic Waste Repackaging Module

This bagless transfer port offers a capability that does not presently exist (Fig. 2). The bagless transfer allows waste to be moved from a contaminated environment to a 55-gallon drum. Radioactive materials

may be bagged or placed directly into the container. Automating the loading process reduces labor requirements and cost.

Fig. 2. TWRM—startup test at MSE.

Process Waste Reduction Module

This module, a heavy-duty, commercial waste shredder, will size reduce the opened 55-gallon drums and liners for volume-efficient waste disposal (Fig. 1). The process reduces shipping and storage costs through decreased volume. The processed drums and liners will be added to the shipping container for final disposal.

Systems Integration and Control Module

The modular design of HANDSS-55 provides a versatile control system allowing operation from either a central control system or an individual module control. The touch screen menu-based control system provides a user-friendly environment that is simple and powerful for the operator. Voice recognition will be standard with the Waste Sorting Module and available as an option on the other modules. The control system format allows the user to operate the equipment at high- or low-level automation to allow fully automated or manual control.

PROGRESS REPORT

Delivery of Components

In October 2002, MSE received the SRTC polyethylene welder and the TWRM deployment system (DS) robotic end effector. The TWRM Z-mast was received in early November 2001 from the INEEL. The TWRM sphincter seal and bucket transfer unit will be received from the SRS by the end of January 2002.

Test Setup Installation

MSE completed fabrication of the TWRM DS. This consists of an X versus Y system that will move the TWRM Z-mast and end effector. This system is very similar to the X-Y-Z system shown in Fig. 1. There

will be two X-Y-Z robotic end effector systems: one for the waste sorting station, and one for the TWRM.

The waste sorting station was fabricated and tested at the SRS and the INEEL. A new modified sorting table is being fabricated by MSE.

The polyethylene welding methodology was established at the SRTC. Initial results of TWRM waste barrel liner welder testing are that 12 barrels out of 16 barrels attempted were successfully welded. All but three of the failed barrels were due to equipment malfunctions [e.g., loose lamp power connector and air curtain flowmeter malfunction (Figs. 3, 4)].

Fig. 3. Successfully welded liner.

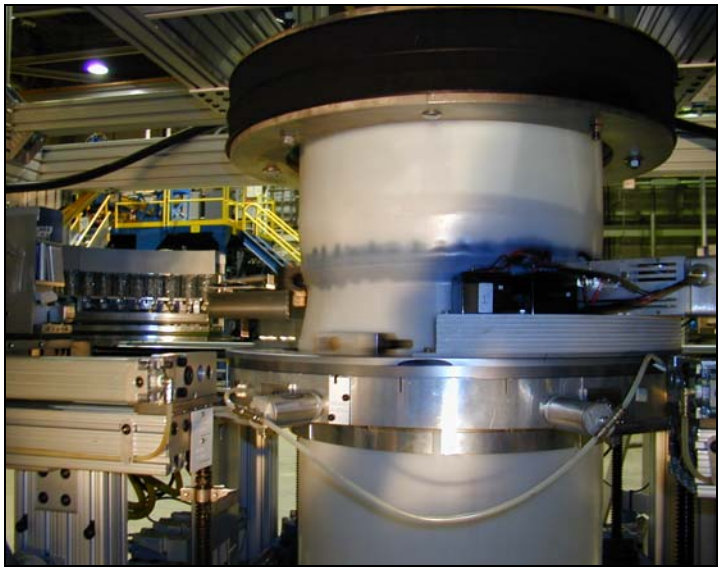

Fig. 4. Liner infrared welder.

The INEEL is completing a mechanical modification of the TWRM Z-mast that is scheduled to be delivered in early February 2002.

Progress is being made on the TWRM integrated control design and installation. This task consists mostly of programming computer control and is expected to be completed by the end of January 2002.

TWRM Startup Test

The TWRM integrated installation and startup test will be completed by March 2002. The objective of the startup test will be to verify the technical and functional requirements (T&FRs) of the TWRM. Currently, approximately 10% of the start-up test has been completed. When parts of the system do not fully satisfy the T&FRs, that item will be reported in the startup test report for future action. The action will probably result in design changes or could be as simple as a part replacement. The work to bring the TWRM into compliance with the TWRM T& FRs will be planned and executed concurrently with the design, fabrication, and installation of the glovebox lower support structure (GLSS).

Glovebox Lower Support Structure Design and Fabrication

MSE has been tasked with design and fabrication of the HANDSS-55 GLSS. The function of the GLSS is to structurally support and integrate the glovebox and four system modules described above. The GLSS is constructed of carbon steel and is finished with an industrial-grade painted surface. The GLSS is expected to be completed by April 2002.

PATH FORWARD

FY02—Complete verification startup testing on drum insertion system, drum handling system, sorting table, and TWRM. Complete deficiency items identified in the startup test necessary to bring the TWRM into compliance with the TWRM T&FRs. Complete design, fabrication, and installation of the GLSS. Complete integration assembly of the entire system, which includes all the subsystem modules described above. Begin the systems integrated test.

FY03—Complete systems integrated test without the glovebox. Install the glovebox and repeat the systems integrated test. Ship the system to the SRS in July 2003.

FY04—Complete installation and commissioning of the system at the SRS. Begin hot operations on September 30, 2004.

REFERENCES

1. “Functional and Operation Requirements for the Deployment of HANDSS-55 at the Savannah River Site,” INEEL/EXT-99-00055, January 1999.

ACKNOWLEDGEMENT

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