U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 79-01

License No. 34-00639-01 Priority 4 Category E

Licensee: Ohmart Corporation
4241 Allendorf Drive
Cincinnati, OH 45209

Type of Licensee: Manufacturer and Distributor

Type of Inspection: Announced Special Inspection

Date of Inspection: November 6, 1979

Inspector: W. H. Schultz 12-12-79

Approved By: J. A. Pagliaro, Chief 12-12-79
Materials Radiological
Protection Section 2

Inspection Summary

Inspection on November 6, 1979 (Report No. 79-01)
Areas Inspected: The inspection was limited to a review of the methods used to package, survey and ship an Ohmart Model SHRH source holder containing a nominal 300 millicurie cesium-137 sealed source from a customers plant in Baltimore, Maryland to the Ohmart plant in Cincinnati, Ohio. The inspection involved 6 inspector-hours by one NRC inspector.
Results: No items of noncompliance were identified.

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DETAILS

1. Persons Contacted

This was an announced limited inspection which was conducted on November 6, 1979. Information in this report was furnished by the following personnel:

Paul Sieck, Vice President of Manufacturing, Ohmart
Frederick Dirling, Radiation Safety Officer, Ohmart
Robert Bailey, Repair Technician, Ohmart
Charles Kock, Group Leader, Ohmart
Paul Houillion, Plant Superintendent, Ohmart
Michael Gorman, Factory Representative, Ohmart
David Brisson, Maryland Department of Health
Charles Heilman, Amstar Sugar Company
Joseph Lasita, Terminal Manager, Branch Motor Express Company, Lockland, OH
James Chappell, Branch Motor Express, Milton, PA

2. Purpose of Inspection

On November 1, 1979, Frederick Dirling, Radiation Safety Officer, Ohmart Corporation contacted W. H. Schultz by telephone and reported that a wood crate containing an Ohmart Model SHRH source holder with a 300 millicurie cesium-137 sealed source was received at the Ohmart facility in Cincinnati, Ohio on October 31, 1979. At the time of receipt, Robert Bailey surveyed the crate and noted a maximum radiation level of 3,000 mR/hr at the surface. This measurement was verified by Charles Kock and Paul Houillion. Since this radiation level was in excess of the limit specified in 10 CFR 20.205(c)(2), the licensee notified the NRC Region III office by telephone and by mailgram. They also notified the final delivering carrier, Branch Motor Express. This limited inspection was conducted to review the circumstances of the packaging, surveying and shipment of the source holder from Baltimore, Maryland to Cincinnati, Ohio.

3. Scope of Inspection

During this inspection a number of individuals were interviewed and from their statements and observations made by the NRC inspector the following reconstruction of this event was made.

On October 9, 1979 an Ohmart Corporation Model SHRH source holder containing a nominal 300 millicurie cesium-137 sealed source malfunctioned and was removed from a process line by employees of the Amstar Sugar Company in Baltimore, Maryland, as authorized by their Maryland License. Although the Amstar personnel were able to remove

the source holder, all attempts to close the shutter were unsuccessful and therefore they contacted Ohmart Corporation in Cincinnati and requested that a field service representative come to Baltimore and take charge of the problem.

On October 13, 1979 Michael Gorman arrived at the Amstar Sugar Company to render assistance. It was determined that the shutter was in the open position and all attempts to close the shutter were unsuccessful. In addition, while attempting to close the shutter the actuating arm was broken off and it became necessary to package and ship the source holder back to the Ohmart factory in Cincinnati for repair or disposal.

The source holder was placed on a table in the carpenter shop of the Amstar Sugar Company and under the direction of Michael Gorman the Amstar personnel fabricated a shield made of many layers of lead sheet. The thickness of the lead sheet was about two inches when complete and extended around part of the perimeter of the source holder. The shield was made in two parts. The first shield, about one inch thick, extended about half way around the perimeter of the source holder and the second shield was also about one inch thick and extended about one quarter way around the perimeter of the source holder.

Amstar personnel then constructed a packing crate, according to Gorman's specifications. This crate had outside dimensions of about 12" x 12" x 36" and was constructed of 2" x 10" lumber with a top constructed of 3/4" plywood. The source holder together with the lead shields were placed in the packing crate and a direct reading survey was made with a Victoreen Thyac III survey meter which was the property of Amstar Sugar Company. The survey was made by Gorman with Amstar's meter because the Victoreen Thyac III which he had brought from Cincinnati was dropped at the airport and was inoperative. According to Gorman, he measured maximum radiation levels of 3 mR/hr at the surface of the packing crate when the source holder and the lead shields were in place. A sketch of the packing crate and a statement prepared by Gorman are attached to this report as Attachments A and B.

After the survey was completed the source holder and the lead shields were removed from the packing crate and placed on the bench. Amstar personnel then secured the lead to the source holder with two large stainless steel screw type hose clamps, placed them in the packing crate and secured the plywood cover with nails spaced about three inches apart. Gorman stated he could not recall if he made another survey of the packing crate after the shielding was secured to the source holder and the cover was in place. Gorman then returned to Cincinnati.

The crate remained on the bench in the carpenter shop for several days and on October 15, 1979, Heilman made an independent survey of

the crate and found a maximum radiation level of 4 mR/hr on the surface of the crate. This measurement was made with the Amstar Victoreen Thyac III survey meter.

Heilman stated that during the period October 13-17, 1979 the crate remained on the table in the carpenter shop but the potentially "hot" side was facing toward the alleyway and toward an unoccupied building which was loaded with sugar.

On October 17, 1979 the crate was moved to a locked storage area which was unoccupied and again the orientation was toward the alleyway. The crate remained in this locked storage area during the period October 17-26, 1979.

On October 26, 1979 at 5:30 p.m. the crate was picked up from Amstar by the local city truck of Branch Motor Express Company. The crate was loaded near the rear of the truck. The crate was taken to the terminal and was loaded into a trailer on the evening of the 26th. The trailer remained stored in an unoccupied lot during the period October 26-29, 1979.

On October 29, 1979 the trailer left Baltimore at 6:18 a.m. and proceeded to Milton, Pennsylvania. It arrived at Milton about 9:50 a.m. During the trip the crate was located at the middle of the trailer about 34 feet from the driver. From 9:50 a.m. until 4:30 p.m. the truck remained parked in an unoccupied area of the terminal at Milton. During the period from 4:30 p.m. until 5:35 p.m. the truck was unloaded and the cargo was transferred to another truck. The crate containing the source holder was transferred with a hand truck to the other vehicle.

At 5:35 p.m. on October 29, 1979 the Branch Motor Express truck left Milton, Pennsylvania for Cincinnati, Ohio. It arrived in Cincinnati at 4:30 a.m. on October 30, 1979. During the trip from Milton to Cincinnati the crate containing the source holder was near the rear of the trailer and was about 52 feet from the driver.

From 4:30 a.m. on October 30th to 5:45 a.m. on October 31st the truck was parked in an unoccupied area about 200 feet from a building. From 5:45 a.m. to 7:15 a.m. on October 31st the cargo was unloaded and the crate containing the source holder was loaded into a Branch Motor Express city truck. The truck left the Cincinnati terminal at 9:15 a.m. on October 31st and the crate containing the source holder was delivered to Ohmart at 10:30 a.m.

When the crate arrived at Ohmart, Robert Bailey made a survey and determined that the maximum radiation level at the surface of the crate was 3,000 mR/hr.

4. Independent Measurements

During the inspection W. H. Schultz made a number of independent measurements with a Victoreen Thyac III survey meter, NRC Serial No. 000710 which was calibrated on September 20, 1979. Most of the measurements were made with the lead shielding in place over the open shutter and not with the lead shielding in the position which existed when the crate arrived at Ohmart on October 31, 1979. A series of measurements showed the following results.

35 mR/hr at surface of lead shielding
0.7 mR/hr at surface on back side of source holder
2.0 mR/hr at 12 inches from surface of lead
1.2 mR/hr at 21 inches from surface of lead (this would be level found on the end of the crate at point most distant from source holder)

Additional measurements were made without the lead shielding in place. However, for these measurements the NRC representative used an Ohmart survey meter since the radiation levels were beyond the range of the Victoreen Thyac III survey meter. For the high level measurements an Eberline Model RO-2 (Serial No. 1751) was used. This instrument has a full scale range of 5R/hr. Houillion stated the survey meter was the one used for the receiving survey and the calibration was checked again on November 2, 1979 and was found to be in calibration.

The radiation level at 2 inches from the surface of the source holder, with no lead shielding and with the shutter open was 3,000 mR/hr. This is equivalent to the radiation level that would be found on the outside of the crate since the crate was approximately 2 inches thick. The radiation level at the surface of the source holder without lead shielding and with the shutter open was 5,000 mR/hr.

The lead shielding, the source holder and the hose clamp were examined in an attempt to determine if it was likely that the lead shielding could have shifted in transit. During shipment the lead shielding was secured with two hose clamps, however, during the inspection it was noted that only one hose clamp was in place. This was adequate to hold the shield in place while the source holder was stored in a restricted area at the Ohmart facility.

Each of the six Ohmart personnel who were interviewed during this inspection stated they could not see any way that the lead shielding could have shifted 180 degrees on the source holder and completely expose the open shutter. They stated the shipping crate was in good condition when it arrived and the source holder was well secured inside the crate when it was opened.

Paul Houillion stated that this method of shipment is typical of that used by Ohmart to return damaged or malfunctioning source holders to

the factory for repair or disposal. He stated that over the last ten years Ohmart received about 10 source holders each year and each was packed in a manner similar to the one that was received on October 31, 1979. In each instance the lead shielding remained in place and the sources remained shielded during transit to the Ohmart facility.

5. Estimated Exposure to Non Radiation Workers

After making a detailed analysis of the route of the crate containing the source holder from the time it left Amstar in Baltimore, Maryland until it arrived at Ohmart in Cincinnati, Ohio an estimate was made of the amount of exposure that might have been received by non-radiation workers. This evaluation included truck drivers, freight handlers, personnel in truck terminals and individuals who might be in the vicinity of one of the trucks that was carrying the crate containing the source holder. These estimates were based on known locations of the crate in the truck trailers as they moved across the highways. As a result of these estimates it appears that the maximum exposure that could have been received by a non-radiation worker was less than 20 millirem. Also, in most of the situations evaluated this exposure would be less 5 millirem.

6. Exit Interview

At the conclusion of this inspection a meeting was held with Messrs. Paul Sieck and Frederick Dirling to review the information gathered during this inspection and to attempt to reach a conclusion regarding the cause of this event. After considering all available information it appears that the most probable causes are as follows:

a. The radiation surveys that were made by Gorman on October 13, 1979 were made with the source holder in the packing crate and with the lead shielding placed in front of the open shutter. However, the stainless steel hose clamps had not yet been attached to the source holder to secure the lead shielding. After it was determined by Gorman that the lead shielding was adequate, the source holder and the lead shielding were lifted from the packing crate and placed on the bench in the carpenter shop where an Amstar employee then attached the two hose clamps. Because of the construction of the source holder and because the shutter actuating arm had been broken from the source holder it was not apparent where the shutter was located. Therefore, it is possible that when the source holder was lifted from the crate it was rotated 180 degrees and the lead shielding was inadvertently clamped on the side of the source holder that was opposite from the shutter. Also, Gorman stated he did not remember if he had made a survey of the source holder after the lead shielding had been secured with the hose clamps.

On October 15, 1979 Charles Heilman an Amstar employee made an independent survey with a Victoreen Thyac III survey meter after the hose clamps had been attached and after the crate had been nailed shut. He found a maximum radiation level of 4 mR/hr at the surface of the crate.

The NRC representative considered the possibility that the Amstar Victoreen Thyac III had saturated due to a high radiation field. Therefore, during the November 6, 1979 inspection the NRC representative attempted to duplicate the conditions that might have existed if the shutter had been unshielded. The Victoreen Thyac III survey meter was placed in the direct beam of the source holder in a field of approximately 5,000 mR/hr. However, the instrument did not saturate on any of the instrument scales. Instead the meter deflected to a full scale position and remained. Ohmart personnel stated that they had conducted the same test with their Victoreen Thyac III survey meter and their results were the same as those of the NRC representative.

b. The lead shielding was properly positioned in front of the open shutter and the hose clamps were securely attached. Sometime during transit the lead shielding shifted in such a manner that by the time the crate arrived at the Ohmart facility the lead shielding had shifted a full 180 degrees and the shutter was completely exposed resulting in a radiation level of 3,000 mR/hr at the surface of the packing crate.

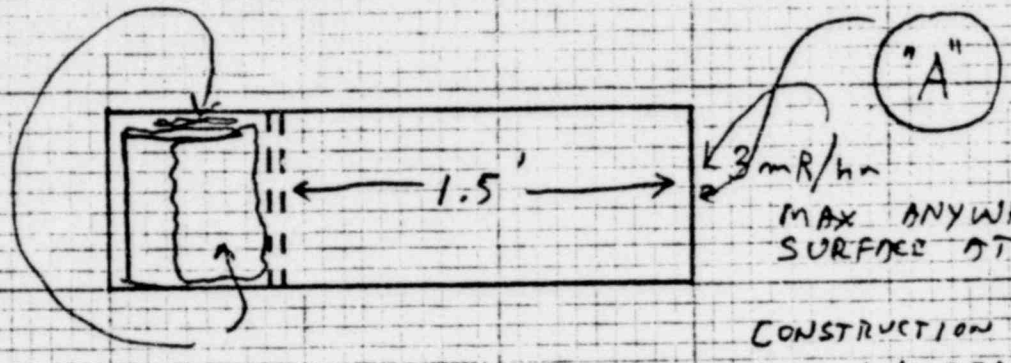
Paul Houillion, Ohmart Plant Superintendent, stated that over the past 10 years about 100 source holders of various shapes and sizes had been returned to Ohmart with the shutters in an open position. In each instance similar lead shielding had been fabricated in the field and had been secured with hose clamps or equivalent. He stated that none of the lead shields had shifted previously and exposed the open shutter.

After reviewing these two possibilities, it is not possible to determine that one has more merit than the other.

Messrs. Sieck and Dirling were informed that the inspection findings would be reviewed and that this information might be made available to other regulatory agencies.

After reviewing all information that was gathered during this inspection it was determined that no items of noncompliance with NRC regulations had occurred.

Attachment: Attachments A and B



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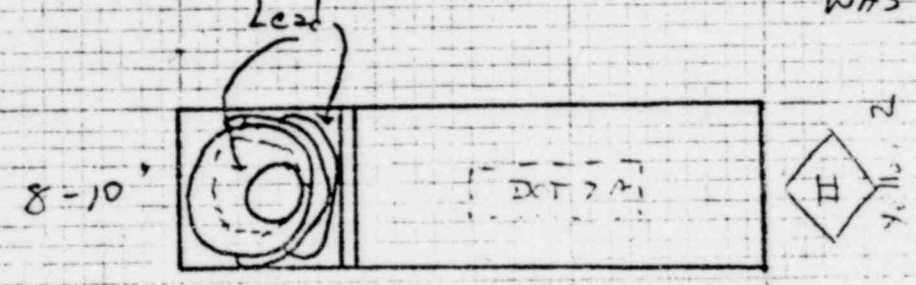

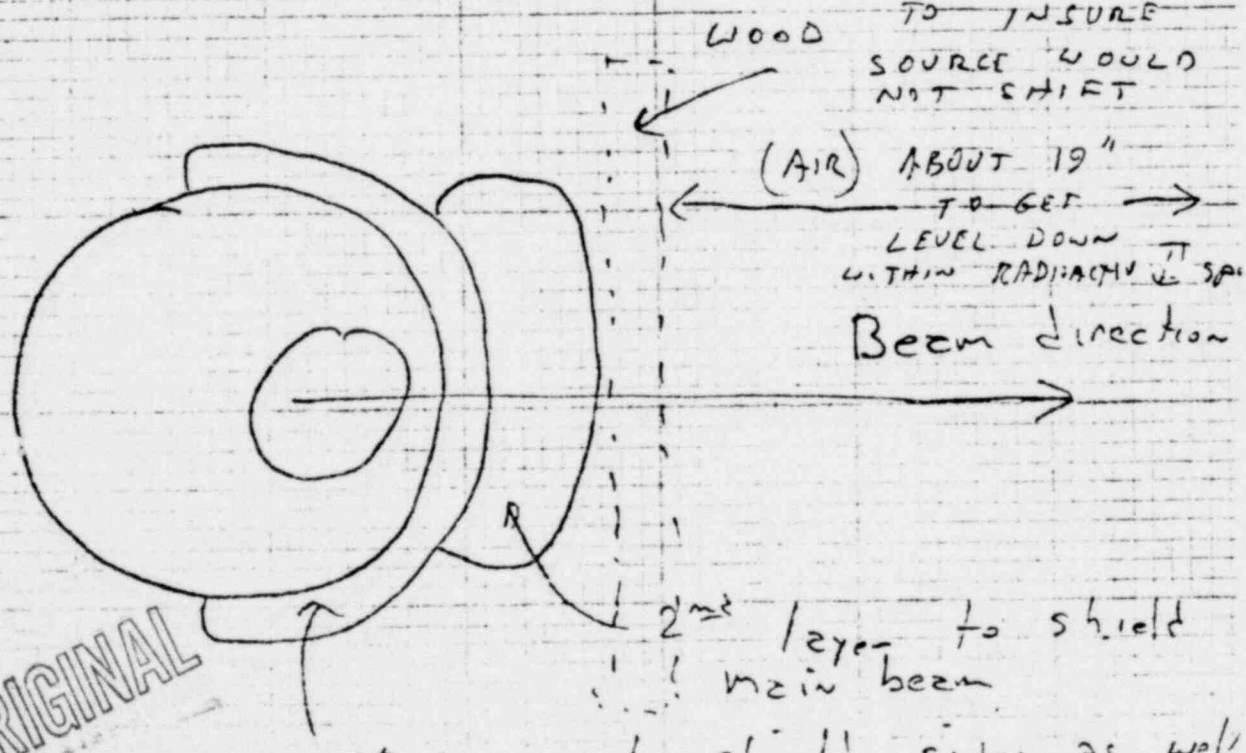

POOR ORIGINAL

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ATTACHMENT "A"

Ca #4

ohmart Cincinnati, Ohio

INTEROFFICE CORRESPONDENCE

To Fred Dirling **From** Mike Gorman

Reply yours **Date** November 5, 1979

Copies to Ken Roth

File

Subject AMSTAR SUGAR - BALTIMORE, MARYLAND

This 300 mCi Cs-137 source had a shutter frozen in the open position.

It was shielded and packed by myself on Saturday, October 13, 1979. The survey meter used was a Victoreen Thyrac III, belonging to the customer. Mine did not function - mine was dropped at the airport.

Because of the high field strength, extra lead had to be obtained to shield it. The thickness was not calculated, but obtained by adding lead until the field strength was down. Five people were present at this time: Frank Wayburg, Wilbur Belt, Bob Fillins, Donald Peregoy and myself. A crate was constructed including internal supports for the source holder. Once shielded, the source was placed in the box and the box surveyed. I found less than 3 MR/HR to be the highest level on the surface of the box, near the point labeled "A" on the attached diagram. The box was then sealed. I tagged it and left that evening.

The box was surveyed on Monday, October 15, 1979 by Amstar employee Chuck Hilman who was concerned about his personnel. He found a spot that had 4 MR/HR right next to the Radioactive II label. From my conversation with Mr. Hilman, I believe this to also be the point "A" referenced above. That was the highest field strength he found. The same meter that I used was used to take this survey.

Two days later, the box was moved to set it out of the way. Four or five days later it was moved to an adjacent building from where it was shipped.

The box was not opened by Amstar employees at any time according to Mr. Hilman.

As you know, it showed up on our door step with the shielding still firmly attached, but 180 degrees away from the shutter, allowing a 3000 MR/HR beam to exist. I have no explanation. These are the facts.

2227 288

Mike Gorman
Mike Gorman

MG/jt
Attachment

ATTACHMENT "B"