International Union of Operating Engineers National Hazmat Program

International Environmental Technology & Training Center

HANDSS-55 Transuranic Waste Repackaging Module

HUMAN FACTORS ASSESSMENT REPORT
August 2001

Frank Hanley, General President

Research supported by the
U.S. Department of Energy's
National Energy Technology Laboratory
Under cooperative agreement DE-FC26-01NT41118 with the
Operating Engineers National Hazmat Program,
1293 Airport Road, Beaver, WV 25813,
Phone: 304-253-8674, Fax (304) 253-7758.
Email: hazmat@iuoeiettc.org

This publication was prepared with the support of the U.S. Department of Energy, under Award No. DE-FC26-01NT41118. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the DOE.

HANDSS-55
Transuranic Waste Repackaging Module

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

1.1 Background

The Transuranic waste generated at the Savannah River Site from nuclear weapons research, development, and production is currently estimated to be over 10,000 cubic meters. Over half of this amount is stored in 55-gallon drums. The waste in drums is primarily job control waste and equipment generated as the result of routine maintenance performed on the plutonium processing operations. Over the years that the drums have been accumulating, the regulatory definitions of materials approved for disposal have changed. Consequently, many of the drums now contain items that are not approved for disposal at DOE Waste Isolation Pilot Plant (WIPP). The HANDSS-55 technology is being developed to allow remote sorting of the items in these drums and then repackaging of the compliant items for disposal at WIPP.

1.2 OENHP Safety and Health assessment

Chip Booth, MS, a safety professional from the Operating Engineers National Hazmat Program (OENHP) and John Patten, Ph.D., a consultant to OENHP, participated in the July 31st demonstration of the Transuranic Waste Repackaging Module (TWRM) at DOE's Savannah River Site (SRS), in Aiken SC. The demonstration was conducted in preparation for the shipment of the TWRM to MSE, Inc., Butte MT for integration testing with other HANDSS-55 components.

Prior to attending the demonstration, Mr. Booth and Dr. Patten reviewed a safety analysis prepared by SRS for the TWRM module. Having access to valuable safety information before arriving on site enabled the team to produce a draft Technology Safety Data Sheet for the TWRM while the demonstration was underway, permitting a more thorough analysis.

1.3 Technology description and operation

1.3.1 HANDSS-55 system

The HANDSS-55 system is designed to be totally enclosed, operating inside a large glove box. This automated operation represents a major improvement in worker safety over the older baseline method of having workers manually sort the materials through glovebox ports. The risk of exposure to radiation was much greater with the older approach and the work was more tiring, given the awkward and static postures that workers had to maintain.

The HANDSS-55 process is composed of a number of modules that perform discrete functions, including:

1. An automatic drum and liner opener (AD&LO),
2. A visual inspection and sorting table,
3. A transuranic-waste repackaging module (TWRM),
4. A process waste reduction module (PWR), and
5. Components for integrating the modules.

The function of the AD&LO module is to open a 55-gallon drum and its internal liner to allow access to the drum's contents. The visual inspection and sorting table module will allow segregation of the drum's contents so that all items unacceptable for shipment to WIPP are removed from the waste stream. The TWRM repackages the acceptable waste and removes it from the glove box. The PWR will reduce the size of the original waste container so that it will fit into the repackaging container. Finally, the components for module integration perform a variety of functions including manipulation of the incoming 55-gallon waste drum, extricating waste stuck in the drum, and moving waste between modules inside the glove box.

OENHP intends to prepare a TSDS for each of the components listed and to combine them into a master TSDS for the entire HANDS -55 system when it is operated in the nuclear environment.

1.3.2 The Transuranic Waste Repackaging Module

The TWRM's function is to remove radioactive waste from the HANDSS-55 glove box. The waste will be loaded into high-density polyethylene, leak-tight containers free of external contamination. A "welding" operation fuses a polyethylene plug into the container's opening and then a cutting operation (using split plug technology) separates the waste container from the glove box while maintaining both glove box and waste container integrity. SRTC engineers have adapted existing "split plug" bagless transfer technology to this repackaging module for HANDSS-55. The split plug bagless transfer system has been developed at SRTC for use with metal cans and specially-modified commercial welding and cutting tools for the processing of special nuclear materials.

In the split plug bagless transfer process illustrated below, a waste-receiving container made of metal or polymer is inserted through a sphincter seal into the glove box. A hollow plug is carried into the glovebox inside the container, removed from the container prior to placement of the compliant waste into the waste-receiving container, and then reinserted into the waste-filled container. Bonding and cutting operations are then performed and the container removed from the glove box

The demonstration was conducted on the actual components that are to be used in the final HANDSS-55 system. However, the components were operating in a test fixture specifically designed by SRTC to test the TWRM prior to shipment to MSE; no radioactive or hazardous materials were included in the test.

The team prepared a TSDS for the TWRM as it was configured for the demonstration test at SRTC. The test demonstrated all of the functions that the TWRM is expected to perform, but without the hazardous materials involved. Since the TWRM will be operated in conjunction with other selected components of the HANDSS-55 system during the integration test at MSE, the TSDS, as prepared, accurately documents the hazards to workers that are present during the installation, checkout, operation and disassembly of the TWRM at MSE.

However, as indicated above, OENHP's intention is to prepare a TSDS for each of the components listed and to combine them into a master TSDS for the entire HANDS -55 system. TSDS preparation for the sorting table is planned for early September with a due date of September 30, 2001. OENHP evaluates the potential for hazards in the four phases that constitute the life cycle of an innovative technology: start-up, operation, maintenance, and decommissioning. Since the HANDSS-55 system is to be operated remotely, it is the maintenance and decommissioning phases that pose the greatest hazards to the worker from exposure to radioactive and hazardous materials.

The completed draft TSDS for the TWRM is included for review. The TSDS for the HANDSS-55 system will include consideration of the hazards associated with operation in the radioactive environment. The level of precautions will be defined by SRS Operations as they prepare their operating and maintenance procedures for the radioactive environment. It is expected that the completed TSDS for the HANDSS-55 system, developed as outlined here, will have broad applicability for any other user of the HANDSS-55 system within the DOE complex.

2.0 Technology safety data sheet

TECHNOLOGY SAFETY DATA SHEET

HANDSS-55 Technology, Transuranic Waste Repackaging Module (TWRM)

Draft Version 1.0, 8-17-01

SECTION 1: TECHNOLOGY IDENTITY	
Department of Energy Tech ID # 2337	
Manufacturer's Name and Address:	Emergency Contact:
Westinghouse Savannah River Company Bldg. 705-3C/ P.O. Box 616, Aiken, SC 29808	Mike Brennan 803-557-6342 Michael.brennan@srs.gov
Other Names:	Information Contact:
Idaho National Engineering and Environmental Laboratory BBWI, M.S. 2220 2095 N. Boulevard Avenue Idaho Falls, ID 83415	Marcela Stacy 208-526-9456 scy@inel.gov
Date Prepared:	Prepared by:
8/15/01	Donald Booth, MS, Operating Engineers National Hazmat Program (OENHP) John Patten, Ph.D., Consultant to OENHP

SECTION 2: PROCESS DESCRIPTION

Across the DOE complex there are thousands of drums containing items that are radioactively contaminated as the result of routine maintenance performed on the plutonium processing operations. Many of the drums now contain items that are not approved for disposal at DOE Waste Isolation Pilot Plant (WIPP). The HANDSS-55 technology is being developed to allow remote sorting of the items in these drums and then repackaging of the compliant items for disposal at WIPP. This remote operation is a major improvement over the old approach of workers manually sorting the material through glovebox ports. HANDSS-55 will reduce the potential for radiation exposure and physical stress.

HANDSS-55 operates in a glovebox, and is composed of a number of modules that perform discrete functions, including

An automatic drum and liner opener (AD&LO),
A visual inspection and sorting table,
A transuranic-waste repackaging module (TWRM),
A process waste reduction module (PWR), and
Components for integrating the modules.

The function of the TWRM is to enable the removal of acceptable, radioactive waste from the HANDSS-55 glovebox. The waste will be loaded directly into a high-density polyethylene, welded, leak-tight container free of external contamination. A welding operation fuses the waste container and then a cutting operation separates the waste container from the glovebox while maintaining both glovebox and waste container integrity.

The system uses a split plug “bagless” transfer system in which a waste-receiving container made of metal or a polymer is inserted through a sphincter seal into the glovebox (see diagram in Section 3). A hollow plug is carried into the glovebox inside the container and removed from the container before the waste is added. After the drum is full, the plug is replaced.

Welding/bonding and cutting operations are then performed outside the glovebox. The outer wall of the plug is welded (if metal) or bonded (if polymer) to the inner wall of the container. It should be noted that this bond must be air tight to fully trap any contamination that may have gotten on the inner wall of the container or outer wall of the plug.

The container/plug seal is then cut horizontally around the outside of the container and at the center of the plug. The top half of the cut maintains the glovebox seal while the bottom half of the cut becomes the lid for the waste-receiving container. Finally, a new receiving container and hollow plug are inserted through the sphincter seal, pushing the upper portion of the previous container, which now becomes waste, into the glovebox, and the process is repeated.

SECTION 3: TECHNOLOGY PICTURES

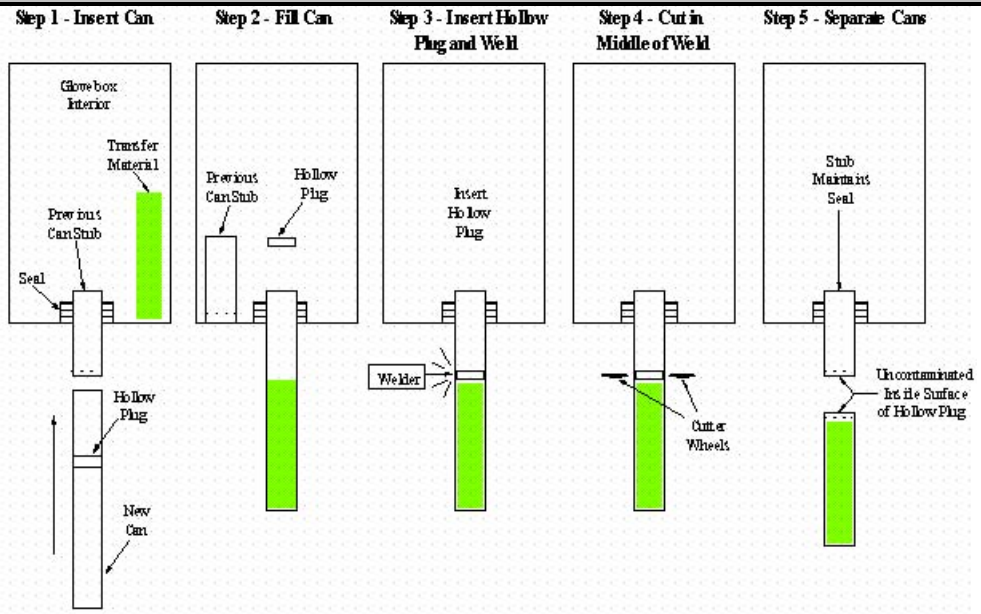


Figure 1 - "Split Plug" bagless transfer process

a) Black HDPE hollow plug

b) Natural colored HDPE container with plug

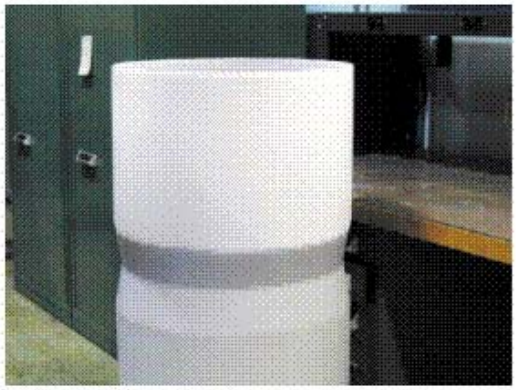
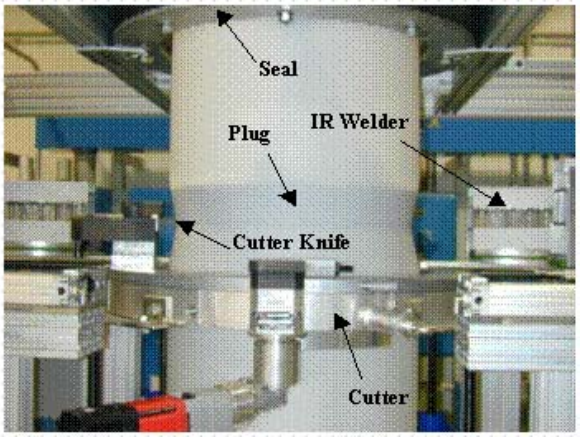


Figure 2 – HDPE container and hollow plug



a) Waste container being welded

b) Waste container in cutting position with IR welder retracted

Figure 5 – Full-scale infrared welder

SECTION 4: CONTAMINANTS AND MEDIA

The Solid Waste Management Division at the Savannah River Site (SRS) has responsibility for thousands of 55-gallon drums of mixed TRU-waste. Typical waste includes wipes, tape, cardboard, paper towels, gloves, bags, plastic suits, and tools. This waste is being stored at SRS while awaiting certification and transfer to the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, NM. The drums must meet the WIPP waste acceptance criteria (WAC) before they can be transferred to WIPP. Unfortunately, some of this waste is mixed with unacceptable items such as resins and aerosol cans.

SECTION 5: ASSOCIATED SAFETY HAZARDS

Probability of Occurrence of Hazard:

1 Hazard may be present but not expected over background level
2 Some level of hazard above background level known to be present
3 High hazard potential
4 Potential for imminent danger to life and health

A. ELECTRICAL (LOCKOUT/TAGOUT)	RISK RATING: 3

The TWRM operates with electrical energy, mechanical energy, and pressure. Each of these must be addressed with lockout / tagout procedures before any maintenance is conducted.

B. FIRE AND EXPLOSION	RISK RATING: 1

Operational temperatures in the TWRM are limited to the 1000° F range. Typical waste such as wipes, tape, cardboard, paper towels, gloves, bags, plastic suits, and tools could be combustible at these temperatures. However, when the TWRM is operational at its peak temperature, the waste is enclosed in a high-density polyethylene (HDPE) drum liners and not subject to a temperatures in the ignition range of the waste. Items that could pose an explosion hazard have been removed from the waste prior to its introduction into the TWRM by the sorting operation.

C. CONFINED SPACE ENTRY	RISK RATING: NA

The size of the TWRM prevents the existence of a confined space entry hazard

D. MECHANICAL HAZARDS	RISK RATING: 2

Operation of the TWRM includes the automated positioning of the loaded plastic barrel liner as well as the welder head over the work. These operations are computer-controlled and do not require operator assistance. When there is a need for operator intervention, special work procedure will have to be followed. Guards and interlocks have been provided for operator protection from moving parts during operation to prevent pinch point hazards. The mechanical features must be guarded to prevent operators from contacting the mechanical components. Additionally, mechanical hazards must be identified in order for lockout/ tagout procedures to be properly applied.

E. PRESSURE HAZARDS	RISK RATING: 2

The TWRM is design to operate at atmospheric pressure or at slightly reduced pressure in a glove box environment. However, there are control systems and instruments that are pneumatically operated. No high-pressure gas systems (greater than 300 psi) are in use.

SECTION 5: ASSOCIATED SAFETY HAZARDS CONTINUED	
F. TRIPPING AND FALLING	RISK RATING: 2
The TWRM relies on electrical and pneumatic energy. During the demonstration test at SRS both of these were supplied externally, which created tripping hazards from the hoses and cords lying on the ground. However, the final installation of the HANDSS-55 system will be a well-integrated package that should significantly reduce the tripping hazard.	
G. LADDERS AND PLATFORMS	RISK RATING: 2
The TWRM requires sufficient clearance from the floor to position the 55-gallon drum directly under the welder head. This requires overall system height of over 15 feet. Ladders and platforms have been provided and may be needed occasionally. OSHA outlines specific guidelines for using ladders and platforms.	
H. MOVING VEHICLES	RISK RATING: NA
This hazard is not applicable to the operation.	
I. BURIED UTILITIES, DRUMS, AND TANKS	RISK RATING: NA
This hazard is not applicable to the operation.	
J. PROTRUDING OBJECTS	RISK RATING: 2
In its present configuration, the TWRM has objects that protrude during operation and maintenance. When the unit is fully integrated and operating in a containment, these risks will drop.	
K. GAS CYLINDERS	RISK RATING: NA
This hazard is not applicable to the operation of the TWRM.	
L. TRENCHING AND EXCAVATIONS	RISK RATING: NA
This hazard is not applicable to the operation of the TWRM.	
M. OVERHEAD LIFTS	RISK RATING: NA
This hazard is not applicable to the operation of the TWRM.	
N. OVERHEAD HAZARDS	RISK RATING: NA
This hazard is not applicable to the operation of the TWRM.	
SECTION 6: ASSOCIATED HEALTH HAZARDS	
A. INHALATION HAZARD	RISK RATING: 2
The TWRM does not create any additional inhalation hazards. Operators should be aware of site-specific hazards that may constitute an inhalation hazard during operation or maintenance. The remote and automatic operation of the TWRM greatly reduces the risk compared to the baseline method of working manually in glove boxes.	
B. SKIN ABSORPTION	RISK RATING: 2
The TWRM does not create any hazards associated with skin absorption. Operators should be aware of hazards that may be present during maintenance.	
C. HEAT STRESS	RISK RATING: NA
This hazard is not applicable to the operation of the TWRM.	

SECTION 6: ASSOCIATED HEALTH HAZARDS CONTINUED	
D. NOISE	RISK RATING: 1
Operational noise levels are less than 85 dBA (the OSHA limit requiring a hearing conservation program), but there may be occasions when the level could be exceeded.	
E. NON-IONIZING RADIATION	RISK RATING: 2
High intensity light is used in this process. Protective eyewear should be worn while the system operating is operating in the "welding" mode.	
F. IONIZING RADIATION	RISK RATING: NA
During the demonstration test at MSE no ionizing radiation will be present. (The integrated TSDS written for the HANDSS-55 system will address this hazard).	
G. COLD STRESS	RISK RATING: NA
This hazard is not applicable to the operation of the TWRM.	
H. ERGONOMIC HAZARDS	RISK RATING: 1
The TWRM system has been designed to operate automatically. The operators will not be required to perform repetitive tasks during operations. However, operators may be exposed to awkward or static positions during maintenance.	
I. OTHER	RISK RATING: NA
None	
SECTION 7: PHASE ANALYSIS	
A. CONSTRUCTION/START-UP	
The TWRM is a component of the HANDS 55 system. Construction will be limited because the technology will already be in place. During start up, operators should be conscious of the electrical, mechanical, and pressure hazards associated with the TWRM. All site-specific procedures should be followed.	
B. OPERATION	
The operation of the TWRM is remote, removing the operator from the hazards. This should be the safest phase.	
C. MAINTENANCE	
Operators should be trained on the maintenance of the TWRM technology with emphasis on lockout/ tagout procedures. During maintenance, operators should practice the proper lockout/ tagout precautions as specified in the site-specific maintenance procedures. Standard maintenance procedures need to be followed carefully. Emergency maintenance is a time of increased risk; scenario planning and training can help reduce the risk.	
D. DECOMMISSIONING	
The TWRM component of the HANDSS-55 system is complex and relies on various forms of energy including electrical, mechanical, and pressure. Decommissioning of the TWRM will require an effective lockout/ tagout program. As with the maintenance procedures, operators should be trained on technology- specific hazards as well as the site-specific procedures used to mitigate these hazards.	

SECTION 8: HEALTH AND SAFETY PLAN REQUIRED ELEMENTS
A. AIR MONITORING
The TWRM does not create a need for air monitoring but any programs already in place to monitor site-specific hazards should be continued. The integrated TSDS written for the HANDSS-55 system will more fully address the monitoring program. In actual operation of the HANDSS-55 system at a site there is the possibility of air borne contamination.
B. WORKER TRAINING
Respiratory protection, hearing conservation, ergonomics, personnel protection equipment, electrical safety, and lock/tag-out training should be required training.
C. EMERGENCY RESPONSE
The TWRM will require emergency response consideration under the existing disaster preparedness plans in place. The TWRM will deal with TRU waste and the highest level of preparedness should be considered.
D. MEDICAL SURVEILLANCE
The TWRM does not create any additional need for medical surveillance. The unit is designed to run remotely, operators may require yearly audiograms if the noise levels are found to above OSHA allowable levels during maintenance.
E. INFORMATIONAL PROGRAM
Technology specific information related to the TWRM should be available at all times to operators. The TWRM does not require any additional informational programs other than would already be in place, such as a HAZCOM program.
SECTION 9: COMMENTS AND SPECIAL CONSIDERATIONS
The information in this TSDS was based on observations of the TWRM being tested with noncontaminated materials as part of a separate demonstration. Consequently, this TSDS needs to be revised as the technology is improved and integrated into the larger HANDSS-55 system.