RECEIVED
OCT 31 1995
OSTI

CONTAINER EVALUATION FOR MICROWAVE SOLIDIFICATION PROJECT

RFP-4990

AUGUST 1994

By
James A. Smith

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DROP TEST
BAGLESS POSTING

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED *www*

MASTER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Table of Contents

Purpose	5
Background	5
Information	6
Procedure	6
Operating Sequence	6
Packing Procedure	12
Results & Discussion	14
Head Drop (G02434)	15
Chime Drop (G02433)	21
Chime Drop (G02435)	36
Benefits	48
Conclusion	51
Recommendations	52
Appendix A (container drawing)	
Appendix B (test plan)	

LIST OF FIGURES

Figure 1. Background- Demonstration Microwave unit with 30 gallon drum in the insulation cage. Foreground- 55 gallon drum over pack with 200 liter simple lid and 30 gallon drum of processed waste from Microwave.

Figure 2. Interior of 55 gallon container with spider in place.

Figure 3. Open 30 gallon drum over packed into the 55 gallon container with spider and spacer blocks.

Figure 4. Overall view of shipping container assembly.

Figure 5. Assembly drawing of shipping container.

Figure 6. Rigging setup for head drop on container G02434.

Figure 7. Free fall of container G02434.

Figure 8. Slightly after impact of container G02434.

Figure 9. Container G02434 after 15 minutes (no leakage).

Figure 10. Overall exterior damage to container G02434 (Head drop)

Figure 11. Damage of 200 liter inner lid. (Head drop)

Figure 12. Damage of packing material (Head drop)

Figure 13. Annular area around 30 gallon container. 30 gallon container untouched. (container G02434)

Figure 14. Free fall of first chime drop. (container G02433)

Figure 15. Slightly after impact on container G02433.

Figure 16. Leakage after 15 minutes on container G02433.

Figure 17. Overall exterior damage of container G02433.

Figure 18. Close up view of damaged chime area on container G02433.

Figure 19. Damage to 200 liter inner simple lid. (container G02433)

Figure 20. Close up of damaged 200 liter lid, 55 gallon container, and Hempelmann boot. (container G02433)

Figure 21. Close up of the interior side of the 55 gallon container. (container G02433)

Figure 22. Annulus area around 30 gallon container. 30 gallon container untouched. (container G02433)

Figure 23. Rigging setup for chime drop on container G02435.

Figure 24. Free fall of container G02435.

Figure 25. Slightly after impact on container G02435.

Figure 26. Leakage after 15 minutes on container G02435.

Figure 27. Close up of the leakage.

Figure 28. Exterior damage to the 55 gallon container (G02435)

Figure 29. Damage around chime area on container G02435.

Figure 30. Damage around chime area on container G02435.

Figure 31. Damage to 200 liter lid.(G02435)

Figure 32. Damage to 200 liter lid. (G02435)

Figure 33. Damage to packing. (G02435)

Figure 34. Undamaged 30 gallon container showing annulus area.

PURPOSE

The objective of this project is to determine a suitable waste container and packaging arrangement to be used with the Microwave Solidification System (MSS) and Bagless Posting System (BPS).

BACKGROUND

At the request of the Department of Energy (DOE) a feasibility study was conducted on BPS during 1988. The study indicated that bagless transfer of radioactive waste to a waste container was feasible. It was concluded from a literature search that a commercially available unit manufactured by Drath & Schrader of West Germany is capable of this task. Systems installed at Rocky Flats during the early 1970's were removed from production environments because of surface and airborne contamination along with corrosion problems. The 1988 study indicated that the systems had evolved with increased experience and that newer models had higher success in contaminated environments.

A development unit was set up at Rocky Flats to demonstrate the capability of the equipment and to evaluate the requirements for a shipping container. Deficiencies of the sealing gasket on the shipping container were identified and a redesigned gasket was fabricated for testing. During 1991 a leak test chamber was fabricated to evaluate the sealing integrity of the system to the shipping container during a simulated transfer. In FY92 & 93 several tests were completed to verify the sealing capability of equipment and the gasket. During 1992 the Traffic Department at Rocky Flats was approached for guidance on requirements for a low level waste container for the project. Since DOE has

been rewriting the requirements for shipping low level waste, expert guidance was critical to define the package configuration. This issue remains unresolved.

INFORMATION

The Drath & Schrader double lid system was modified to operate with a U.S. standard Department of Transportation (DOT) 17C 55 gallon drum with a European style 200 liter simple lid and a Hempelmann boot which provides a seal between an alpha contaminated environment and interior of a 55 gallon drum (appendix A). This modification allowed the DOT 17C 55 gallon drum to be used with European built equipment and components. The current application that this project supports is the development of a container for the MSS for land disposal restricted waste. The MSS vitrifies the waste into a 30 gallon drum then is over packed through the double lid system into a 55 gallon drum using the commercial technology from Drath & Schrader. The waste package assembly has never been tested for DOT approval according to 49 CFR Section 173.435 for use in the United States.

PROCEDURE

Operating sequence:

The demonstration MSS that processes the 30 gallon drum is shown in figure 1. The 30 gallon container serves as the microwave vitrification chamber during operation of the microwave solidification process. The interior of the 30 gallon container is subjected directly to the waste stream constituents and process variables. After the 30 gallon container is filled with waste and cooled, the container is closed with the commercial lid

CA
— PINGU —
HAZARD

Figure 1. Background: demonstration microwave unit with 30-gallon drum in the insulation cage.

Foreground: 55-gallon drum over pack with 200-liter simple lid and 30-gallon drum of processed waste from microwave.

and secured with a clamp ring. The processed drum is then ready to be over packed through the double lid system.

The over pack requires a centering device for the 30 gallon container during shipment. Figure 2 shows the spider positioned to accept the 30 gallon container. The annular area between the 55 gallon container and the 30 gallon container is shown in figure 3. The annulus acts as a crush zone during impact and allows the 30 gallon container to be positioned into the 55 gallon container during glovebox operations.

After the 30 gallon container has been placed into the over pack 55 gallon container the double lid system closes the 55 gallon container. The container has an inner and outer lid that controls the contamination during the operation. The inner lid is a custom lid manufactured by Drath & Schrader. The double lid system automatically places the inner lid onto the 55 gallon container. The container is then lowered from the equipment. The outer or over lid is then manually placed onto the 55 gallon container to cover up an annular area of contamination which results during the transfer operation. The area of contamination lies between the inner lid and the Hempelmann boot gasket. A final clamp ring is then put onto the 55 gallon container to secure the outer lid. This container (figure 4) with all of the components assembled is the proposed waste container for the MSS product .

The procedure just described follows the operating sequence for the MSS to remove a fully loaded waste drum from a glovebox environment. The drum is then ready for

Figure 2. Interior of 55-gallon container with spider in place.

Figure 3. Open 30-gallon drum over packed into the 55-gallon container with spider and spacer blocks.

Figure 4. Overall view of shipping container assembly.

shipment to a land disposal facility. The waste from this process is expected to produce a product with a physical form number 3 under the guidelines from CFR 173.443. The product will have no significant dispersible or removable contamination in the 30 gallon container. The exterior of the 30 gallon container will also be subjected to the process environment. This environment will be free of dust and dispersible contamination to ensure process control. If process control is not achieved in this area other measures will be taken to ensure contamination control.

Packaging procedure:

The shipping container components are shown in figure 5 with a detailed drawing and parts list in Appendix A. Three test container were packed for a four foot drop test evaluation as described in the following sections. The test plan for dropping the containers is included in Appendix B. All materials and components shall be new and free from defects.

First an open headed 55 gallon 17C drum (item 8, figure 5) is inspected for any defects and any loose contamination that could cause problems. The sealing gasket (item 3, figure 5) is adhesively bonded to the top of the drum. The centering spider (item 9, figure 5) is then placed in the bottom of the container. Next the 30 gallon container (items 10,11,12 figure 5) is placed into the 55 gallon container. The assembly is then centered down onto the spider to keep it concentric with the 55

Figure 5

gallon container.

The next item added to the package was water (5 gallons). The water was used primarily as a visual aid after the drop impact to evaluate leakage. This practice is not standard in the CFR, however it does provide a visual indication for the outer containers ability to maintain a tight package. The packing materials that rest on top of the 30 gallon container (items 6,7 figure 5) are then placed into the 55 gallon container. The packing material is Styrofoam brand square edge nominal thickness 1 1/2 inch and 1 inch manufactured by DOW Chemical Co. Next the inner 200 liter lid (item 2, figure 5) is placed onto the package. Finally the over lid (item 13, figure 5) is placed onto the 55 gallon container. The over lid covers an annular contamination area caused during the bagless posting operations. The final clamp ring (items 4,5 figure 5) was then placed onto the 55 gallon container to secure the inner lid. The bolt is torqued to 40 foot pounds. At this point, the package is complete and ready for evaluation.

RESULTS & DISCUSSION

All drop tests were conducted in accordance with the test plan in Appendix B. Since 30 gallon drums from previous microwave test operations were used for the drop tests, the difference in weight between these containers was due to varying amounts of material processed during microwave operations. The container's orientation during the drop test determine if it is a head or chime drop. For a head drop the container is inverted upside down and impacts the top of the container with a surface that is parallel to the top of the

container. For a chime drop the container is oriented upside down and at an angle to impact on the edge of the container. The drops were oriented to cause maximum damage to the safety features of the package been tested. One head and two chime drops were done.

Head drop:

The first drop was a head drop on container G02434. Total weight of the drum and contents are 462 pounds. The center of gravity was calculated based upon the contents of the inner drum. Rigging was placed onto the drum to ensure the orientation of the drum upon impact was in line with center of gravity. The drum was positioned four feet above a solid steel plate. The point of impact of the container was centered on the steel plate.

The photo series in figures 6, 7, and 8 show the head drop sequence. Figure 6 shows the rigging and placement four feet above the plate. Four feet is measured from the steel plate up to the lowest point of the test container. Figure 7 shows the container in free fall. Note: Upon release of the test container, no rotation was noticed thus indicating that the container did impact the steel plate parallel to the surface of the lid. Figure 8 shows the container immediately after impact. At impact there were no visible signs of rupture of the outer container or leakage of the added water. The container then sat for 15 minutes to allow any leakage of contents to accumulate. During this time no visible leakage occurred, figure 9.

Figure 6. Rigging setup for head drop on container G02434.

Figure 7. Free fall of container G02434.

Figure 8. Slightly after impact of
container G02434.

Figure 9. Container G02434 after
15 minutes (no leakage).

Deformations to the exterior of the 55 gallon drum indicate that an evenly distributed force partially collapsed the side walls of the test container. Figure 10 shows the overall damage of the dropped container. The wall of the drum was compressed between the clamp ring and first chime of the drum. After removing the clamp ring and over lid, it was noted that the inner 200 liter lid had been deformed. Figure 5 shows the shape of a new 200 liter lid. Note the gap between the bottom of the over lid and top of the inner 200 liter lid. After the drop there was no noticeable gap between the level and surface of the lid (figure 11) indicating that deformation of the inner lid had occurred. The contents of the package during impact struck the packing and caused deformation of the 200 liter lid. The deformation was equivalent in magnitude to a 48 g force calculated. The magnitude was based upon a 1/2 inch permanent deformation of the inner 200 liter lid.

The deceleration of the package upon impact was adequately absorbed by the packing material. The square edge insulation board was sheared and broken as shown in figure 12. The inner 30 gallon container did not move enough at impact to contact the interior of the 55 gallon container. Figure 13 shows the annular area of the 55 gallon container with no deformations touching the 30 gallon container. No other component of the assembly showed signs of damage or failure.

Chime drop:

The second drop was a chime drop on container G02433. Total weight of the drum and contents was 332 pounds. The center of gravity was calculated based upon the contents

Figure 10. Overall exterior damage to container G02434 (head drop).

Figure 11. Damage of 200-liter
inner lid (head drop).

Figure 12. Damage of packing material
(head drop).

Figure 13. Annular area around 30-gallon container; 30-gallon container untouched (container G02434).

of the inner drum. Rigging was placed onto the drum to ensure the orientation of the drum upon impact was in line with center of gravity. The drum was positioned four feet above a solid steel plate. The point of impact of the container was centered on the steel plate. Upon release of the test container no rotation of the container was noted.

The photo series in figures 14 and 15 show the chime drop sequences. Figure 14 shows the rigging and container in free fall. Figure 15 shows the container just after impact on the first bounce. At impact there were visible signs of rupture of the outer container. The container was allowed to sit for 15 minutes to allow water to leak.

The total amount of leakage that accumulated during the 15 minutes is shown in figure 16. Approximately 20 ml leaked from the container. After the primary impact of the container on the chime, the container continued to rotate. The second impact occurred when the container came to rest on its side. This impact caused the inner 30 gallon container to impact the spider at two points. The spider deformed the lower exterior of the 55 gallon container (figure 17). The spider is made of thin aluminum sheet.

Close up view of the damaged chime area (figure 18) indicate a significant impact on the container. No physical fracture of material or failure of components is evident. The container is damaged but all components are intact. After removing the 200 liter over lid it was noted that approximately 100 ml of water was trapped between the inner and over lids (figure 19). The accumulation of water in this area might have occurred during

Figure 14. Free fall of first chime drop
(container G02433).

Appendix B

Test Plan for Drop Test

1.0 OBJECTIVE

To determine a suitable drum and packaging arrangement to be used with a Bagless Posting System (BPS). The BPS will be used to remotely open and close 55 gallon waste containers at Rocky Flats. The design of the BPS equipment allows for remote handling of European style drums. The current equipment configuration of the BPS has been modified to allow for a standard U.S. 55 gallon drum, European 200 liter lid, and a Hempelmann boot. The Hempelmann boot is used to seal between the BPS and the standard U.S waste drum. Currently low level radioactive waste packaged in standard U.S 55 gallon waste containers drums must meet Department of Transportation (DOT) 7A Type A requirement for shipment. The Hempelmann boot, inner 200 liter European lid, over lid, and clamp ring have not been approved for 7A Type A packaging. Initial drop tests will be conducted at Rocky Flats for information on drum integrity and packaging requirements. All other testing requirements to the container will not be evaluated at this time. This evaluation will then be forwarded to the appropriate group within the Department of Energy for testing and approval to the Department of Transportation specifications.

2.0 EQUIPMENT DESCRIPTION

The main components for this test at Rocky Flats include the waste drum assembly, lifting equipment, lifting cable and release mechanism. A detailed check list of equipment required for the test is in appendix A. All components within the waste drum assembly are listed in the figure 1 of appendix B. The lifting equipment shall provide vertical travel sufficient to meet test procedure plus allowances for rigging. The lifting cable shall provide sufficient support to orientate the drum to the required position. The release mechanism shall provide for a smooth release of the waste drum and lifting cable.

3.0 SAFETY/ENVIRONMENTAL PRECAUTIONS

All waste containers will be new and free of any contamination. All test conducted will not have radioactive materials. The mass in the barrel could include surrogate sample runs from the microwave melting project, sand and water. All equipment handling components will be rated to a minimum of 150 % of the maximum load. Necessary personnel safety precautions shall be used to ensure safe movement, overhead lifting, release and point of impact for all tests. In addition a Job Safety Analysis will be completed and on file with area safety representatives and at the test site during testing.

4.0 TEST PROCEDURES

4.1 Sample preparation

All drums shall be labeled as a test container. Label shall include responsible testing organization, contact and extension. A minimum of three samples shall be prepared. Log and record all weights and lot numbers of components for each specimen. Assemble waste drum with the appropriate components and visual check. Pack drums with surrogate waste container (30 gallon) from Microwave system. Seal drums with inner European lid, place over lid on and torque closure ring to 25 ft lbs. Check and record all samples for weight and visual inspect for leaks. Appendix C is the record of results for each drop test and shall be filled out completely.

4.2 Drop Test

Drum shall be positioned in slings with the slings connected to a tripping device and hoist that will allow for proper placement of specimen. Orientation and common points between test specimens are indicated in figure 2. of appendix B. Still photographs shall be used to record the condition of the container both before and after the drop tests. Still photographs shall also be used to record damage caused by each test. A reference scale shall be clearly visible in all photographs. A video camera may be used to record the drop test.

4.2.1 Head Drop

Position drum vertically in slings to be dropped on the head or lid of the container from a height of 4 feet above the ground. Allow the container to come to a complete stop from swinging. Clear all personnel and drop container.

4.2.2 Chime Drop

Position drum so that the center of gravity for the container and the contents is directly 4 feet above the point of impact. The drum shall strike the ground on the most vulnerable place around the chime of the drum. Allow the container to come to a complete stop from swinging. Clear all personnel and drop container.

4.3 Disposal of Tested Drums

All drums tested will not be contaminated with hazardous or radioactive wastes. Drums will be monitored by Radiation Protection Technician after tests. Report will be given to user to forward with trucking for sanitary landfill disposal.

5.0 Quality Assurance

5.1 Analysis of test results

Failure of a drop test will occur if contents have spilled out on to the ground or if contents of the drum is leaking. Visual inspection of drum after drop test shall show no signs of leakage for 15 minutes. Other modes of failure will be documented. All recommendations and findings will be forwarded to the appropriate personnel for evaluation and possible future testing to meet any regulator requirements for a shipping container.

6.0 Documentation

A lab notebook will be kept throughout the tests to record the results, calculations, observations, etc. Photographs will be taken to show results of the impact. At the conclusion of the tests, a final report will be issued with recommendations.

Appendix A
CHECK LIST OF EQUIPMENT

Date of Test _____ Location _____

NOTE ALL ADDITIONAL EQUIPMENT

- ___ Scale 0-1000 lbs.
Serial No. _____
Calibration _____
- ___ Torque wrench
- ___ Tape measure minimum 8 ft.
- ___ Scale 12 in. minimum
- ___ Thermometer -20°C to 100°C
- ___ Wire rope sling 16 ft. minimum
PMO date _____
- ___ Tripping device
PMO date _____
- ___ Plumb bob with 6 ft. of cord
- ___ Hoist & overhead rail or forktruck
PMO date _____
- ___ Steel drop plate
- ___ Barrier tape or rope

Check Performed by: _____ Witnessed by: _____

Appendix C

RECORD OF RESULTS

Date: _____ Location: _____ Time: _____ Temperature: _____

Assembly of container

Item	Description	Tested	Comments
1	Drum 17C 55 gallon plant standard SX-200		
	Weight (pounds)	_____	
	Lot No.	_____	
2	Hempelmann boot Dwg. 42027510-B		
	Weight (pounds)	_____	
3	Liner plant standard SX-_____		
	Weight (pounds)	_____	
4	Load type		
	Media	_____	
	Weight (pounds)	_____	
5	Inner lid European 200 liter		
	Weight (pounds)	_____	
6	Over lid		
	Weight (pounds)	_____	
7	Clamp ring		
	Weight (pounds)	_____	
	Torque (foot pounds)	_____	
8	Height above floor for drop test	_____	
9	Type of drop (chime or head)	_____	
10	Observations	_____	
11	Summary of damage		
12	Photograph numbers	_____	
13	Signatures		

Person performing test _____

Witness _____

Figure 15. Slightly after impact on container G02433.

Figure 16. Leakage after 15 minutes
on container G02433.

Figure 17. Overall exterior damage of container G02433.

Figure 18. Close-up view of damaged
chime area on container G02433.

Figure 19. Damage to 200-liter inner simple lid (container G02433).

rigging. It took several minutes to adjust the rigging to ensure the correct orientation upon impact. During this time the seal might have been leaking between the Hempelmann boot and the inner 200 liter lid. The damage to the inner 200 liter lid is also shown in figure 19.

Figures 20 and 21 show the deformation of the 55 gallon container at the point of impact. Figure 20 indicates some localized buckling of the containers side wall at this point. The deformation of the over lid in relation to the gasket suggest that the elastic limit of the lid was exceeded causing permanent deformation. There is no evidence of the gasket being cut or damaged due to compression by the inner 200 liter lid. The 200 liter lid seems to have sprung back to a position (figure 20) leaving a slight gap between the sealing surface and the lid. This most likely is the path of leakage.

Figure 21 shows the deformation of the 55 gallon container from inside. The bond between the gasket and the 55 gallon container did not fail. The deformation of the 55 gallon container was great enough to require additional force to remove the 200 liter inner simple lid. Even though the deformation around the area of impact is

significant it was not enough to cause any damage to the inner 30 gallon container. Figure 22 shows that the 30 gallon container remained undamaged.

Chime drop:

Figure 20. Closeup of damaged 200-liter lid, 55-gallon container, and Hempelmann boot (container G02433).

Figure 21. Closeup of the interior side of the 55-gallon container (container G02433).

Figure 22. Annulus area around
30-gallon container; 30-gallon
container untouched (container
G02433).

The third drop was a chime drop on container G02435. Total weight of the drum and contents was 607 pounds. The center of gravity was calculated based upon the contents of the inner drum. Rigging was placed onto the drum to ensure the orientation of the drum upon impact was in line with center of gravity. The drum was positioned four feet above a solid steel plate. The point of impact of the container was centered on the steel plate. Upon release of the test container, no rotation of the container was noted.

The photo series in figures 23, 24 and 25 show the third drop (chime) sequence. Figure 23 shows the rigging and container placement four feet above the drop point. Figure 24 shows the container in free fall. Figure 25 shows the container just after impact with the container rotating and continuing to fall to the ground. At impact there were signs of rupture of the outer container. Figures 26 and 27 show the water leakage from the container after 15 minutes. Of all the test containers this one had the most damage and leaked the most. The additional weight combined with the chime impact caused the container to deform to the point where the seal integrity of the 55 gallon container was compromised.

All components of the container were intact, but had some damage. Figure 28 shows the overall damage to the exterior of the 55 gallon container. The side wall of the container near the top chime collapsed near the point of impact. The point of impact was centered on the bolt and clamp ring. The clamp ring and tightening bolt were driven far enough onto the top chime to cause localized deformation (figure 28). There was also damage

Figure 23. Rigging setup for chime drop
on container G02435.

Figure 24. Free fall of container G02435.

Figure 25. Slightly after impact on container G02435.

Figure 26. Leakage after 15 minutes on container G02435.

Figure 27. Closeup of the leakage.

Figure 28. Exterior damage to the 55-gallon container (G02435).

to the side of the container where it came to rest after impact. The locating spider at the bottom of container caused deformation to the exterior 55 gallon container. This damage was not severe enough to puncture the outer container.

Figures 29 and 30 show close ups of the damaged area around the bolt and clamp ring on container G02435. The deformation of the over lid, clamp ring and container indicate that the container absorbed the impact well. The container side wall near the top chime seems to have deformed more than the over lid. This is due to the difference in gauge thickness between the inner lid and the 55 gallon container. The inner lid thickness is .085 inches and the drum is .059 inches. In figures 31 and 32 the over lid has been removed. The limited deformation of the inner 200 liter simple lid indicates that it returned to its original shape after impact. Again, the reason appears to be the difference in gauge thickness between the 200 liter simple lid and the container wall.

The gap between the inner 200 liter lid and the Hempelmann boot is about 1/4 inch. This gap was not enough to cause an open void between the inner lid and gasket. The gap was not in the radial direction, it was in the longitudinal direction. Since the 200 liter lid sits down into the Hempelmann boot by about 7/8 inch, it did not disengage from the container. The deformation of the 200 liter lid proved to be a path for the water to escape. This path could be a potential path for airborne particles to escape from the container during an actual accident. Water from inside the 55 gallon container did appear between the over lid and the inner 200 liter lid. Accumulation of water between the lids during the

Figure 29. Damage around chime area
on container G02435.

Figure 30. Damage around chime area on container G02435.

Figure 31. Damage to 200-liter lid
(G02435).

Figure 32. Damage to 200-liter lid
(G02435).

15 minute evaluation time was significant. The overall damage to the over lid and inner 200 liter lid for this drop was the worst for all containers tested.

Damage to the interior packing between the 55 gallon container and the 30 gallon container is shown in figure 33. The impact force sheared the packing material but did not cause any damage to the 30 gallon container. The top surface of the 30 gallon container (figure 34) was not displaced from the annular area. The 30 gallon container was not damaged.

BENEFITS

This container package has applications across plant site and site wide. The Microwave Solidification Project has tested the equipment that opens and closes the 55 gallon container. The tests showed that a 55 gallon container can be opened and closed in a glovebox environment with no measurable release of airborne particles (.3 microns) to the exterior work environment. This container would eliminate bag cuts and plastic waste generation caused during normal radiological operations. Radiation exposure to personnel could also be reduced by using this equipment and container. Additionally the container can be reopened and the contents evaluated at any time. Ideally, this container could possibly be reused many times for shipment of waste to approved handling facilities.

CONCLUSION

Figure 33. Damage to packing (G02435).

Figure 34. Undamaged 30-gallon container showing annulus area.

These preliminary drop tests showed that the container will safely contain the packaged contents. There were no visual signs of leakage of the packaged 30 gallon contents (ie.. vitrified microwave waste). This was based upon the criteria set up in the packaging design guide that states "no significant release," which implies no measurable leakage based on visual evaluation.

During testing the leakage of the added water demonstrated visual paths of leakage. The two chime drops resulted in water leakage after impact. The added water showed that a path for leakage is present and should be evaluated if the interior volume of the 55 gallon container is in question. This interior volume in practice will have no significant dispersible process waste. The 55 gallons interior volume should be evaluated based upon the process environment contamination control. Any leakage of this environment (dispersible solids and aerosols) allowed to accumulate onto the exterior 30 gallon container could cause dispersible contamination in the interior of the 55 gallon container. If the operating procedures for the equipment fail to provide a contamination free environment it could be necessary to evaluate leak rate sensitivity for the package during a drop test.

The exterior damage to the 55 gallon containers varied with the loading of the 30 gallon drum. With the limitation that the contents of the 55 gallon container be solids which are properly packed and braced, the container should meet the applicable drop test requirements in the regulations. The square edge insulation packing material will

probably not be used in the final configuration. A more suitable material with a higher crush strength will be used. The more energy absorbed by the packing material, the more efficiently the container will sustain an impact. No damage to the interior 30 gallon container occurred any of the drop tests.

RECOMMENDATIONS

The shipping container assembly has successfully passed preliminary evaluation for use with the Microwave Solidification Project. Formal review of the package by certified personnel can now begin. It is recommended that a docket be opened through the Traffic Department of Rocky Flats with Hanford, Washington for DOT testing of the container. After the container has been evaluated for use with the Microwave Solidification Project, the information can be shared for containers that will use bagless transfer technology at Rocky Flats and other DOE facilities.

Appendix A

741
107

1-KOM-200	1	SHIPPING CONTAINER ASSEMBLY
2-KOM-200	1	DRATH & SCHROEDER BUSH CO. 200 LITER SIMPLE LID
3-KOM-200	1	BUSSET "HOPPELMAN BUSH"
4-KOM-200	1	CLOSURE BOLT RING RPT STD ST-200
5-KOM-200	1	CLOSURE BOLT / LOCK MIT RPT STD ST-200
6-KOM-200	1	1 1/2" SPACER
7-KOM-200	1	1" SPACER
8-KOM-200	1	STANDARD FIB DOT 17C 55 GALLON DRUM RPT STD ST-200
9-KOM-200	1	SPIDER
10-KOM-200	1	CLOSURE BOLT RING 30 GALLON
11-KOM-200	1	CLOSURE BOLT / LOCK MIT
12-KOM-200	1	30 GALLON DOT DRUM
13-KOM-200	1	SPECIAL 17C OVER LID

JAS	
CHECK PRINT	
Technology Development	
CHECKED BY:	DATE:
J.A. SMITH 8-21-53	
J.A. SMITH 8-21-53	
BAGLESS POSTING SYSTEM	
SHIPPING CONTAINER	
42000-570	A

DETAIL A
FULL SCALE

DETAIL B
FULL SCALE

1 SHIPPING CONTAINER ASSEMBLY