**Norfolk Southern Boxcar Blocking/Bracing Plan for the
Mixed Waste Disposal Initiative Project**

R. S. Seigler

**Environmental Restoration Program
P.O. Box 2003
Oak Ridge, Tennessee 37831-7298**

Date Issued—January 1994

**Prepared by
Central Engineering Services
K-25 Maintenance Division
Oak Ridge K-25 Site**

**Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste
Management
under budget and reporting code EW 20**

**MARTIN MARIETTA ENERGY SYSTEMS, INC.
managing the**

**Oak Ridge K-25 Site
Oak Ridge Y-12 Plant
Oak Ridge National Laboratory
under contract DE-AC05-84OR21400**

**Paducah Gaseous Diffusion Plant
Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-76OR00001**

**for the
U.S. DEPARTMENT OF ENERGY**

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

CONTENTS

FIGURES	v
ACRONYMS	vii
1. INTRODUCTION	1
2. RAILROAD RULES AND REGULATIONS	5
2.1 GENERAL	5
2.2 SELECTION OF BOXCAR	5
2.3 DOORWAY PROTECTION	5
3. DRUM LOADING	5
3.1 GENERAL	5
3.2 HEAVY LOADING	9
3.3 DRUMS	9
4. BRACING AND ANCHORING	9
4.1 GENERAL	9
4.2 LUMBER	9
4.3 NAILING	9
4.4 TOOLS	12
4.5 ANCHORED LOAD METHOD	12
4.5.1 Flat Metal Bands	12
4.5.2 Anchored Plates	12
4.5.3 Heavily Loaded Containers	12
APPENDIX A	15
APPENDIX B	16
APPENDIX C	17

FIGURES

1	Polyethylene railcar floor liner.	2
2	Lined boxcars with prefabricated, white, 15 mm low-density polyethylene liner material.	3
3	Plywood panels nailed to boxcar floors.	4
4	Protected boxcar doorway.	6
5	Loaded metal boxcars. (loaded on end and tightly configured).	7
6	Loading sequence.	8
7	All metal boxcar with nailable metal floor.	10
8	Detail of metal floor	11
9	Drums in metal boxcar	13
10	Elevation view of all metal boxcar	14

ACRONYMS

DOE
LDPE
MWDI

U.S. Department of Energy
low-density polyethylene
Mixed Waste Disposal Initiative

1. INTRODUCTION

The U.S. Department of Energy's (DOE) Environmental Restoration and Waste Management programs will dispose of mixed waste no longer deemed useful. This project is one of the initial activities used to help meet this goal. The project will transport the ~46,000 drums of existing stabilized mixed waste located at the Oak Ridge K-25 Site and presently stored in the K-31 and K-33 buildings to an off-site commercially licensed and permitted mixed waste disposal facility.

Shipping and disposal of all ~46,000 pond waste drums (~1,000,000 ft³ or 55,000 tons) is scheduled to occur over a period of ~5-10 years. The first shipment of stabilized pond waste should transpire some time during the second quarter of FY 1994.

Martin Marietta Energy Systems, Inc., proposes to line each of the Norfolk Southern boxcars with a prefabricated, white, 15-mm low-density polyethylene (LDPE) liner material (Fig. 1 and Fig. 2). To avoid damaging the bottom of the polyethylene floor liner, a minimum .5 in. plywood (Fig. 3) will be nailed to the boxcars' nailable metal floor. At the end of the Mixed Waste Disposal Initiative (MWDI) Project, workers at the Envirocare facility will dismantle and dispose of all the polyethylene liner and plywood materials.

Envirocare of Utah, Inc., located in Clive, Utah, will perform a health physic survey and chemically and radiologically decontaminate, if necessary, each of the rail boxcars prior to them being released back to Energy Systems. Energy Systems will also perform a health physic survey and chemically and radiologically decontaminate, if necessary, each of the rail boxcars prior to them being released back to Norfolk Southern Railroad.

POLYETHYLENE RAILCAR FLOOR LINER

Fig. 1. Polyethylene railcar floor liner.

MIXED WASTE DISPOSAL INITIATIVE PROJECT

* DRAWING NOT TO SCALE

Fig. 2. Lined boxcars with prefabricated, white, 15 mm low-density polyethylene liner material.

Fig. 3. Plywood panels nailed to boxcar floors.

2. RAILROAD RULES AND REGULATIONS

2.1 GENERAL

The shipper (herein referred to as Energy Systems) must observe the carrier's (herein referred to as Norfolk Southern Railroad) rules regulating the safe loading of freight (cargo) and protection of equipment. Blocking and bracing is required for the safe transport of these 1400-lb solid waste drums. Stacking the 1400-lb drums will not be allowed.

2.2 SELECTION OF BOXCAR

Boxcars selected by Norfolk Southern Railroad for loading will be clean and have sound floors, roofs, side and end walls, and be free of protruding nails or other projections that might cause damage to the contents.

2.3 DOORWAY PROTECTION

If the cargo extends into or through the 10-ft doorway area or the contents have the potential to move into the doorway area during transport, the boxcar doorways must be protected, as shown in Fig. 4 (see Appendix A, *Association of American Railroads, Circular No. 42-H*).

3. DRUM LOADING

3.1 GENERAL

All boxcars should be loaded on end and should be tightly configured (Figs. 4 and 5). Start the load against the steel side wall, being sure to properly space the containers across the car so that straight crosswise rows will be obtained. When loading using the rigid braced method, the containers at each end of the first row across the car should be placed in the corners of the boxcar touching both the end wall and side wall with remaining metal drums in this row to be equally spaced along end wall. Nest the second crosswise row of containers in the valleys formed by the containers in the first crosswise row and continue to load alternate rows in this manner (Fig. 6). The K-25 Waste Management Division has prepared an operating procedure, WMD-OP-2029, Rev. 0, "*Transportation and disposal of stabilized pond waste drums in building K-31/33*" for this project.

Fig. 4. Protected boxcar doorway.

Fig. 5. Loaded metal boxcars. (loaded on end and tightly configured).

Fig. 6. Loading sequence.

3.2 HEAVY LOADING

Heavily loaded containers (1400 lbs each) in a rigid braced load, must be segregated into multiple units in each end of the boxcar to distribute the weight and pressure of the load against the divisional and doorway area bracing. Each unit of each layer must be separately braced in position (Fig. 5).

3.3 DRUMS

Bilge protection is not necessary when loading metal drums. Drums should be loaded in nested crosswise rows as explained in Sect. 3.1.

4. BRACING AND ANCHORING

4.1 GENERAL

A tight compact load is essential in loading drums, and each container should be blocked and braced within the boxcar by adjacent containers or by properly applied bracing to prevent movement or dislodgement due to dynamic impact [see Appendix B, (*Pamphlet No. 4, Recommended Methods for The Safe Loading of Barrels, Drums or Kegs in Closed Cars and Protection of Equipment*) revised November 1965].

4.2 LUMBER

All lumber used for blocking and bracing must be made of sound material, free from cross-grain, knots, knotholes, checks or splits, which impair its strength or interferes with proper nailing. Only the clearest lumber should be used for cross car braces and diagonals. The only area in the boxcar (boxcar series selected by Norfolk Southern Railroad) that can be nailed is the nailable metal floor (Figs. 7 and 8.)

4.3 NAILING

Common nails are recommended for use in the construction and assembly of blocking and bracing and the securing of the same within the boxcar. Nails should be long enough to develop the necessary holding power through ample penetration into the boxcars' walls, posts, floors, and other blocking and bracing members. A sufficient number of nails should be used because strength increases directly with the number of nails used. Nails should be driven straight and not toe nailed. The location of nails should be staggered to avoid splitting the lumber material.

Fig. 7. All metal boxcar with nailable metal floor.

ALL METAL BOXCAR (details)

DETAIL A
ANCHORING DEVICE
14 PER CAR POST

SECTION B-B
NAILABLE METAL FLOOR

* DRAWING NOT TO SCALE

Fig. 8. Detail of metal floor.

4.4 TOOLS

To accomplish the task of blocking/bracing the individual 1400-lb stabilized pond waste drums inside the Norfolk Southern Railroad boxcar, certain tools must be used. Those tools include (1) portable coils of 2 in. $\times$ 0.044 in. $\times$ 300 ft steel strapping (Fig. 9), (2) heavy-duty boxcar loading steel strapping dispenser with rubber tires, (3) manual heavy-duty windlass steel tensioner, (4) heavy-duty manual steel crimp sealer, and (5) thread-on double crimp joint sealers.

4.5 ANCHORED LOAD METHOD

4.5.1 Flat Metal Bands

In the anchored load, metal ties in the form of flat bands are used for securing gates and lading within the car in lieu of wood bracing. Flat metal bands must not be less than 1 1/4 in. $\times$ 0.0035 in. with a load strength of 4000 lbs per metal tie. Flat metal bands $\sim$ 2 in. $\times$ 0.044 in. with a breaking strength of 10,600 lbs (Fig. 9) is recommended by Norfolk Southern Railroad [Appendix C, (*letter from David Bandy, Norfolk Southern to Robert Seigler, Martin Marietta*)].

4.5.2 Anchored Plates

Flat metal ties must be properly threaded through anchor plates (Figs. 9 and 10), and metal stays must be used to keep the ties in proper position at the quarter hoops of the drums. The anchors must be located a minimum of 3 ft back from the front face of the load. After the loading is completed, the metal ties must be properly tensioned and sealed with the proper tools. It is desirable to tension the ties for each layer at the same time in order to obtain uniform tension. The application of the anchored load to containers in one end of a boxcar is illustrated in Fig. 5.

4.5.3 Heavily Loaded Containers

Heavily loaded containers must be separately braced in units and the units secured in both directions as illustrated in Fig. 6. A unit consist of fourteen 1400-lb drums clustered together. Note the units are spaced apart and do not contact each other.

Fig. 9. Drums in metal boxcar.

APPENDIX A

A-3

CIRCULAR NO. 42-H

(Supersedes Circular No. 42-G)

ASSOCIATION OF AMERICAN RAILROADS

Operations and Maintenance Department
TRANSPORTATION DIVISION

American Railroads Building
50 F Street N.W.
Washington, D.C. 20001

A. W. Johnston, Vice President
Operations and Maintenance Department

OFFICERS OF DIVISION
J. A. Zito, Chairman
P. H. Croft, Jr. Vice Chairman
J. J. Robinson, Senior Ass't Vice President

September 1, 1986

GENERAL RULES
COVERING LOADING OF CARLOAD
SHIPMENTS OF COMMODITIES
IN CLOSED CARS

To the Members:

The "General Rules" quoted in Circular No. 42-G, dated June 1, 1981, have been revised as shown herein.

These "General Rules" MUST be observed for all closed car loading and take precedence over the "Loading Methods" referred to, or included, in the loading publications listed on Pages 15 & 16 or subsequently issued. Those publications contain detailed methods for loading specific commodities.

On behalf of the General Committee.

Respectfully,
J. J. Robinson
Senior Ass't Vice President

GENERAL RULES - CLOSED CARS

- (E) The threads on rods or bolts used as bracing or blocking, or in connection therewith, must be chisel checked immediately behind single or double nuts to insure nuts remaining in original position. Two or more threads must extend beyond nuts. Not required when nut lock or lock nuts are used and properly seated and torqued to manufacturer's recommended minimum ft.-lb. value.
NOTE: Lock washers are not acceptable substitutes.
- (F) High-tension bands or wires securing the load must be machine tensioned and sealed or twist tied, respectively.
- (G) Metal protectors, such as corner guards or plates, sufficient to provide a suitable radius must be used to protect bands and wires at all points on lading having sharp edges. Apply so as to prevent displacement.
- (H) The manner of attaching metal ties to car walls must be in accordance with the methods prescribed for the individual commodities reducing to a minimum the possibility of anchor plates pulling loose or metal ties shearing.
- (I) Where high-tension bands or high-tension wires are specified in the detailed rules, they may be substituted for each other, if of equal load strength, provided all the other items used to secure the load are equal in number and strength.
- (J) Unless otherwise specified in the loading pamphlets, the number of bands or wire for rigid braced loads must have the combined joint strength in each longitudinal impact direction equal the weight of the lading being secured.
- (K) The proper combination of steel bands or wire, seals and sealing tools must be used to provide the minimum joint strength for sizes listed below.

Width & Thickness Inches	Width & Thickness Millimeters	Minimum Breaking Strength- Pounds	Minimum Joint Strength- Pounds	Recommended Minimum No. of Pairs of Notches On Joint	Recommended Minimum No. of Pairs of Crips on Joint		
Securement Bands				Surface Finish All Types	Surface finish		
					Uncoated- Dry	Coated- Not Waxed	Waxed
1 1/4 x .031	32 x .75	4750	3565	2	3	3	4
1 1/4 x .035		4750	3565	2	3	3	4
1 1/4 x .044		6750	5065	4	4	4	4
1 1/4 x .050		6750	5065	4	4	4	4
					Std. Grit	Std. Grit	Std. Grit
* 2 x .044		10600	7950	4	4 4	4 4	6 4
2 x .050		10600	7950	4	4 4	4 4	6 4
2 x .065		13800	10350	4	4 4	4 4	6 4

* recommended by Norfolk Southern Railroad. Reference Letters in Appendix C.

GENERAL RULES - CLOSED CARS

Note - A sufficient number of seals must be applied to accommodate the recommended number of pairs of notches or crimps.

The above recommended minimum number of notches or crimps is based on current general recommendations of high-tension banding manufacturers on the basis of tensioning and sealing tools being in proper operating condition. A lesser number of notches or crimps may be used provided the shipper can demonstrate that the joint has the minimum strength shown in the table under column "Minimum Joint Strength - Pounds".

The following seals are acceptable with three (3) crimps or notches on 2 in. X .044 in. and 2 in. X .050 in. Uncoated-Dry-Not-Waxed, high tension bands.

Company	Seal No.
Signode	203
Acme	1656 L
Stanley	473-32

In all cases, a sufficient number of notches or crimps must be used to achieve the minimum joint strength - pounds, as shown in the column headed "Minimum Joint Strength - Pounds".

Users of tensioning and sealing equipment should be properly instructed in the correct use of these tools and tools should be checked periodically to ensure their efficiency.

Following are illustrations of crimp and notch types of seal joints:

**CRIMP-TYPE JOINT
THREE PAIR SHOWN**

**NOTCH-TYPE JOINT
TWO PAIR SHOWN**

GENERAL RULES - CLOSED CARS

High-tension band sizes 1 1/4" and 2" used for load securements are to be marked to indicate manufacturer's or suppliers's name and the letters "AAR".

Markings shall consist of the letters "AAR", the manufacturer's or distributor's name, or abbreviated name, or registered trademark, or symbol, or AAR code consisting of two digits. Markings shall be in characters not less than 1/8" high for steel die imprint and not less than 1/4" high for paint, ink surface printing or embossing, spaced at not more than 5 foot intervals.

Markings applied to high tension bands manufactured to metric dimensions must be followed by the letter "M" of the same size as the original marking.

The following methods of marking for purpose of identification have been assigned to manufacturers and suppliers whose products have been tested by the AAR and found to meet the requirements of this Rule.

Name	Method of Marking	Markings
Acme Steel Company of Canada, Ltd.	Ink Print	AAR 22
American Banding Corporation	Ink Print	AAR 24
Brainard Strapping Division, Sharon Steel Corporation	Ink Print	AAR 26
Delta Strapping Industries	Ink Print	AAR 27
A. J. Gerrard & Company	Steel Die Imprint	AAR 28
Gibraltar Steel Corporation	Steel Die Imprint	AAR 29
Gibraltar Steel Corporation	Ink Print	AAR 29
Interlake, Incorporated	Steel Die Imprint	AAR 30
Pacific Steel & Supply	Ink Print	AAR 32
Samuel Strapping System, Ltd.	Ink Print	AAR 33
Signode Corporation	Paint Emboss	AAR* 34
Signode Corporation	Paint Emboss	AAR 11
Signode Canada, Ltd.	Ink Print	AAR 35
Stanley Strapping Systems, Div. of The Stanley Works	Ink Print	AAR 36
Stanley Strapping Systems, Div. of The Stanley Works	Steel Die Imprint	AAR 36
Stanley Strapping Systems, Div. of The Stanley Works, Ltd.	Ink Print	AAR 37
Steel Distributors, Ltd.	Ink Print	AAR 45
U. S. Steel Corporation, Cuyahoga Works	Paint Emboss	AAR 39
United States Steel Supply Division	Steel Die Imprint	AAR 42
Kasle Steel Corporation	Paint Emboss	AAR 43
Unimart, Incorporated	Paint Emboss	AAR 44
Kohan Kogyo Company, Ltd.	Ink Print	AAR 46
Concept Metals, Ltd.	Ink Print	AAR 46
Samual Strapping Systems, Inc.	Ink Print	AAR 47
Independent Metal Strap Co. Inc.	Steel Die Imprint	AAR 48
Milspec Industries, Inc.	Paint Emboss	AAR 49
Cyklops Canada Ltd.	Ink Print	AAR 50

*Reg. Signode Trademark.

IMPORTANT - High-tension bands must be applied to packages and/or loads with markings facing outward.

APPENDIX B

PAMPHLET NO. 4

LIST OF LOADING PAMPHLETS-CLOSED CARS
(Bracketed date indicates latest issue)

No.	Title
2	Wheeled Vehicles (April 1949)
3	Bags-Commodities In (Nov. 1964)
4	Barrels, Drums or Kegs (Nov. 1965)
8	Plywood in Closed Cars (Sept. 1969)
9	Cable & Similar Commodities on Reels (Oct. 1948)
12	Cylinders-Empty, With or Without Caps (June 1945)
14	Freight-Loading, Bracing & Blocking Of (Dec. 1963)
15	Furniture-Carload (Jan. 1963)*
16	Furniture-Less Carload (Jan. 1963)*
18	Cylindrical Steel Containers (Small)-Commodities & Mixed Loads in Larger Steel Drums (Oct. 1963)*
20	Lumber (Dressed) & Mill Work (Jan. 1963)*
21	Machinery (April 1967)
23	Sheet Steel and Tin Plate (Jan. 1970)
25	Paper & Similar Commodities on Skids (Jan. 1963)*
26	Gypsum, Plasterboard, Lath & Plaster (April 1963)
27	Empty Projectiles, Bombs & Cartridge Cases (Jan. 1963)*
34	Tank Cars Transporting Non-Dangerous Commodities (Nov. 1965)
38	Unsaturated Roofing Felt (Nov. 1965)
40	Vitrified Clay Sewer Pipe (Jan. 1963)*
41	Dictionary of Standard Terms-Commodities in Closed Cars (Dec. 1961)
42	Glass, Rolled & Plate (Nov. 1965)
42-D	General Rules-Covering Loading of Carload Shipments of Commodities in Closed Cars (June 1967)

*—Reprinted

FOR COPIES ADDRESS
FREIGHT LOADING AND CONTAINER SECTION
ASSOCIATION OF AMERICAN RAILROADS
59 E. VAN BUREN STREET
CHICAGO, ILL. 60605

Recommended Methods
For
The Safe Loading
Of
Barrels, Drums or Kegs
In
Closed Cars
And
Protection of Equipment

B-3

REVISED NOVEMBER 1965

ISSUED BY
ASSOCIATION OF AMERICAN RAILROADS
Operations and Maintenance Department

FREIGHT LOADING & CONTAINER SECTION

59 East Van Buren Street
CHICAGO, ILL. 60605

RECOMMENDED METHODS FOR THE SAFE LOADING OF CARLOAD SHIPMENTS OF BARRELS, DRUMS OR KEGS IN CLOSED CARS AND PROTECTION OF EQUIPMENT

GENERAL RULES

The "General Rules" as contained in Circular No. 42C, or supplements thereto, issued by the Operating - Transportation Division, Association of American Railroads, which have been formulated for the purpose of fixing safe methods of loading in closed cars, must be observed.

A—GENERAL

A-1—Shippers must observe Carrier's rules regulating the safe loading of freight and protection of equipment. (See Rule 27, Section 3, Uniform Freight Classification.) (In Canada, See Rule 30, Canadian Freight Classification.)

Selection of Car

A-2—Cars selected for loading should be clean and have sound floors, roofs, side and end walls, and be free from protruding nails or other projections which might cause damage to the contents.

Doorway Protection

A-3—When the load extends into or through the doorway area, or the contents may move into the doorway area, the doorways must be protected, as shown herein.

Containers

A-4—The use of good sound containers is important. Carefully examine and reexamine containers before loading if any evidence of leakage is detected. (See current issue of Uniform Freight Classification Rule 40.) For explosives and other dangerous articles, see current issues of I.C.C. Regulations, Agent T. C. George's Freight Tariff No. 15 or Board of Transport Commissioners for Canada Regulations for Transportation of Explosives and Other Dangerous Articles.

B—LOADING

B-1—**Tight Cooperage.** Ends of cars used for loading of liquids and semi-liquids, such as molasses, paints, syrups, vinegar, pickles, lard, etc., in tightly coopered barrels or kegs, must be prepared with bilge protection, as shown in Illustration No. 1, except when the floating unit method is used and other means of bilge protection are provided as described in paragraphs C-16 and C-17. The application of this material prevents contact of the weakest part of the barrel; namely, the bilge, with the car end wall, and places such contact above and below the bilge where greater strength in the barrel is present and also provides two points of contact instead of one.

B-2—**Load all barrels, tierces and kegs on end.** Tight loading is necessary. Start the load against the bilge protection, being sure to properly space the containers across the car so that straight crosswise rows will be obtained. When loading by the rigid braced method, the containers at each end of the first row across the car should be placed in the corners of the car touching both the end wall bilge protection and side walls with remaining containers in this row to be equally spaced along end wall. Nest the second crosswise row of containers in the valleys formed by the containers in the first crosswise row and continue to load alternate rows in this manner, see Illustration No. 2. As the bung stave is the weakest stave in a barrel or keg, the containers must be so loaded that the bung stave will not be in contact with adjacent barrels, kegs, wall of car, bracing or blocking members.

B-3—**Heavily loaded containers in a rigid braced load, must be segregated into multiple units in each end of the car, to distribute the weight and pressure of the load against the divisional and doorway area bracing.** Each unit of each layer must be separately braced in position, see Illustrations Nos. 3 and 8.

B-4—**Fillers of not less than one inch thick material must be placed lengthwise of the car on top of floor layer when a second layer of containers is to be loaded.** Similar fillers must be used between subsequent layers, see Illustrations Nos. 4, 7 and 8. Crosswise end cleats must be nailed to the ends of the filler boards to keep them in line. Bilge protection, as shown in Illustrations Nos. 1, 8 and 15 must be affixed to end walls to protect the containers in each layer.

B-5—**Slack Cooperage.** Barrels and kegs containing such commodities as flour, salt, soda ash, sugar, etc., must be loaded in units in the same manner prescribed for tight cooperage and as shown in Illustrations Nos. 3, 7 and 8. Fillers between layers, as shown in Illustrations Nos. 4, 7 and 8 must be used when loading more than one layer.

B-6—**Drums.** Bilge protection is not necessary when loading metal drums. Drums should be loaded in nested crosswise rows, as shown in Illustrations Nos. 5 and 6.

C—BRACING AND BLOCKING

C-1—A tight compact load is essential in the loading of barrels, drums and kegs and each container should be braced and blocked within the car by adjacent containers or by properly applied bracing to prevent movement or dislodgement.

Lumber

C-2—All lumber used for bracing and blocking must be of sound material, free from cross-grain, knots, knotholes, checks or splits, which impair its strength, or interferes with proper nailing. Always select the clearest lumber for cross car braces and diagonals.

Nailing

C-3—Common nails are recommended for use in the construction and assembly of blocking and bracing, and the securing of same within the car. Nails should be of such a length as to develop the necessary holding power through ample penetration into car walls, car posts, floors, and other bracing and blocking members. Sufficient nails should be used as the strength increases directly with the number of nails used. Drive nails straight, do not "toenail." Stagger the location of the nails to avoid splitting of material.

Wood Braced Method

C-4—Tight or Slack Cooperage. Lading should be braced against movement or dislodgement within the car by use of cross car braces and gates as shown in Illustrations Nos. 3, 9 and 11.

C-5—Drums. Brace and block as specified for tight and slack cooperage. Single trip or light gauge containers easily damaged by contact with cross car bracing must be protected by application of vertical buffer strips of 1 x 6 inch material between the containers and cross car bracing, as shown in Illustration No. 5.

C-6—Drums with rolling hoops must be loaded with hoops against sides of adjacent drums and not hoops against hoops. Crosswise fillers used under alternate crosswise rows will provide such contact, see Illustrations Nos. 18-20.

C-7—Heavy gauge, heavy-duty metal drums loaded in one layer only may be blocked and braced as shown in Illustration No. 6.

C-8—Cross Car Bracing. Crosspieces used in gates should be placed with narrow face against gate verticals for maximum strength, see Illustration No. 5.

C-9—Backup, Hold-Down and Pocket Cleats. All cross car braces or gates should be secured to the car walls or doorway protection with cleats, as shown in Illustrations Nos. 3, 5, 9, 10 and 11.

C-10—Reinforcing Cross Car Braces. Cross car bracing can be reinforced with diagonal members which extend to the car walls and form a "K" brace, see Illustrations Nos. 10 and 11. Where the load extends into the doorway area, the cross braces should be applied as shown in Illustration No. 9.

C-11—Partial Layers. Partial layers should be blocked and braced securely in place with a "K" brace, as shown in Illustration No. 10.

Anchored Load Method

C-12—In the anchored load, metal ties in the form of flat bands

are used for securing gates and lading within the car in lieu of wood bracing. Flat metal bands must be not less than $1\frac{1}{4}$ x 0.035 inch with a load strength of 4,000 pounds per tie. The containers are loaded and bilge protection applied as described in paragraphs B-1 and B-2.

C-13—The flat metal ties must be properly threaded through anchor plates, see Illustration No. 12, after which the anchor plates must be securely nailed to the car post in the car wall as shown in Illustration No. 13. Illustration No. 14 shows the preparation of a car for the anchored load. Metal or wood stays must be used to keep the ties in proper position at the quarter hoops.

C-14—The anchors must be located a minimum of 3 feet back from the front face of the load. After the loading is completed, the metal ties must be properly tensioned and sealed with the proper tools for this purpose. It is desirable to tension the ties for each layer at the same time in order to obtain uniform tension. The application of the anchored load to containers in one end of a car is shown in Illustrations Nos. 15 and 16.

C-15—Heavily loaded containers must be separately braced in units and the units secured in both directions as shown in Illustration No. 16. Note the units are spaced apart and do not contact each other.

Floating Load Method

C-16—Metal ties are temporarily draped on car sides and end walls prior to loading, as shown in Illustration No. 17. Ties must be spaced so that they will contact barrels above and below the bilge at the quarter hoops and be held in that position with wood or metal stays. A sufficient number of stays must be used to insure that the metal ties will not drop out of position, thereby causing a loose load. Flat metal ties must be not less than $\frac{3}{4}$ x 0.035 inch, with a load strength per band of not less than 2,500 pounds.

C-17—Load must be started 18 inches or more away from the end wall according to the number of barrels to be loaded and the floor space required. The barrels are stowed in a nested formation and on completion of loading, the metal ties must be drawn around unit in each end of the car and tensioned and sealed with proper tools, see Illustrations Nos. 7 and 19. It is desirable to tension the ties for each unit at the same time in order to obtain uniform tension. Fillers with cross cleats at each end must be placed between all layers. Ends of upper layer must be in from the ends of lower layer a distance of $1\frac{1}{2}$ barrels or drums. Under no condition should second or subsequent layers be rigidly braced when the floor layer is tied as a floating load. Bilge protection must be used in this method of loading and is applied in the form of gates located at each end of the unit. The horizontal members of the gates contact the barrels at points approximately 6 inches from the chimes and are held in position by two vertical members placed in the voids between the barrels, as shown in Illustrations Nos. 7, 17 and 19.

C-18—Drums with rolling hoops must be loaded as shown in Illustration No. 19 which shows tight contact of containers obtained through the use of lengthwise fillers and tied in units as described in Paragraph C-16.

C-19—Equipped cars should be loaded as in Illustrations Nos. 8 and 20.

ILLUSTRATION NO. 1.
APPLICATION OF BILGE PROTECTION

ILLUSTRATION NO. 2.
NESTING OF CROSSWISE ROWS

ILLUSTRATION NO. 3.
BRACING OF UNITS—
HEAVILY LOADED CONTAINERS

ILLUSTRATION NO. 4.
FILLERS BETWEEN LAYERS—RIGID BRACED LOAD

ILLUSTRATION NO. 5.
WOOD BRACING OF LIGHT GAUGE
STRAIGHT SIDE METAL DRUMS

ILLUSTRATION NO. 6.
LOADING HEAVY GAUGE HEAVY-DUTY
DRUMS IN ONE LAYER ONLY

ILLUSTRATION NO. 10.
BRACING OF PARTIAL LAYER

ILLUSTRATION NO. 11.
DETAIL OF "K" BRACE

ILLUSTRATION NO. 12.
PROGRESSIVE STEPS OF THREADING
FLAT METAL TIE IN ANCHOR PLATE

ILLUSTRATION NO. 13.
APPLICATION OF FLAT METAL
TIES TO CAR WALL

ILLUSTRATION NO. 14.
DRAPING ONE END OF CAR WITH METAL
TIES FOR ANCHORED LOAD

ILLUSTRATION NO. 15.
ANCHORED LOAD WITH PARTIAL LAYER

ILLUSTRATION NO. 16.
ANCHORED LOAD—DIVIDED INTO UNITS

ILLUSTRATION NO. 17.
DRAPING ONE END OF CAR WITH METAL
TIES FOR FLOATING LOAD

ILLUSTRATION NO. 18.
RIGID BRACED METHOD OF LOADING METAL
DRUMS WITH ROLLING HOOPS

ILLUSTRATION. NO. 19.
FLOATING LOAD OF DRUMS WITH ROLLING HOOPS

ILLUSTRATION NO. 20.
MIXED LOAD IN EQUIPPED CAR

APPENDIX C

CHATTANOOGA, TN.
JUNE 22, 1993

MR. ROBERT S. SEIGLER
MARTIN MARIETTA ENERGY SYSTEMS, INC.
P.O. BOX 2003
OAK RIDGE, TN. 37831-5768

DEAR MR. SEIGLER:

REFERENCE IS MADE TO YOUR LETTER OF MAY 25, 1993 AND ENCLOSED DRAWINGS MARKED Y-GA-93M-705A AND Y-GA-93M-705B. THE DRAWING SHOW ADEQUATE BLOCKING AND BRACING AS LONG AS THE BANDING USED IS OF SUFFICIENT STRENGTH TO SUPPORT THE WEIGHT.

HEREWITH, FIND ATTACHMENT "A" (COPY CIRCULAR NO 42-A) PAGES EIGHT THROUGH TEN. PLEASE NOTE ON PAGE NUMBER EIGHT AT BOTTOM OF PAGE IS CHART SHOWING BAND WIDTH AND THICKNESS. ALSO NOTE MINIMUM BREAKING STRENGTH FOR BANDS AND JOINTS. WITH THIS CHART YOU CAN DETERMINE WHAT COMBINATION OF STRAPPING YOU WISH TO USE TO SECURE THE WEIGHT IN EACH SECTION AS SHOWN IN YOUR DRAWINGS. PAGE TEN SHOWS AAR METHOD OF MARKING AND SOME VENDOR NAMES.

HEREWITH, FIND ATTACHMENT "B" (COPY DAMAGE PREVENTION PRODUCT VENDOR LIST). THIS LIST SHOWS SOME OF THE VENDORS YOU MAY WISH TO CONTACT ABOUT THEIR PRODUCT.

LOOKS LIKE YOU ARE OFF TO A GOOD START. I WOULD SUGGEST YOU MAY CONSIDER USING 2"X 6" LUMBER FOR BACK UP CLEATS AS OPPOSED TO 2" X 4" ACCOUNT SPLITTING WHEN NAILED.

SINCERELY,

DAVID BANDY
REGIONAL SUPERVISOR DAMAGE
PREVENTION AND FIELD SERVICES
1301 MARKET ST.
CHATTANOOGA, TN. 37402

ATTACHMENTS 2

CHATTANOOGA, TN.
SEPTEMBER 16, 1993.

MR. ROBERT S. SEIGLER
MARTIN MARIETTA ENERGY SYSTEMS, INC.
P.O. BOX 2003
OAK RIDGE, TN 37831-7233

DEAR MR. SEIGLER:

REFERENCE IS MADE TO YOUR LETTERS OF AUGUST 10, 1993 AND SEPTEMBER 13, 1993 WITH REGARD TO BLOCKING AND BRACING METHODS PROPOSED IN THE SHIPMENT OF DRUMS OF STABILIZED SOLID CONCRETE WASTE.

YOUR ILLUSTRATIONS Y-GA 93M-705, Y-GA 93M-705B, AND SUPPLEMENTAL ILLUSTRATION Y-GA 93M-705N SHOW ADEQUATE BLOCKING AND BRACING FOR THE PROPOSED SHIPMENTS WHEN USED IN THE SOUTHERN SERIES 19,000 THROUGH 19,999 ALL-STEEL BOXCAR.

PLEASE CONTACT ME WHEN YOU ANTICIPATE LOADING AND SHIPMENT OF YOUR FIRST CARS. I SHOULD BE HAPPY TO MAKE AN ON SITE OUTBOUND INSPECTION TO INSURE THE SUCCESS OF THE SHIPMENTS TO DESTINATION IN A DAMAGE FREE CONDITION.

MY TELEPHONE NUMBER IN CHATTANOOGA IS 615-697-1102 OR DIGITAL BEEPER NUMBER 615-697-5845. I LOOK FORWARD TO MEETING YOU AND MAKING THE INSPECTION.

THE PROPOSED POLYETHYLENE RAILCAR FLOOR LINER, Y-GA 93M-706FL, AND Y-GA 93M-705B2, I SHALL FORWARD TO MR DAVE SCHOENDORFER IN OUR HAZARDOUS MATERIAL DEPARTMENT IN ROANOKE, VA. HIS TELEPHONE NUMBER IS 703-981-3762. HE WILL NEED TO QUALIFY THE LINER.

DAVID BANDY
REGIONAL SUPERVISOR DAMAGE
PREVENTION AND FIELD SERVICES
1301 MARKET STREET
CHATTANOOGA, TN. 37402

CC: MR. DAVE SCHOENDORFER W/ATT.2
MR. DON EDWARDS
MR. BILL DOLLE
MR. NATHAN MARTIN

CHATTANOOGA, TN.
JUNE 22, 1993

MR. ROBERT S. SEIGLER
MARTIN MARIETTA ENERGY SYSTEMS, INC.
P.O. BOX 2003
OAK RIDGE, TN. 37831-5768

DEAR MR. SEIGLER:

REFERENCE IS MADE TO YOUR LETTER OF MAY 25, 1993 AND ENCLOSED DRAWINGS MARKED Y-GA-93M-705A AND Y-GA-93M-705B. THE DRAWING SHOW ADEQUATE BLOCKING AND BRACING AS LONG AS THE BANDING USED IS OF SUFFICIENT STRENGTH TO SUPPORT THE WEIGHT.

HEREWITH, FIND ATTACHMENT "A" (COPY CIRCULAR NO 42-A) PAGES EIGHT THROUGH TEN. PLEASE NOTE ON PAGE NUMBER EIGHT AT BOTTOM OF PAGE IS CHART SHOWING BAND WIDTH AND THICKNESS. ALSO NOTE MINIMUM BREAKING STRENGTH FOR BANDS AND JOINTS. WITH THIS CHART YOU CAN DETERMINE WHAT COMBINATION OF STRAPPING YOU WISH TO USE TO SECURE THE WEIGHT IN EACH SECTION AS SHOWN IN YOUR DRAWINGS. PAGE TEN SHOWS AAR METHOD OF MARKING AND SOME VENDOR NAMES.

HEREWITH, FIND ATTACHMENT "B" (COPY DAMAGE PREVENTION PRODUCT VENDOR LIST). THIS LIST SHOWS SOME OF THE VENDORS YOU MAY WISH TO CONTACT ABOUT THEIR PRODUCT.

LOOKS LIKE YOU ARE OFF TO A GOOD START. I WOULD SUGGEST YOU MAY CONSIDER USING 2"X 6" LUMBER FOR BACK UP CLEATS AS OPPOSED TO 2" X 4" ACCOUNT SPLITTING WHEN NAILED.

SINCERELY,

DAVID BANDY
REGIONAL SUPERVISOR DAMAGE
PREVENTION AND FIELD SERVICES
1301 MARKET ST.
CHATTANOOGA, TN. 37402

ATTACHMENTS 2

C-6

CHATTANOOGA, TN.
SEPTEMBER 16, 1993

MR. ROBERT S. SEIGLER
MARTIN MARIETTA ENERGY SYSTEMS, INC.
P.O. BOX 2003
OAK RIDGE, TN 37831-7233

DEAR MR. SEIGLER:

REFERENCE IS MADE TO YOUR LETTERS OF AUGUST 10, 1993 AND SEPTEMBER 13, 1993 WITH REGARD TO BLOCKING AND BRACING METHODS PROPOSED IN THE SHIPMENT OF DRUMS OF STABILIZED SOLID CONCRETE WASTE.

YOUR ILLUSTRATIONS Y-GA 93M-705, Y-GA 93M-705B, AND SUPPLEMENTAL ILLUSTRATION Y-GA 93M-705N SHOW ADEQUATE BLOCKING AND BRACING FOR THE PROPOSED SHIPMENTS WHEN USED IN THE SOUTHERN SERIES 19,000 THROUGH 19,999 ALL-STEEL BOXCAR.

PLEASE CONTACT ME WHEN YOU ANTICIPATE LOADING AND SHIPMENT OF YOUR FIRST CARS. I SHOULD BE HAPPY TO MAKE AN ON SITE OUTBOUND INSPECTION TO INSURE THE SUCCESS OF THE SHIPMENTS TO DESTINATION IN A DAMAGE FREE CONDITION.

MY TELEPHONE NUMBER IN CHATTANOOGA IS 615-697-1102 OR DIGITAL BEEPER NUMBER 615-697-5845. I LOOK FORWARD TO MEETING YOU AND MAKING THE INSPECTION.

THE PROPOSED POLYETHYLENE RAILCAR FLOOR LINER, Y-GA 93M-706FL, AND Y-GA 93M-705B2, I SHALL FORWARD TO MR DAVE SCHOENDORFER IN OUR HAZARDOUS MATERIAL DEPARTMENT IN ROANOKE, VA. HIS TELEPHONE NUMBER IS 703-981-3762. HE WILL NEED TO QUALIFY THE LINER.

DAVID BANDY
REGIONAL SUPERVISOR DAMAGE
PREVENTION AND FIELD SERVICES
1301 MARKET STREET
CHATTANOOGA, TN. 37402

CC: MR. DAVE SCHOENDORFER W/ATT.2
MR. DON EDWARDS
MR. BILL DOLLE
MR. NATHAN MARTIN

DISTRIBUTION

1. J. K. Bailey	28. L. B. Oakley
2. D. T. Bell	29-30. P. T. Owen
3. A. R. Belt	31. S. A. Peeler
4. B. V. Carter	32. T. P. A. Perry
5. H. M. Clancy	33. A. S. Quist
6. L. L. Cobb	34. E. J. Raines
7. J. S. Colley	35. R. R. Redmond
8. G. D. Conner	36. W. J. Reich
9. P. R. Cotten	37. R. A. Rickard
10. D. G. Cope	38. G. E. Rymer
11. M. F. P. DeLozier	39. T. L. Sams
12. C. E. Frye	40. R. S. Seigler
13. C. D. Goins	41. M. J. Shelton
14. K. P. Gosnell	42. R. V. Stachowiak
15. P. J. Halsey	43. L. H. Stinton
16. F. K. Heacker, Jr.	44. B. D. Walker
17. A. G. Hodgson	45. H. D. Whitehead, Jr.
18. L. W. Little	46. C. A. Wood
19. L. W. Long	47. Central Research Library
20-23. D. M. Matteo	48. Applied Technology Library,
24. L. S. McAdams	K-25
25. L. J. Mezga	49-53. ER Document Management
26. M. E. Mitchell	Center
27. H. B. Nennstiel	54. ORNL Lab Records
-
55. Office of Assistant Manager for Energy Research and Development, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
 56. S. Meyers, Jacobs Engineering, 800 Oak Ridge Turnpike, Suite C102, Oak Ridge, TN 37830
 - 57-58. R. L. Nace, Branch Chief, Nonenrichment Facilities, Oak Ridge Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, EM-423, Trevion 2, U.S. Department of Energy, Washington, DC 20585
 - 59-60. Richard Nace, Branch Chief, Nonenrichment Facilities, Oak Ridge Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, EM-423, Trevion 2, U.S. Department of Energy, Washington, DC 20585
 - 61-71. E. J. Powell, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8541
 - 72-73. H. M. Thron, Chief, Enrichment Facilities, Oak Ridge Program Division, Office of Eastern Area Programs, Office of Environmental Restoration, EM-423, Trevion 2, U.S. Department of Energy, Washington, DC 20585
 - 74-75. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831

END

DATE
FILMED

3 / 30 / 94